FACULTY PROSPECTUS 2013

FACULTY

OF

SCIENCE

UNIVERSITY OF NAMIBIA

EDUCATION SERVICE DEVELOPMENT

Inspiring minds & shaping the future

NOTE

Regulations and curricula for 2013 may be amended without prior notice. General regulations and information appear in the **General Information and Regulations and Fees Prospectus**.

Although the information contained in this faculty prospectus has been compiled as accurately as possible, Council and Senate accept no responsibility for any errors and omissions, which may occur. The University retains the right to amend any regulation or condition without prior notice.

The information is correct up to 31 October 2012.

The fact that particulars of a specific course or field of study have been included in this Faculty Prospectus does not necessarily mean that such programme, subject, or module will be offered in 2013 or any consecutive year.

This Faculty Prospectus must be read in conjunction with the **General Information and Regulations and Fees Prospectus**.

CONTENTS

FACULTY PREAMBLE

The mission of the Faculty of Science is to produce graduates of high caliber who will make a positive contribution to the socioeconomic development of Namibia and beyond, through the application of their knowledge and skills in various fields of science and technology. Given the past history, which did not encourage and promote effective teaching of science and mathematics, especially in the formerly disadvantaged communities, the Faculty particularly aims at promoting student interest in the learning and teaching of science; and producing good quality science graduates, who will help to build a science culture in society. The Faculty's principal objective is to promote the development of science, technology, and environmental studies, and to encourage and facilitate research activities, which address the new demands of the national economy.

All degree programmes in the Faculty of Science, just like all other degree programmes at the University of Namibia, were thoroughly revised to reflect the changing socioeconomic, biophysical and job market environments and the needs of the country. We now offer attractive degree programmes in all the seven Departments of the Faculty. The degree programmes in the Faculty of Science are of exceptional quality. They are designed to develop investigative skills and teach the tools of critical analysis and communication skills which are necessary pre-requisites for lifelong learning. Our programmes offer good employment opportunities and exciting future careers, and equip you with a unique blend of generic and discipline-related skills that give you the capacity to tackle problems with initiative and resourcefulness. The Faculty has close links with industry and will thus provide you with opportunities to explore various career options during your studies. Studying science gives you the innovative skills for an ever-changing employment environment and makes you a valuable resource for employers. Therefore, this is a particularly fascinating time to study science at the University of Namibia.

The world today continues to witness major technological advances which are opening up in many new areas. The boundaries between traditional subject areas are blurring as interdisciplinary research leads to rapid progress on a wide range of issues that underpin the future prosperity and quality of life in Namibia and the world at large. Such issues include biodiversity conservation; environmental management; pollution control; sustainable utilization of resources; combating effects of, and adaptation to climate change and desertification; cleaner energy production; genetically modified organisms; molecular and other new genetic advances in health, medicine and food technology; nanotechnology; biotechnology; new computing developments & ICT/IT; and many others. The comprehensive scope of the Faculty of Science allows us to offer modules and conduct research in these areas. By so doing, the Faculty of Science contributes immensely towards meeting the Vision and Mission of the University of Namibia. Through this, we are playing our part in helping Namibia achieve the goals set out in Vision 2030, the National Development Plans and the ETSIP targets.

We are proud of who we are and our achievements so far. We encourage you to join us for an exciting career in science.

ACADEMIC YEAR 2013

SEMESTER 1

14 January	University opens
21 January –	08 February Registration (Last day for Late Registration: 13 February)
24 January	Academic staff resumes office duties
11 February	Lectures commence for SEMESTER 1
29 March	EASTER BREAK starts
08 April	Lectures resume after Easter Break
24 May	Lectures end for SEMESTER 1
28 May	Regular Examinations commence (Semester 1 modules)
18 June	Regular Examinations end
20 June –	28 June Supplementary/Special Examinations
28 June	End of Semester 1
08 July - 12 July	Mid-year recess

SEMESTER 2

22 July	Lectures commence for SEMESTER 2
09 September	SPRING BREAK starts
16 September	Lectures resume after Spring Break
01 November	Lectures end for SEMESTER 2
05 November	Regular Examinations commence (Semester 2 & Double modules)
26 November	Regular Examinations end
28 November -	06 December Supplementary/Special Examinations
06 December	End of 2nd Semester
20 December	Academic Year ends & University closes (until 16 January 2014)
16 January 2014	University opens (2014 academic year)
28 January 2014	Academic staff resumes office duties

DUE DATES FOR THE 2013 ACADEMIC YEAR

(i) GENERAL

Last day for appeals (Semester 1 modules – Regular & Supplementary/Special Examinations)………..……..(Nov 2012)25 Jan
Last day for application of retention of continuous assessment mark……………………………………………… 08 Feb
Last day for application for exemption(s)…………………………………………………………………………… 08 Feb
Last day for Late Registration (Late fee payable) ………………………………………………………………… 13 Feb
Last day for approval of exemption(s)…………………………………………………………………….………… 13 Feb
Last day for approval of retention of continuous assessment mark……………………………………...…………13 Feb
Last day for approval of module(s) & qualification changes…………………………………………………………. 13 Feb
Last day to change Examination Centres at Regional Centres (Semester 1 modules – Regular & Supplementary/ Examinations)……12 April
Last day for appeals (Semester 1 modules – Regular & Supplementary/Special Examinations)……… …… 02 Aug
Last day to submit outstanding documentation……………………………………………………………… …… 23 Aug
Last day to change Examination Centres at Regional Centres (Semester 2 & Double modules – Regular & Supplementary / Examinations)…………………………………………………………………………………………………… …… 27 Sept
Last day to cancel enrolment ……………………………………………………………………………………………27 Sept
Last day for submission of Theses and Dissertations for examination………………………………………………15 Nov
Last day for appeals (Sem 2 & Double modules – Regular & Suppl/Special Examinations)…………………(Nov 2013)30 Jan 2014

(ii) CANCELLATIONS

Semester 1 modules

Last day to cancel Semester 1 modules ……………………………………………………………………08 May

Semester 2 modules

Last day to cancel Semester 2 modules ……………………………………………………………………27 Sept

Double modules (A double module normally extends over one academic year)

Last day to cancel Double modules ……………………………………………………………………27 Sept

(iii) FINANCE

Semester 1 modules

Last day to cancel with 100 % credit ……………………………………………………………………08 March

Last day to cancel with 50 % credit ……………………………………………………………………19 April

Semester 2 modules

Last day to cancel with 100 % credit ……………………………………………………………………09 August

Last day to cancel with 50 % credit ……………………………………………………………………30 August

Double modules (a double module normally extends over one academic year)

Last day to cancel with 100 % credit ……………………………………………………………………08 March

Last day to cancel with 50 % credit ……………………………………………………………………31 May

A. STRUCTURE AND PERSONNEL OF THE FACULTY

A.1. OFFICE OF THE DEAN

DEAN

Dr F Gideon: B.Sc. (UNAM), BSc-Hons, MSc (Rhodes Univ), Ph.D (University of North West)

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DEPUTY DEAN

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HEAD OF DEPARTMENT: DEPARTMENT OF BIOLOGICAL SCIENCES

Dr. E.M. Julies: B.Sc.B.Sc.Hons (Rhodes Univ), PGDE (UNAM), M.Sc. (Univ of Ghent, Belgium), Dr. Rer. nat. (Max Planck Inst. for Marine Microbiology, Bremen, Germany)

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HEAD OF DEPARTMENT: DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

Dr E Naomab: B.Sc, MSc. (UNAM), MRes (Nottingham Trent, UK), PhD (Nottingham University, UK)

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HEAD OF DEPARTMENT: DEPARTMENT OF COMPUTER SCIENCE

Ms. T K Mufeti: B.Sc. (UNAM), B.Sc.Hons (Rhodes), M.Sc. (Rhodes)

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HEAD OF DEPARTMENT: DEPARTMENT OF GEOLOGY

Dr. A.W. Wanke: Diplom Arbeit/MSc (Göttingen), PhD (Würzburg)

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HEAD OF DEPARTMENT: DEPARTMENT OF MATHEMATICS

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HEAD OF DEPARTMENT: DEPARTMENT OF PHYSICS

Dr R Steenkamp: B.Sc., M.Sc., Ph.D. (NWU, RSA)

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HEAD OF DEPARTMENT OF STATISTICS AND POPULATION STUDIES

Dr I Neema: B.Sc. (UNAM), M.Sc. in Applied Statistics (WPI, USA); PhD in Applied Statistics (Reading University, UK)

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Matters regarding specific subjects and departments should be addressed to the relevant Head of Department.

Faculty Officer
Ms T Tjipura, B.Econ, M. Admin (UNAM)

Faculty Secretary
Ms M Matengu-Lizazi, Dip Public Admin (Polytechnic of Namibia)

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Typist Vacant

General Assistant: Ms. A. Amutenya: Grade. 6

General enquiries regarding the Faculty of Science and the qualifications offered by the Faculty should be directed to:

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A.2. ACADEMIC DEPARTMENTS

DEPARTMENT OF BIOLOGICAL SCIENCES

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Professor:	Vacant
Associate Professor:	Prof. I. Mapaure: B.Sc.Hons, MSc, Ph.D (Univ of Zimbabwe)
Senior Lecturer:	Dr. E. Kwembeya:
Senior Lecturer:	Dr. J.K.E .Mfune: B.Sc.B.Sc.Hons (Malawi) M.Sc, Ph.D (Aberdn, U.K)
Senior Lecturer:	Dr. P.M. Chimwamurombe: B.Sc.Biochemistry, MSc. Biotechnology (UZ), PhD Plant Biotechnology (Univ of Pretoria, RSA)
Senior Lecturer:	Dr. K.C. Chinsembu: B.Sc. (Zambia), MSc. (Brussels), PhD (UNAM)
Lecturer:	Dr. R. Böck: M.Sc. (Saarbrücken/Germany), Ph.D (Oklahoma State/USA)
Lecturer:	Dr. E.M. Julies: B.Sc.B.Sc.Hons (Rhodes Univ), PGDE (UNAM), M.Sc. (Univ of Ghent, Belgium), Dr. Rer. nat. (Max Planck Inst. for Marine Microbiology, Bremen, Germany)
Lecturer	Mr. S. Eiseb: BSc, PGDE (UNAM), MSc (University of Zimbabwe)
Lecturer:	Mr. B. Kaonjua: B.Sc. (State Univ of New York) M.Sc. (University of Brussels)
Lecturer:	Ms. F. Kangombe:
Lecturer:	Mr. JD Uzabakiriho: B.Sc. M.Sc. (NUR)
Lecturer :	Mr. H. Eiman : BSc(Hons) Molecular and Cell Biology, M.Sc. Molecular and Cell Biology (UCT)
Lecturer :	Ms. W. C. Mukaru: B.Sc. (UNAM) , MSc. Biodiversity Management and Research (UNAM and Humboldt Universität zü Berlin)
Lecturer:	Vacant
Lecturer:	Ms. P. Kadhila-Muandingi B.Sc.(China), MSc Applied biology (UNAM)
Guest Lecturer:	Dr. D. Mumbengegwi: B. Sc (Hons) Biological Sciences (Univ of Zimbabwe), M.Sc. Biotechnology and Molecular Biology (University of Hull, U.K), PhD. Pharmaceutical Sciences (University of Manchester, U.K)
Assistant Lecturer:	Mr. A.H. Du Plesis: BSc. (Education) (University of Western Cape)
Assistant Lecturer:	Mrs. C. Deelie: BSc. (UNAM), BEd Hons (UNISA), HDE postgraduate diploma (UNAM)
Tutor:	Ms. R. Shifa: BSc (UNAM)
Tutor:	Vacant
Senior Technologist:	Vacant
Technologist:	Mr. A. Hijarunguru: B.Sc. (US)
Technologist:	Ms. M. A Morkel: B.Sc. (Humboldt, USA)
Technologist:	Ms. M.J Johnson: B.Sc. (UNAM)
Technologist:	Mr. A.T Mbangu: B. Sc. (UNAM)
Technologist:	Vacant
Lab. Ass. Technician:	Ms. R. Shimwooshili: Med and Lab Science Cert (Limbe Cameroon)

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

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Associate Professor:	Prof E F Archibong: PhD. (University of New Brunswick, Canada)
Associate Professor:	Prof Wang: M. Eng (China)
Senior Lecturer:	Dr M A Kandawa-Schulz: M.Sc. Dr.rer.nat. (University of Rostock)
Senior Lecturer:	Dr Stefan Louw PhD (University of Cape Town)
Lecturer:	Dr ERT Elago: B.Sc. (UDW) PGDE (UNAM) B.Sc. Hons, MSc (UPE), PhD (NMMU)
Lecturer:	Dr E Naomab: B.Sc., MSc. (UNAM), MRes (Nottingham Trent, UK), PhD (Nottingham University, UK)
Lecturer:	Dr R Hans: B.Sc. (UNAM), MSc (University of Botswana), PhD (University of Cape Town)
Lecturer:	Dr G Kahaka: B.Sc. (UNAM), MSc & PhD (Nottingham University, UK)
Lecturer, PhD candidate:	Ms C V Raidron: B.Sc., HED (UNAM), MPhil (Murdoch University, Australia)
Lecturer:	Mr V Uahengo: B.Sc. (UNAM), MSc. (Wuhan. Univ, China), Staff Development Fellow
Lecturer:	Ms T Thomas B.Sc. (UNAM), MSc. (UCT)
Lecturer:	Mr G Uiseb: B.Sc.(UNAM), MSc (Loughborough University, UK), Staff Development Fellow
Researcher:	Ms N Pogori B.Sc. (UNAM), MSc, (Jiangnan University, China)
Senior Technologist:	Mr W Song: B. Eng. (South East University. China)
Technologist, PhD candidate:	Ms C Mukakalisa: B.Sc. (UNAM), MSc (UNAM)
Technologist, MSc Student:	Mr T Ndunge: B.Sc. (UNAM)
Technologist, MSc Student:	Mr N Gariseb B.Sc. (UNAM)
Technologist, MSc Student:	Ms S Potgieter: B.Sc. PGDE, Hon Science Education
Technologist, MSc Student:	Ms M Nyambe (UNAM), Hons (Stelellenbosch)
Technologist:	Ms A Shiimi: B.Sc. (UNAM), B. Sc Hons (UCT), MSc (UCT)
Technologist, MSc Student:	Ms N Shifeta B.Sc. (UNAM)
Technologist:	Ms S Namwandi (Stellenbosh) Staff Development Fellow
Technologist, MSc Student	Ms H Hakwenye B.Sc. (UNAM)
Technologist:	Ms C Tjiurutue B.Sc. (UNAM) Staff Development Fellow
Technologist:	Mr D Likius: BSc (UNAM), MSc (UNAM) Staff Development Fellow
Assistant Technician:	Mr T Manuel

DEPARTMENT OF COMPUTER SCIENCE

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Senior Lecturer:	Dr. J Mbale: Ph.D. (HIT, China), M.Sc. (Shanghai, China), B. A. (UNZA), Dip.Ed. (TVTC), CCAI, CISCO IT-Essentials: PC Hardware and Software
Senior Lecturer:	Mr. E L Mkusa: B.Sc. (Mech Eng) MBA (UDSM) M.Sc. (OR, Lancaster) M.Sc. (IT. Strathclyde)
Senior Lecturer:	Ms. T K Mufeti: B.Sc. (UNAM), B.Sc.Hons (Rhodes), M.Sc. (Rhodes)
Lecturer:	Mrs. N Suresh: BE (Eng), MTech (India); (On Study Leave)
Lecturer:	Ms. V Hasheela: B.Sc. (UNAM), B.Sc.Hons (Stellenbosch), M.Sc. (Mannheim)
Lecturer:	Mr. F David: M.Sc. (China);
Lecturer:	Mr J Mutuku: B.Sc.(Hons)(Nairobi), PGDE(UNAM), HDipCS (Wits), MSc (UCT)
Lecturer:	Dr. V Hashiyana: PhD. (St. Petersburg, Russia)
Tutor:	Ms. S R Mwatilifange: B.Sc.(Strayer, USA)
Tutor.	Mr. S P Shihomeka: MBA (SA), B.Ed. (UNAM), ICDL (SA)
Tutor:	Ms. T K Mukaya: B.Sc. (UNAM)
Tutor:	Mr . F D Bernardo: B.Sc.Eng (HIMEE – Varna, Bulgaria)
Tutor:	Mrs. A K Nkandi-Hauwanga: BSc(Boumerdes, Algeria)
Tutor:	Mr. A M Ghania: BSc (Benha, Egypt), PGDC (Azahr, Egypt), M.Sc. (Azahr, Egypt)
Tutor:	Mr. G B Kooper: B. Sc(UNAM)
Tutor:	Mr. J Nelulu: B.Sc.(Strayer, USA)
Technologist:	Mr. J M Mutonga: MCSE, CCNA1, Computer Network Engineering and Management Certificate
Technologist:	Vacant

DEPARTMENT OF GEOLOGY

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Senior Lecturer:	Dr. B.S. Mapani: B.Sc. (UNZA), MSc. (Nancy), PhD (Melbourne)
Lecturer:	Dr. A.E. Macuvele: B.Sc. (Edward Mondlane), PhD (Aachen, Germany)
Lecturer:	Dr. A.W. Wanke: Diplom Arbeit/MSc (Göttingen), PhD (Würzburg)
Lecturer:	Dr. H.U. Wanke: Diplom Arbeit/MSc (Kiel), PhD (Würzburg)
Lecturer:	Vacant
Lecturer: (Part-time):	Dr. B. Corner: B.Sc.Hons, M.Sc, PhD (Wits)
Lecturer:	Mr A. Vatuva: B.Sc. (UNAM), Master (Nancy, France); on study leave
Tutor:	Ms S. Uugulu: B.Sc. (UNAM), Master II (Besancon, France)
Tutor	Mr F. Maske: B.Sc.Hons. (Rand Afrikaans University, Johannesburg)
Technologist:	Ms J. Kaluwapa: Nat. Dipl (Mech. Eng), Polytechnic of Namibia
Technologist:	Mr G. Nghikongelwa: Nat. Dipl (Mech. Eng), Polytechnic of Namibia

DEPARTMENT OF MATHEMATICS

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Senior Lecturer:	Dr F. Gideon BSc (UNAM), BSc Hons, MSc (Rhodes Univ), Ph.D (University of North West) **(Dean)**
Senior Lecturer:	Dr M M Mugochi BSc Hons (UZ), MPhil (UZ), PhD (UNISA)
Lecturer:	Mr T Sikwambi BSc (UNAM), MSc (China)
Lecturer:	Vacant
Lecturer:	Mr D Elago B.Sc. (UNAM) PGDE (UNAM), BSc Hons, MSc (UWC)
Lecturer	Mr. Vijayakumar Kandaswamy, BSc (BDU, India), MSc (BDU, India), PGDCS (Central University, Hyderabad, India)
Lecturer:	Vacant
Staff Development Fellow:	Mr D Iiyambo BSc, PGDE (UNAM), BSc Hons, (UCT), MSc (UCT)
Staff Development Fellow:	Mr A Shikongo BSc (UNAM), BSc Hons (University of Pretoria), MSc (UWC)
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Tutor:	Ms C Amakutsi BSc (UNAM), PGDE (UNAM)
Tutor:	Mr L Komomungondo BSc (UNAM)
Tutor:	Mr W Nangolo BSc (UNAM)
Tutor:	Mr S S Amukugo Licentiate in Education – Maths (Cuba)
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Senior Lecturer:	Dr R Steenkamp: B.Sc., M.Sc., Ph.D. (NWU, RSA)
Senior Lecturer:	Mr W Liu: B.Sc. (Harbin), M.Sc. (Heilongjiang, China)
Lecturer:	Ms P Dobreva: M.Sc. (Sofia, Bulgaria)
Lecturer:	Mr. ID Davids: B.Sc., PGDE (UNAM), BSc.-Hons, M.Sc (NWU, RSA)
Lecturer:	Mr S Shimboyo: B.Sc. (UNAM), M.Sc. (UNAM)
Staff Development Fellow:	Mr. A. Chatu B.Sc. (UNAM), B.Sc.Hons. (WITS, RSA)
Tutor:	Ms. Q Auala: B.Sc. (UNAM)
Tutor:	Mr. E Taapopi: B.Sc. (UNAM)
Laboratory Technologist:	Mr O Mutenda: B.Sc. (UNAM)
Laboratory Technologist:	Mr H C Hofmann: National Certificate N3 (RSA), Trade Diploma (Namibia)
Laboratory Technologist:	Mr E Tjingaete: Diploma in Mechanical Engineering (DGZ, Gemany)
Technical Assistant:	Ms E Shilongo: Diploma in Education (Mutare, Zimbabwe)

DEPARTMENT OF STATISTICS AND POPULATION STUDIES

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Professor:	Vacant
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Senior Lecturer:	Dr. N Indongo: B.Sc. (UNAM), MSc. in Social Statistics (Soton, UK), PhD in Demography (Univ of Pretoria)
Lecturer:	Dr M A E Muller: B.Sc. Hons, (Unisa), M.Sc. (UOFS), H.E.D.(Unisa) PhD. (Univ of Pretoria)
Lecturer:	Mr W Tjipueja B.Sc.(UNAM) M.Sc. (UHasselt - formerly LUC, Belgium)
Lecturer:	Dr I Neema: B.Sc. (UNAM), M.Sc. in Applied Statistics (WPI, USA); PhD in Applied Statistics (Reading University, UK)
Lecturer:	Mr C J Mahindi: BA. (Dar-er Salaam) PGD, M.Phil. (Cairo)
Lecturer:	Ms Lillian Pazvakawambwa (MSc. Statistics, University of Zimbabwe)
Lecturer:	Ms N. Nickanor: B.Sc. (UNAM), PGD (Population Studies - UB), M.A (Population Studies - UB)
Staff Development Fellow	Mr PT Iiyambo: B.Sc. (UNAM), B.Sc. Hons in Statistics (Univ. of the Free State), MSc. in Statistics (Univ. of the Free State)
Staff Development Fellow:	Mr. K. Mutorwa: BSc. (UNAM), Hons. (Wits)
Staff Development Fellow:	Mr I Kamwi: B.Sc.(UNAM),MSc in Statistics (UWC)
Staff Development Fellow	Mr LP Unandapo: B.Sc(UNAM)

B. QUALIFICATIONS OFFERED BY THE FACULTY

The Faculty may award the following Undergraduate and Postgraduate degrees:

B.1. UNDERGRADUATE PROGRAMMES AND POSTGRADUATE PROGRAMMES

IN 2013 THE FIRST YEAR STUDENTS WILL REGISTER FOR THE FOLLOWING QUALIFICATIONS:

B.1.1	**BIOLOGICAL SCIENCE DEPARTMENT**	
CODE	**DIPLOMA/DEGREE**	**MINIMUM DURATION**
11BEBL	Bachelor of Science in Environmental Biology (Honours)	4 years full-time
11BMBL	Bachelor of Science in Micro Biology (Honours)	4 years full-time
POSTGRADUATE PROGRAMME		
11MSCB	Master of Science Biodiversity Management & Research	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

B.1.2	**CHEMISTRY AND BIOCEMISTRY DEPARTMENT**	
CODE	**DIPLOMA/DEGREE**	**MINIMUM DURATION**
11BSCC	Bachelor of Science in Chemistry (Honours) Medicinal	4 years full-time
11BSEC	Bachelor of Science in Chemistry (Honours) Environmental	4 years full-time
11BSGC	Bachelor of Science in Chemistry (Honours) Geochemistry	4 years full-time
11BCAC	Bachelor of Science in Applied Biochemistry (Honours) Biomedical	4 years full-time
11BCAB	Bachelor of Science in Applied Biochemistry (Honours) Environmental	4 years full-time
POSTGRADUATE PROGRAMME		
11MSCC	Master of Science Chemistry	2 years full-time
	Master of Science in Industrial Biochemistry	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

B.1.3	**COMPUTER SCIENCE DEPARTMENT**	
CODE	**DIPLOMA/DEGREE**	**MINIMUM DURATION**
11DCMP	Diploma in Computer Science	2 years full-time
11BSCO	Bachelor of Science in Computer Science (Honours)	4 years full-time
11BSIT	Bachelor of Science in Information Technology (Honours)	4 years full-time
POSTGRADUATE PROGRAMME		
11MSCI	Master of Science Information Technology	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

B.1.4 GEOLOGY DEPARTMENT

CODE	DIPLOMA/DEGREE	MINIMUM DURATION
11BSCG	Bachelor of Science in Geology (Honours)	4 years full-time

POSTGRADUATE PROGRAMME

11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

B.1.5 MATHEMATICS DEPARTMENT

CODE	DIPLOMA/DEGREE	MINIMUM DURATION
11BSCM	Bachelor of Science in Mathematics (Honours)-Physics	4 years full-time
11BSMC	Bachelor of Science in Mathematics (Honours)-Computer Science	4 years full-time
11BSMS	Bachelor of Science in Mathematics (Honours) Statistics	4 years full-time
11BFMA	Bachelor of Science in Financial Mathematics (Honours)	4 years full-time

POSTGRADUATE PROGRAMME

11MSCM	Master of Science Mathematics	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

B.1.6 PHYSICS DEPARTMENT

CODE	DIPLOMA/DEGREE	MINIMUM DURATION
11BPHY	Bachelor of Science in Physics (Honours) Mathematics	4 years full-time
11BPCO	Bachelor of Science in Physics (Honours) Computer Science	4 years full-time
11BPGL	Bachelor of Science in Physics (Honours) Geology	4 years full-time
11BPCH	Bachelor of Science in Physics (Honours) Chemistry	4 years full-time

POSTGRADUATE PROGRAMME

11MSPH	Master of Science Physics	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

B.1.7 STATISTICS AND POPULATION STUDIES DEPARTMENT

CODE	DIPLOMA/DEGREE	MINIMUM DURATION
11DSST	Diploma in Applied Statistics	2 years full-time
11BSCS	Bachelor of Science in Statistics (Honours)	4 years full-time
11BSPO	Bachelor of Science in Population Studies (Honours)	4 years full-time

POSTGRADUATE PROGRAMME

11MSST	Master of Science Applied Statistics and Demography	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time

C. GENERAL REGULATION PERTAINING TO UNDERGRADUATE STUDIES

C.1. DURATION OF STUDY

All Bachelor of Science and Bachelor of Science (Honours) degree programmes cannot be completed in less than four (4) years. All B.Sc. and Bachelor of Science (Honours) degrees must be completed within six (6) years of full-time study, unless special permission is granted for this period to be exceeded.

C.2. TWO MODES OF STUDY FOR FIRST YEAR MATHEMATICS

All new students enrolling into the Faculty of Science are required to register for Basic Mathematics (MAT3511) and Precalculus (MAT3512). Also students which programme requires Analytic Geometry (MAT3501) and Matrices & Complex Numbers (MAT3521) must register them. In order to assist students with a weaker background in mathematics, the Department of Mathematics has introduced two modes of teaching for its first year courses. The decision as to which mode a student shall take is reached upon sitting for the first class test in Basic Mathematics (MAT3511) after the first four weeks of classes. Any student who scores a mark of 40% or higher, in the said test, shall proceed with the current mode of study, which enables such student to complete the first year mathematics courses in the first academic year of registration. The student who scores a mark below 40% shall proceed to a special mode in which the current content of first year mathematics is taught over a period of two years. The Two Modes modules are Basic Mathematics A (MAT3580), Analytic Geometry A (MAT3520), Matrices & Complex Numbers A (MAT3540) and Precalculus A (MAT3570).

C.3. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme of the Bachelor of Science degree. See the General Information & Regulations Prospectus and Fees Prospectus.

C.4. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Refer to the **General Information and Regulations Prospectus**.

C.5. PRACTICALS

Attendance of practical classes is compulsory.

C.6. CURRICULUM

C.6.1. MODULES, CREDITS AND CONTACT HOURS

One contact hour is equivalent to one (1) lecture period on the timetable of the Faculty of Science.
A full semester module carries 16 credits and is taught at four (4) contact hours per week over one semester, i.e. 56 contact hours per semester.
A half-module carries 8 credits and is taught at two (2) contact hours per week over one semester, i.e. 28 contact hours per semester. A half-module counts as one half (0.5) of a module.
A double-module carries 32 credits and is taught at four (4) contact hours per week over the full academic year (both semesters), i.e. 112 contact hours per academic year. A double-module is equivalent to two (2) modules.
Refer to the relevant programmes (to determine the credits and contact hours of any particular module).

C.6.2. CURRICULUM COMPILATION

To be awarded a Bachelor's degree by the Faculty, a student must pass all the modules prescribed for each curriculum combination. In the BSc degree programme a student may compile his/her curriculum by selecting the modules offered by a specific department, in accordance with Faculty and department regulations.

C.6.3. STUDENT REGISTRATION

C.6.3.1. UNIVERSITY CORE CURRICULUM

All students will take the equivalent of three (4) modules (48 credits) in the University Core Curriculum in the first year of study as part of their curriculum .All students register for the following two (2) half-modules:

SEMESTER	CODE	MODULE NAME
1&2	CSI3580	Contemporary Social Issues (half-module)
1	CLC3509	Computer Literacy (half-module)

Students furthermore add the equivalent of two (2) full English modules from the University Core Curriculum to their curriculum according to the following rules:

Students with any one of the following qualifications in English will apply to be **credited** for LCE3419 English Communication and Study Skills and will register for the module below: (a) a pass (minimum grade 4) in English First Language at NSSC Higher Level or the equivalent; (b) grade 1, 2 or 3 in English Second Language at NSSC Higher Level or the equivalent.

SEMESTER	CODE	MODULE NAME
1	LCE3419	English Communication and Study Skills
2	LEA3519	English for Academic Purposes

Students with a D symbol in English First/Second Language at NSSC Ordinary Level, or the equivalent, register for only the double-module below:

SEMESTER	CODE	MODULE NAME
1 & 2	LEG 2410	English for General Communication (double-module)

C.6.3.2. UNIVERSITY CORE CURRICULUM MODULE DESCRIPTIONS

LCE3419 ENGLISH COMMUNICATION & STUDY SKILLS

Module title: **ENGLISH COMMUNICATION AND STUDY SKILLS**
Code: **LCE3419**
NQF Level: 4
Contact hours: 4 hours per week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment (60%): two tests (reading and writing), two reading assignments, one oral presentation Examination (40%): one three hour examination paper
Pre-requisites: None
Module description: This module is aimed at assisting students in the development of their reading, writing and speaking and listening skills, in order to cope with studying in a new academic environment and in a language which may not be their first language. The module also focuses on study skills that students need throughout their academic careers and beyond. The module serves as an introduction to university level academics, where styles of teaching and learning differ from those at secondary schools in that more responsibility is placed on the student. The module therefore, focuses on the skills that students need throughout their academic careers and beyond.

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Module title: **ENGLISH FOR ACADEMIC PURPOSES**
Code: **LEA3519**
NQF level: 5
Contact hours: 4 periods per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment (**60%**): 2 tests (reading and writing), 1 academic written essay,1 oral presentation Examination **(40%)** : One three hour examination paper
Prerequisites: None
Module description: This module develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.

CLC3509 COMPUTER LITERACY

Module title: **COMPUTER LITERACY**
Code: **CLC3509**
NQF level: 4
Contact hours: 1 lecture theory and 1 lecture practical per week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment **100%**: 2 Practical Tests 50%, 2 Theory Tests 50%
Prerequisites: University Entry
Module description: The aim of this module is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment.
Content: The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

Course Title:	**CONTEMPORARY SOCIAL ISSUES**
Code:	**CSI3580**
NQF level:	5
Contact Hours:	1 hour lecture per week for 28 weeks
Credits:	8
Course Assessment:	Continuous Assessment **(100%).** Portfolio/Student's file **(90%)** and quizzes/tests **(10%)**
Prerequisite	None

Course Description: This course, Contemporary Social Issues (CSI), encourages behavioural change among UNAM students. It offers on an integrative and inter-disciplinary basis the six broad themes on teaching and learning strategies; norms, rules, and contact; citizenship, democracy, and common good; ethics and responsible leadership; health and human sexuality, environment and sustainability as well as stressing the interconnectedness of such issues/themes. The course shall empower students to responsible behaviour changes and to transform high risk behaviour to the common good and responsible citizenship, including broadening the student's scope and understanding of the environment and sustainability of the ecosystem services and how humans influence these. Therefore, critical transformative theory will under gird the content of CSI. After completion students shall be empowered and prepared to enjoy productive, meaningful careers and lives that benefit a society that increasingly resembles a global community. Flexible modes of assessment may be harnessed and may be combined with in-situ visits to appropriate sites. Compulsory attendance required.

C.6.3.3. FACULTY CORE CURRICULUM

All students must register for the following two (2) full modules (32 credits):

MAT3511 Basic Mathematics
MAT3512 Precalculus

C.6.3.4. FACULTY CORE CURRICULUM MODULE DESCRIPTIONS

MAT3511 BASIC MATHEMATICS

Module name:	**BASIC MATHEMATICS**
Code:	**MAT 3511**
NQF level:	5
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests) Examination **50%** (3 hours examination paper).
Prerequisite:	None

Module description: Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement. Algebraic expressions: simplification, expansion, polynomials, reminder and factor theorem, partial fractions. Trigonometry: trigonometric functions, basic trigonometric identities. The absolute value, linear equations, linear inequalities, quadratic equations, the quadratic formula, quadratic inequalities. Functions: domain, codomain, image, preimage, even function, odd function. Sequences: the general term, the geometric sequence, the arithmetic sequence. The Binomial Theorem.

MAT3512 PRECALCULUS

Module name:	**PRECALCULUS**
Code:	**MAT 3512**
NQF level:	5
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	None

Module description: Functions: one-to-one and onto functions, horizontal line test, composition of functions, inverse of a function. Introduction to exponential and logarithmic functions. Limit of a function: definition, left and right limits, infinite limits, limits at infinity, continuity in terms of limits. Differentiation: rate of change, derivative of a function, rules of differentiation, increasing and decreasing functions and graph sketching. Integration: antiderivatives, the definite integral, area under a graph. Trigonometry: further trigonometric identities, area of a sector and segment of a circle, derivatives and integrals of trigonometric functions.

C.7. EXAMINATION REGULATIONS

For detailed examination and promotion rules see the General Information and Regulations Prospectus. A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of 40%. Examination will be administered at the end of each semester.

C.8. RE-ADMISSION INTO THE FACULTY OF SCIENCE

A student will not be re-admitted into the Faculty if he/she has not passed the required modules to be re-admitted

C.9. PASS REQUIREMENTS

In all cases, prerequisites for modules have to be passed before a student can proceed to register for modules that require prerequisites.

- All first year modules must be passed before one can register for third year modules.
- All second year modules must be passed before one can register for fourth year modules

C.10. MAXIMUM NUMBER OF MODULES PER YEAR

No student will be allowed to register for more than **12** modules per year

C.11. MODULE RESTRICTIONS

A student will be admitted to a specific module only if he/she meets the requirements for the particular module. The UNAM CORE, as well as MAT3511 Basic Mathematics and MAT3512 Precalculus are compulsory for all first year B.Sc. degree students, including all students from other Faculties who wish to major in a subject offered by the Faculty of Science.

D. DEPARTMENT OF BIOLOGICAL SCIENCES

D.1. DEPARTMENTAL REGULATIONS

D.1.1. ADMISSION REQUIREMENTS

To register for the B.Sc Environmental Sciences Honours or B.Sc Microbiology Honours degree programmes a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (Ordinary or Higher) or a recognized equivalent qualification.

English is a compulsory subject and should have been obtained as a second language at NSSC (O level) with a minimum C symbol or English as a first language at NSSC (O level) with a minimum D symbol.
In addition to the above, admission to the Bachelor of Science module requires at least a symbol C on NSSC or equivalent qualification in Mathematics; at least a symbol C on NSSC or equivalent qualification in Biology and at least a symbol C on NSSC or equivalent qualification in Physical Sciences.

A candidate should obtain a minimum of 25 points on the UNAM evaluation point scale in his/her five best subjects (of which the above mentioned subjects must be included) to be admitted to undergraduate studies. Obtaining the minimum number of points however, does not necessarily ensure admission. Admission is based on places available in modules, subjects and programs and is awarded on the basis of merit.

Admission can also be considered for candidates who qualify through the mature age entry scheme upon successful completion of the relevant examinations as set out in the general regulations.

D.1.2. RE-ADMISSION REGULATIONS

To be re-admitted to the Faculty of Science for a particular year of registration, a student must have passed the minimum number of modules required as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core
- 8 modules (equivalent to 128 credits) by the end of the second year
- 15 modules (equivalent to 240 credits) by the end of the third year
- 23 modules (equivalent to 368 credits) by the end of the fourth year

A student will not be re-admitted into the Faculty if he/she has not passed the above modules.

D.1.3. PASS REQUIREMENTS

D.1.3.1 ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least two thirds of the modules of the curriculum for a specific year have been passed. If a student passed only one third of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases prerequisites for modules have to be passed before a student can proceed to register for modules that require prerequisites.

From Year 1 to Year 2
At least 7 modules (equivalent to 112 credits) prescribed for Year 1

From Year 2 to Year 3
All first year modules plus at least 6 modules (equivalent to 96 credits) prescribed for Year 2

From Year 3 to Year 4
All second year modules plus at least 5 modules (equivalent to 80 credits) prescribed for Year 3

D.1.3.2 MAXIMUM NUMBER OF MODULES PER YEAR

No student will be allowed to register for more than 12 modules per year

D.1.4. COMPULSORY REQUIREMENTS

- Lab coats are compulsory for practical sessions for all students.
- Students pursuing B.Sc. (Honours) in Environmental Biology must DO and PASS the module Field Ecology (SEBF3800). Failure to take part in these field-based modules will disqualify students from sitting the theory examination of the specific co-requisite modules.

D.1.5. WEIGHTING OF CA AND EXAM MARKS

- Unless otherwise indicated, the relationship between the CA mark and the Examination mark is **40:60.**

D.2. BSC ENVIRONMENTAL BIOLOGY (HONOURS)

QUALIFICATION: B.Sc. in Environmental Biology (Honours) 11BEBL

YEAR 1

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDITS	CO-REQUISITES
1	Contemporary Social Issues	CSI3580		8	None
1	Basic Mathematics	MAT3511		16	None
1	Computer Literacy	CLC3509		8	None
1	English Communication & Study Skills	LCE3419		16	None
1	Introduction to Biology	BLG3511		16	None
1	Introduction to Physical Geology	GLY3521		8	None
1	Physics for Life Sciences	PHY3501		8	None
2	Pre-Calculus	MAT3512		16	None
2	English for Academic Purposes	LEA3519		16	None
2	Introduction to Statistics	STS3522		8	None
2	Chemistry 1 B	CHM3512		16	None
2	Diversity of Life	BLG3512		16	None
2	Introduction to Earth Systems	GLY3502		8	None
Total Credits				160	

YEAR 2

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDITS	CO-REQUISITES
1	Animal Form and Function	BLG3611	BLG3512	16	None
1	Cell Molecular Biology and Genetics	MBL3631	BLG3511& BLG3512,	16	None
1	Biometrics I	BLG3621	STS3522	8	None
1	Introduction to Ecology	EBL3631	BLG3511& BLG3512	16	None
1	Introduction to Hydrology	GLY3621	MAT3512 &GLY3521	8	None
2	Plant Form and Function	BLG3612	BLG3511& BLG3512	16	None
2	Introduction to Microbiology	MBL3632	BLG3511& BLG3512	16	None
2	Biometrics II	BLG3622	STS3522	8	None
2	Ecological Field Techniques	EBL3632	BLG3511& BLG3512	16	None
2	Introduction to Geochemistry **or**	GLY3642	MAT3512&GLY3521& CHM3512	8	None
2	Social Geography	HGE3682	None	8	None
Total Credits				136	

YEAR 3

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDIT	CO-REQUISITES
1	Microbial Ecology I	BLG3701	MBL3632	8	None
1	Aquatic Ecology	EBL3711	EBL3631	16	None
1	Biosystematics I	EBL3721	BLG3612&BLG 3611	8	None
1	Conservation Biology and Biodiversity	EBL3771	EBL3631	16	None
1	Environmental Geology I **and**	GLE3701	GLY3642	8	None
	Ecological systems and climate change **or**	EBL3741	EBL3631	8	None
	Geographic Analysis and Techniques	GIS3711	None	16	None

2	Ecosystem Ecology	EBL3712	EBL3631	16	None
2	Ecophysiology	EBL3752	BLG 3611& BLG3612	16	None
2	Biosystematics II	EBL3722	BLG3612&BLG 3611	8	None
2	Research Methodology	BLG3702	BLG3621&BLG3622	8	None
2	Geographic Information Systems **or**	GIS3732	HGIS3711	16	None
2	Hidrogeology I **and**	GLY3702	GLY3621& GLY3642	8	None
2	Introduction to Petrology	GLY3662	GLY3521	8	None
Total Credits				160	

YEAR 4

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDIT	CO-REQUISITES
1 & 2	Research Project	BLG3810	BLG3702	32	None
1 & 2	Field Ecology	EBF3800	EBL3711&EBL3771& EBL3712&EBL3752	16	EBL3871
1	Integrated Natural Resources Management I	EBL3841	EBL3712& EBL3771	8	EBL3871
1	Population Ecology	EBL3871	None	16	None
1	Biogeography	EBL3851	EBL3712	16	None
2	Integrated Natural Resources Management II	EBL3852	EBL3712& EBL3771	16	EBL3871
2	Disturbance & Restoration Ecology	EBL3802	EBL3712& EBL3771	8	None
2	Behavioural Ecology	EBL3812	EBL3712 OR EBE3772 - for education students	16	None
2	Entomology	EBL3822	None	8	None
Total Credits				136	

D.2.1 BACHELOR OF SCIENCE IN ENVIRONMENTAL BIOLOGY (HONOURS) 11BEBL : MODULE EQUIVALENTS

YEAR	SEMESTER	MODULE TITLE (new modules)	MODULE EQUIVALENT
1	1	BLG3511Introduction to Biology	BLG3511 Introduction to Biology
	2	BLG3512 Diversity of Life	BLG3512 Diversity of Life
2	1	BLG 3611 Animal Form and Function	BLG 3611Animal Form and Function
		MBL3631 Cell Molecular Biology and Genetics	MBL3631Cell Molecular Biology and Genetics
		BLG3621Biometrics I	STS3621Statistics for Life Sciences I
		EBL3631 Introduction to Ecology	EBL3631 Introduction to Ecology
	2	BLG3612 Plant Form and Function	BLG3612 Plant Form and Function
		MBL3632 Introduction to Microbiology	MBL3632 Introduction to Microbiology
		BLG3622 Biometrics II	STS3622 Statistics for Life Sciences II
		EBL3632 Ecological Field Techniques	EBL3632 Ecological Field Techniques
3	1	BLG3701Microbial Ecology	None/New Module
		EBL3711Aquatic Ecology	EBL3711 Fresh Water & Marine Ecology
		EBL3721Biosystematics I - Students who fail the old module, Biosystematics (EBL3831) will be still be offered to them.	EBL3831Biosystematics
		EBL3771Conservation Biology and Biodiversity	EBL3771 Conservation Biology and Biodiversity
		EBL3741Ecological systems and Climate Change	None/New module
	2	EBL3712 Ecosystem Ecology	EBL3712 Ecosystem Ecology
		EBL3752 Ecophysiology	MBL3751 Plant Physiology MBL3752 Comparative Animal Physiology
		EBL3722 Biosystematics II - Students who fail the old module, Biosystematics (EBL3831) will still be offered to them	EBL383 Biosystematics
		BLG3702 Research Methodology	BLG3702 Research Methodology
4	1 & 2	BLG3810 Research Project	BLG3810 Research Project
		EBF3800 Field Ecology	EBL3700 Field Ecology I EBL3800 Field Ecology II
	1	EBL3841 Integrated Natural Resources Management I	EBL3832 Management of Natural Resources EBL3811 Environmental Management
		EBL3871Population Ecology	EBL3731 Population Ecology
		EBL3851Biogeography	EBL3851 Biogeography
	2	EBL3852 Integrated Natural Resources Management II	EBL3832 Management of Natural Resources EBL3811 Environmental Management
		EBL3802 Disturbance & Restoration Ecology	EBL3802 Disturbance & Restoration Ecology
		EBL3812 Behavioural Ecology	EBL3812 Behavioural Ecology
		EBL3822 Entomology	MIC3802 Parasitology

D.3. BSC MICROBIOLOGY (HONOURS)

QUALIFICATION: B.Sc.in Microbiology (Honours) 11BMBL

YEAR 1

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDIT	CO-REQUISITES
1	Contemporary Social Issues	CSI3580		8	None
1	Basic Mathematics	MAT3511		16	None
1	Computer Literacy	CLC3509		8	None
1	English Communication & Study Skills	LCE3419		16	None
1	Introduction to Biology	BLG3511		16	None
1	Chemistry 1A	CHM3511		16	None
1	Physics for Life Sciences	PHY3501		8	None
2	Pre-Calculus	MAT3512		16	None
2	English for Academic Purposes	LEA3519		16	None
2	Introduction to Statistics	STS3522		8	None
2	Chemistry 1 B	CHM3512		16	None
2	Diversity of Life	BLG3512		16	None
Total Credits				160	

YEAR 2

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDIT	CO-REQUISITES
1	Animal Form and Function	BLG3611	BLG3512	16	None
1	Cell Molecular Biology and Genetics	MBL3631	BLG3511&BLG3512,	16	None
1	Biometrics I	BLG3621	STS3522	8	None
1	Microbial Systematics	MBL3611	BLG3512	16	None
1	Organic Chemistry I	CHM3651	CHM3511&CHM3512	16	None
2	Plant Form and Function	BLG3612	BLG3512	16	None
2	Introduction to Microbiology	MBL3632	BLG3511&BLG3512	16	None
2	Biometrics II	BLG3622	STS3522	8	None
2	Biomolecules and Catalysis	CHB3632	CHM3511& CHM3512	16	CHM3651
Total Credits				128	

YEAR 3

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDIT	CO-REQUISITES
1	Microbial Ecology	BLG3701	MBL3632	8	None
1	Physiology	MBL3771	None	16	None
1	Microbial Genetics	MBL3711	MBL3632	16	None
1	Bioenergetics and Metabolism	CHB3731	CHB3632	**16**	None
1	Recombinant DNA Technology	MBL3701	MBL3631& MBL3632	8	None
2	Biotechnology	MBL3712	MBL3631	16	MBL3701
2	Genetics	MBL3732	MBL3631& MBL3632	16	None
2	Organic Chemistry II	CHM3712	CHM3651	16	None
2	Research Methodology	BLG3702	BLG3621& BLG3622	8	None
2	Transmission of Genetic Information	CHB3722		8	CHB3711
Total Credits				128	

YEAR 4

SEMESTER	MODULE	CODE	PRE-REQUISITES	CREDIT	CO-REQUISITES
1 & 2	Research Project	BLG3810	BLG3702	8	None
1	Environmental And Industrial Microbiology	MIC3831	MBL3701	16	None
1	Mycology	MIC3811	None	8	None
1	Bioinformatics	MBL3801	MBL3732	8	None

1& 2	Internship	MIC3800	BLG3702	8	None
2	Immunology	MBL3812	MBL3711	16	None
2	Virology	MIC3842	MBL3711	8	None
2	Medical Bacteriology **or**	MIC3822	MBL3711		None
2	Applied Genetics	MOL3822	MBL3711	8	None
2	Parasitology **or**	MIC3852	None	16	None
2	Developmental Biology	MIC3872	MBL3732 OR MBE3771- for education students	16	None
Total Credits				110	

D.3.1. BSC MICROBIOLOGY (Hons) 11BMBL MODULE EQUIVALENTS

YEAR	SEMESTER	MODULE TITLE (new modules)	MODULE EQUIVALENT
1	1	BLG3511 Introduction to Biology	BLG3511Introduction to Biology
	2	BLG3512 Diversity of Life	BLG3512 Diversity of Life
2	1	BLG 3611 Animal Form and Function	BLG3611Animal Form and Function
		MBL3631Cell Molecular Biology and Genetics	MBL3631Cell Molecular Biology and Genetics
		BLG3621Biometrics I	STS3621Statistics for Life Sciences I
		MBL3611Microbial Systematics	None/New module
	2	BLG3612 Plant Form and Function	BLG3612 Plant Form and Function
		MBL3632 Introduction to Microbiology	MBL3632 Introduction to Microbiology
		BLG3622 Biometrics II	STS3622 Statistics for Life Sciences II
3	1	BLG3701Microbial Ecology	None/New Module
		MBL3771Physiology	MBL3752 Comparative animal physiology MBL3751Plant physiology
		MBL3711 Microbial Genetics	MBL3711 Microbiology
		MBL3701Recombinant DNA Technology	MBL3731 Recombinant DNA Technology
	2	MBL3712 Biotechnology	MBL3712 Biotechnology
		MBL3732 Genetics	MBL3732 Genetics
		BLG3702 Research Methodology	BLG3702 Research Methodology
4	1 & 2	BLG3810 Research Project	BLG3810 Research Project
		MIC3800 Internship	MIC3800 Internship
	1	MIC3831Environmental and Industrial Microbiology	MIC3812 Environmental and Industrial Microbiology
		MIC3811Mycology	MIC3811Mycology
		MBL3801 Bioinformatics Students who fail MOL3811 will be allowed to repeat the old module to ensure they have enough credits at level 8.	MOL3811Bioinformatics
	2	MBL3812 Immunology	MBL3811Immunology
		MIC3842 Virology	MIC3832 Virology
		MIC3822 Medical Bacteriology	MIC3822 Medical Bacteriology
		MOL3822 Applied Genetics	MOL3812 Applied Genetics
		MIC3852 Parasitology	MIC3802 Parasitology
		MIC3872 Developmental Biology Students who fail MOL3852 and/or MOL3832 will be allowed to repeat them to ensure they have enough credits at level 8.	MOL3852 Animal growth and development MOL3832 Plant growth and development

D.4. DEPARTMENT OF BIOLOGICAL SCIENCES CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

BLG3511 INTRODUCTION TO BIOLOGY

Module title: **INTRODUCTION TO BIOLOGY**
Code: **BLG3511**
NQF level: 5
Contact hours: 4 lectures/ week for 14 weeks and one 3-hour practical session per week.
Credits: 16
Module assessment: Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports)
Examination **60%** (1 x 3 hour examination paper)
Prerequisites: **NSCC** (Biology C or better)
Module description: This is an introductory biology module that is designed to allow students to acquire a strong foundation into the biological sciences. The following topics will be covered: Basic techniques in biology such as microscopy, drawing, the scientific method and writing of scientific reports will be covered; Introduction to systems of classification (taxonomy and binomial nomenclature, including the five kingdoms and the three domain system); Organization of life (levels of organization): Molecule, organelle, cell, tissue, organ, organ system, organism, population, community, ecosystem (including the scales in ecology), biosphere; Chemical basis of life: carbohydrates, proteins, nucleic acids, lipids and fats, water; Cell biology: prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell cycle, cell division; Genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance; Early theories on evolution, Evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. (Concepts such as homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered)

BLG3512 DIVERSITY OF LIFE

Module title: **DIVERSITY OF LIFE**
Code: **BLG3512**
NQF level: 5
Contact hours: 4 lecture periods / week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports)
Examination **60%** (1 x 3 hour examination paper)
Prerequisites: **NSCC** (Biology C or better)
Module description: This module is designed to give students a detailed understanding of the diversity of life. This module gives students the broader appreciation of biodiversity in the different ecological habitats. The following topics will be covered: introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdom and the three domain system. This module will cover topics of viral, bacterial, fungal, algal and plant diversity. It then considers the characteristics and life cycles of the following important algae and plant groups: chlorophyta, phaeophyta, rhodophyta, chrysophyta, euglenophyta, pyrrophyta, cryptophyta, bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia). Examples from Namibia shall be used where possible and applicable. The module content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.The module shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each phylum shall follow a phylogenetic approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted.

SECOND YEAR MODULES

BLG3611 ANIMAL FORM AND FUNCTION

Module title: **ANIMAL FORM AND FUNCTION**
Code: **BLG3611**
NQF Level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals (at least 10 graded practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites: **BLG3512** Diversity of Life
Module description: Introduction: Animal Structural Design and Classification. Protection and the integumentary system. Skeletal systems and movement: Hydrostatic, endo-and exo-skeletons, amoeboid movement, cilia and flagella, muscle structure and physiology. Nutrition and digestion: Feeding on particulate matter, liquids and solid food masses. Digestive systems of different animal groups. Homeostasis: Positive and negative feedback, osmoregulation and thermoregulation. Respiration and gas exchange: Simple diffusion, tracheal systems, book lungs, gills, cutaneous and lungs. The nervous system and sense organs: Nervous systems in different animal groups, neurons, the resting and action potential, the synapse, divisions of the vertebrate nervous system. The Endocrine System. Circulation and Immunity. Reproduction.

EBL3631 INTRODUCTION TO ECOLOGY

Module title: **INTRODUCTION TO ECOLOGY**
Code: **EBL3631**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous Assessment **(40%)**: Practicals 50% (no less than 5 assessed practicals), Theory 50% (3 tests, 1 assignment) Examination **60%**: 1 x 3 hr theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG 3512** Diversity of Life
Module description: Introduction to Ecology and the Biosphere: Definitions, history, scales in ecology, application of ecology, Components of the environment, the levels of organization in Ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources, Introducing Population Ecology: Characteristics of populations- birth, death, movement, size, age structure, and sex ratios, density, dispersion, demographics, factors and processes influencing, density dependent and independent factors, survivorship curves, life-tables, Life histories . Community Ecology: Patterns in conditions and resources, measuring biodiversity, biomes, biotic interactions, biotic and abiotic influence on community structure. Ecosystem ecology: Primary productivity, flux of matter and trophic structures, food chains and food webs, biogeochemical cycles (hydrological-, carbon-, nitrogen-, and sulphur and phosphorous- cycles) and human influence on them. Conservation Ecology and Biodiversity: Definitions of biodiversity, distribution of the world's biodiversity; the current human caused mass extinction. History, concepts and definitions of Conservation Biology. Aquatic Ecology: The physical properties of water, Stream Ecology, Lake Ecology, Oceans, Coasts, Estuaries.

MBL3631 CELL MOLECULAR BIOLOGY AND GENETICS

Module title: CELL MOLECULAR BIOLOGY AND GENETICS
Code: **MBL3631**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports) Examination **60%** (1 x 3 hour examination paper)
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: Chemical basis of life: water, essential and trace elements, bonds; macromolecules: proteins, carbohydrates, and nucleic acids; lipids and fats; cell structure and function; properties and function of enzymes, and models for binding; cell membrane; cell communication; cell cycle and DNA replication; cellular respiration: glycolysis, transition reaction, Krebs cycle, electron transport chain; and gene expression: transcription and translation.

BLG3612 PLANT FORM AND FUNCTION

Module title: **PLANT FORM AND FUNCTION**
Code: **BLG3612**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment (**40%**): Theory (not less than 2 tests and 1 assignment); Practicals (not less than 10 marked assignments). Examination (**60%**): 1 x 3 hour theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: Scope and introduction to Pant Biology -Traits common to all plants: Apical meristems, Alternation of generations, dependent multicellular embryo, sporangia and gametangia. Review of major groups of plants: survey through the 10 extant plant phyla - Hepatophyta, Anthocerophyta, Bryophyta, Lycophyta, Pterophyta, Cycadophyta, Gingkophyta, Gnetophyta, Coniferophyta and Magnoliophyta. Topics will emphasize the morphological adaptations of plants, the genetic properties of plant populations, plant reproduction and mating system variation, a survey of biotic and abiotic ecological interactions important to flowering plants. Plant Structure, Growth and development, Functional Plant -Microbe Associations, Stem Form and Function, Roots Form and Function, Leaves Form and Function, The flowering Plant and Animal Coevolution, Plant Adaptation to various environments. Laboratory work will include a survey of flowering plant taxonomy and plant forms and functions. Laboratory projects will explore various plant structures in selected groups, and discuss functional relationships, as well as identifying adaptive features of plant form and function.

EBL3632 ECOLOGICAL FIELD TECHNIQUES

Module title: **ECOLOGICAL FIELD TECHNIQUES**
Code: **EBL3632**
NQF Level: 6
Contact hours: 4 lecture periods per week for 14 weeks, 3 hours practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports) Examination **60%** (1 x 3 hour examination paper)
Pre-requisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: Formulation of scientific questions and hypotheses in the field; Quality assurance criteria during field work: replication, blanks, repetitions; Safety during field sampling; Ecological Field Sampling: Considerations in field sampling (objectives of sampling, type and behaviour of organism, habitat considerations, equipment requirements, selection of appropriate method, sampling design and strategy, random sampling, sample size, data recording and storage); Basic Ecological Measurements: Density, frequency, coverage and biomass; Methods of sampling terrestrial vascular plants, surveying fungi, lichens and mosses (Basic vegetation measures, Plot-based and plotless-based techniques); methods of sampling aquatic macrophytes and algae; methods of sampling invertebrates in the field; methods of inventorying small mammals; methods of surveying large mammals; methods of sampling reptiles; methods of sampling birds and bats; methods of sampling fish and other aquatic animals. All the discussions on methods must include their applicability, advantages and disadvantages of in every case. Preserving organisms for natural history collections (killing jars and their uses, herbarium specimens, 'spirit' collections, dry mounts, various agents of preservation and their advantages and disadvantages); simple dichotomous keys and their uses (parallel keys, indented keys, flow-chart keys only); methods of assessing abiotic variables, data analysis methods (include basic statistics)

MBL3632 INTRODUCTION TO MICROBIOLOGY

Module title: **INTRODUCTION TO MICROBIOLOGY**
Code: **MBL3632**
NQA level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Module assessment: Continuous assessment 40%: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination 60%: 1x3 hour theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life.
Module description: The module will include principles of microbiology, importance of microorganisms, microorganisms as cells, microorganisms and their natural environments, impacts of microorganisms on humans, and pathways of discovery in microbiology: historical roots of microbiology, Pasteur and the defeat of spontaneous generation, Koch postulates, infectious disease, pure culture microbiology. Microbial diversity and the rise of general microbiology. The modern era of microbiology. It will also give an overview of microbial life, cell structure and evolutionary history, physiological diversi ty of microorganisms, prokaryotic diversity, and eukaryotic microorganisms. Other topics are microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and chemotaxis, staining techniques, microbial nutrition, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, microbial evolution and systematics, Eubacteria, Achaea, eukaryotic microorganisms, viruses, bacteriophages, prions, diversity of microbial metabolism, microbial ecology, and methods in microbial ecology.

BLG3621 BIOMETRICS I

Module title: **BIOMETRICS I**
Code: **BLG3621**
NQA level: 6

Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session every second week for 14 weeks.
Credits: 8
Module assessment: Continuous assessment **40%:** (Practicals –at least 6 assessed practicals – contribute 40% to CA); Theory (2 tests, 1 assignment – contribute 60% to CA)
Examination **60%:** 1x2 hour theory paper
Prerequisites: **SSTS3522** Introduction to Statistics
Module description: Probability and distributions: data types; populations; means and variances; normal distribution; data collection; sampling distributions and sampling designs. Estimation and hypothesis testing: estimation of the population mean; testing hypotheses about the population mean; population variance unknown; comparing samples; pooled estimate of variance. Simple experiments: randomization and replication; completely randomized designs with two treatments; completely randomized designs with several treatments; testing overall variation between treatments.

BLG3622 BIOMETRICS II

Module title: **BIOMETRICS II**
Code: **BLG3622**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session every second week for 14 weeks.
Credits: 8
Module assessment: Continuous assessment **40%:** (Practicals –at least 6 assessed practicals – contribute 40% to CA); Theory (2 tests, 1 assignment – contribute 60% to CA)
Examination **60%:** 1x2 hour theory paper
Prerequisites: **SSTS3522** Introduction to Statistics
Module description: Control of the random variation: local control of variation; blocking; randomized block designs; meaning of error mean square; assumptions behind analysis; significance tests; comparison of two samples; one-way ANOVA; factorial experiments; split plots; Latin square designs; Studying linear relationships: linear regression; correlation; inferences; analysis of covariance. More complex relationships: multiple regressions. Analysis of proportions; non-parametric statistics; choosing a good experimental design; computers and statistical analysis of data; practice and presentation of data and results.

MBL3611 MICROBIAL SYSTEMATICS

Module title: **MICROBIAL SYSTEMATICS**
Code: **MBL3611**
NQA level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session every week for 14 weeks.
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%**: 1x3 hour theory paper
Prerequisites: **BLG 3512** Diversity of Life
Module description: Microbial diversification, endosymbiotic origin of Eukaryotes. Microbial evolution: the evolutionary process, evolutionary analysis (theoretical aspects and analytical methods), microbial phylogeny, application of SSU rRNA phylogenetic methods. Microbial systematics, with emphasis on domains bacteria and archeabacteria: Phenotypic analysis, genotypic analysis, phylogenetic analysis, the species concept in microbiology, classification and nomenclature. The proteobacteria: Phylogenetic overview of bacteria, purple phototrophic bacteria, the nitrifying bacteria, sulphur and iron-oxidizing bacteria, hydrogen-oxidizing bacteria, methanotrophs and methylotrophs. Aerobic and facultatively aerobic chemoorganotrophic proteobacteria: Pseudomonas and Pseudomonads, acetic acid bacteria, free-living aerobic and nitrogen-fixing bacteria, Neisseria, Chromobacterium and relatives, enteric bacteria, Vibrio, Aliivibrio and Photobacterium, Rickettsias. Morphologically unusual proteobacteria: Spirilla, Sheathed proteobacteria (Sphaerotilus and Leptothrix), Budding and prosthecate/stalked bacteria. Delta and epsilon-proteobacteria: Gliding myxobacteria, sulphate and sulphur-reducing proteobacteria, the epsilonproteobacteria. The practicals will include identification of bacteria based on morphological, physio-biochemical properties that enables classifications of bacterial phyla.

THIRD YEAR MODULES

BLG3701 MICROBIAL ECOLOGY

Module title: **MICROBIAL ECOLOGY I**
Code: **BLG3701**
NQF level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session every second week for 14 weeks.
Credits: 8
Module assessment: Continuous assessment **40%**: Practicals (at least 6 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%**: 1x 2 hours theory paper

Pre-requisites: **MBL3632** Introduction to Microbiology
Module description: Main themes include:

1. Role of microbial life in origin of life, evolution and the ecology
2. Microbial Interactions: Function and regulation of microbial productivity and metabolism; microbial population ecology; microbial community structure; Microbial food webs;
3. Physiological Microbial Ecology: Redox cascade; Thermodynamics and microbial ecology; Growth curves, morphology and metabolic diversity
4. Biogeochemical cycling: Carbon cycle, Nitrogen cycle, Phosphorus cycle, Sulfur cycle
5. Extremophiles: Definition of an extreme environment; thermophiles (hydrothermal vents, cold seeps and deserts); acidophiles and alkalophiles (micro flora in the gut; peats and bogs)
6. Microbiological and molecular techniques in Microbial Ecology: Quantitative ecology (numbers, biomass, metabolic activity); method for species identification; Metagenomic analysis of communities

EBL3711 AQUATIC ECOLOGY

Module title: **FRESHWATER AND MARINE ECOLOGY**
Code: **EBL3711**
NQF Level: 7
Contact hours: 4 lectures / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%:** 1x3 hour theory paper
Prerequisites: **EBL3631** Introduction to Ecology
Module description: General characteristics of water as a medium of life and how it differs from air as a medium of life in terrestrial ecosystems.Freshwater EcologyEcology of lentic systems (lakes, dams and ponds): Thermal stratification, seasonal lake turnover (destratification) and its effects on productivity; Energy flow and food webs in lentic systems; Eutrophication and harmful algal blooms. Ecology of lotic systems (rivers and streams): Distinguishing characteristics of rivers; the river continuum concept; Ephemeral river dynamics; Floodplain dynamics; Energy flow and food webs in lotic systems; Freshwater wetland systems of Namibia. Marine EcologyPhysical and chemical oceanography: Extent and depth of the oceans, ocean currents, Physical conditions (temperature, pressure, illumination, El Nino events); chemical conditions (gases, nutrients, pH and alkalinity); Ocean circulation (great conveyor system, physics of waves, tides and upwelling); upwelling
Productivity of oceans: Nutrients, upwelling, plankton, Harmful algal blooms, energy flow and food webs in the pelagic environment.Intertidal zone ecology: Rocky shores and sandy shores – physical conditions and adaptations of organisms, zonation within the intertidal zoneAquatic biogeochemistry and ecology: Sulfide events (eruptions).

EBL3741 ECOLOGICAL SYSTEMS AND CLIMATE CHANGE

Module title: **ECOLOGICAL SYSTEMS AND CLIMATE CHANGE**
Code: **EBL3741**
NQF Level: 7
Contact hours: 2 lecture periods per/ week; 3 hours practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **40%**: Practicals (at least 6 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%:** 1x 2 hours theory paper
Pre-requisites: **EBL3631** Introduction to Ecology
Module description: This module will expose students to the following topics:
Climate change science: the main elements of climate change, greenhouse gases, the sun, anthropogenic factors and the greenhouse effect, previous changes (warming and ice age,). Methods to measure climate change, sources of data, how the data is obtained and different models –global, downscaling, uncertainties. Causes of climate change -greenhouse gas emissions, nitrogen deposition and pollution, land-use change). Impacts of climate change at global, regional and national level; e.g. sea level rise, rise in global temperature, floods, drought, extreme events. The module will explore specific impacts of climate change on socio-economic sectors and ecological systems how organisms and ecosystems affected. How 'climate change' influence primary productivity, nutrient cycling, water relations and vegetation-climate feedbacks. The module will also discuss vulnerability to impacts of climate change. Linkages between climate change and medium (e.g. Millennium Development Goals and National Development goals) to long-term (e.g. Vision 2030) development goals. Climate change, poverty, gender and environmental sustainability. Adaptation and mitigation of climate change. The role of indigenous /Traditional knowledge systems in climate change adaptation and mitigation. Biological responses to CC will be examined in the context of aquatic and terrestrial ecosystems . Legal and policy frameworks on climate change. The United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, Post-Kyoto. The Clean Development Mechanism; carbon trading; tradable permit system, integrated framework of climate change. carbon sequestration and dynamic global vegetation models. As far as possible, and where applicable, relevant and appropriate discussion points and examples from Namibia will be used on each of the above e.g. vulnerability of Namibia to impacts of climate change, adaptation (food security and sustainable resource base, sustainable water resources, human health and well-being, infrastructure) and mitigation (sustainable energy and low carbon development, transport) of climate change in Namibia. Climate change cross-cutting issues in Namibia: capacity building, training and institutional strengthening, research and information, public awareness, participation and access to climate change information, disaster reduction and risk management, financial resource mobilization, international cooperation and networking, technology development and transfer, legislative development. National policy on climate change for Namibia. Namibia climate change strategy and action Plan. Climate change–related projects such as the Country partnership Program, Africa Adaptation project etc will be discussed.

MBL3771 PHYSIOLOGY

Module title: **PHYSIOLOGY**
Code: **MBL3771**
NQF level: 7
Contact hours: 4 lecture periods per week for 14 weeks, 3 hour practicals per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites: **None**
Module description: Energy and its use by plants ; Sunlight as source of energy and information; Photosynthesis – the leaf as a photosynthetic machine; Respiration ,Nitrogen metabolism – the nitrogen cycle, biological nitrogen fixation ,Water & solute uptake by cells; Mineral nutrition – essential elements, beneficial elements, soils and plant nutrition, interactions with bacteria, interaction with fungi, kinetics of ion uptake, movement of water and solutes into the roots; Whole plant water uptake Transport of photosynthetic products. Cellular and animal energetics. Physico-chemical effects of temperature, and temperature and metabolic rates. Membrane physiology and solute regulation by cells and electrophysiology of cells. Control of various body functions e.g. growth and regeneration, reproduction, iono-and osmoregulation, cellular metabolism and color by neurohormonal and classic hormonal systems. Physiology of respiration, haemoglobin and the factors that influence its oxygen carrying capacity, the Bohr effect. Blood chemistry and the physiological role of formed elements. Physiological role of water and solute regulation in terrestrial and aquatic animals. Feeding: cell secretion and movement (secretion and peristalsis by gut tube), cellular biochemistry (digestive enzymes and biochemistry of hydrolysis of various organic substrates) and nutrition (role of minerals and vitamins).

EBL3712 ECOSYSTEM ECOLOGY

Module title: **ECOSYSTEM ECOLOGY**
Code: **EBL3712**
NQF level: 7
Contact hours: 4 hours lectures / week, 3 hrs practicals per week
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%**: (1x3 hours theory paper)
Prerequisites: **EBL3631** Introduction to Ecology
Module description: Basic components of ecological systems, essential processes of ecological systems: Photosynthesis and decomposition. Nature of ecosystem energetics. Primary production; environmental factors facilitating and / or limiting primary production. Secondary production; environmental factors facilitating and / or limiting, food chains and food webs; trophic levels and ecological pyramids, Food chains and poisons in the environment, models of energy flow in ecosystems. What is a community? Physical (vertical and horizontal) structure, biological structure (species dominance, species diversity); species diversity hypotheses, species abundance, edge communities, community population interactions, community patterns in space and time. Theory of island biogeography, habitat fragmentation, habitat corridors, applications of island biogeography theory to design of protected areas. ecological disturbance? Characteristics of ecological disturbance (intensity, frequency and scale), Causes of disturbance, impacts of disturbance on nutrient cycling, Responses of animals to disturbance, disturbance and community stability. What is community succession? Process of ecological community succession, Types of succession; primary and secondary succession, Causes of succession; models of succession, climax succession state; climax community, theories of climax succession, fluctuations in climax communities, attributes of succession during succession, time and direction in succession, changes in ecosystem attributes, time and direction of succession, succession and animal life, degradative succession. Definition and classification of biomes. Desert biome, Tropical savanna biome, Tropical rain forest biome, grassland biome. For each biome, shall cover: geographic location, climate, soils, life forms, and human activities. Classification of biomes of Namibia. Desert biome, savanna biome, woodland biome, Karroo biome, Coastal and marine biome, wetland biome, land use practices in terrestrial and aquatic biomes of Namibia. What are arid environments? Causes and classification of arid ecosystems, characteristics of arid ecosystems; water (surface and ground), floods, Humidity, temperature, wind and wind erosion, soils, dust & dust storms, adaptations of organisms to arid environments. What is desertification? Causes of desertification (proximate and ultimate causes), manifestations of desertification, action to combat desertification, What is deforestation? Causes of deforestation (proximate and ultimate causes), Effects of deforestation; deforestation in Namibia, possible solutions to deforestation.

BLG3702 RESEARCH METHODOLOGY

Module title: **RESEARCH METHODOLOGY**
Code: **BLG3702**
NQF level: 7
Contact hours: 2 lecture session per week, 3 hour practical every other week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **100%** (5 assessed assignments, 1 test). Students should have prepared and present their research proposal by for their research project at the end of this module.
Prerequisites: BLG3621 Biometrics I, **BLG3622** Biometrics II
Module description: Ethics of research. The scientific method: logic and the scientific, natural observations, asking questions and formulation of hypothesis, predictions. Types of hypotheses; null, alternative, research. Biological variation, populations and sampling. Statistical significance. Experimental (research study /project) design. Data collection & keeping / documenting research data and other records. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review. Writing a research proposal. Report writing. Presenting results in an oral presentation. Presenting results as posters.

EBL3771 CONSERVATION BIOLOGY AND BIODIVERSITY

Module title: **CONSERVATION BIOLOGY AND BIODIVERSITY**
Code: **EBL3771**
NQF level: 7
Contact hours: 4 lecture periods per week for 14 weeks, 3 hours practical per week for 14 weeks
Credits: 16
Module assessment: Continuous Assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%**: 1 x 3 hr theory paper
Prerequisites: **EBL3631** Introduction to Ecology
Module description: Students will study in depth: Introduction: History and definition of Conservation Biology and Biodiversity. Biodiveristy: Global patterns, distribution and measurement of biodiversity with special emphasis on Namibian biodiversity; Biodiversity inventories; rapid biodiversity assessment. Environmental ethics. Ecological Economics: valuation of biodiversity with emphasis on the direct use value, indirect use value, option value, and existence value. Threats to Biological Diversity: Extinction with special emphasis on the causes of extinction (Habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease) as well as species vulnerability to extinction. Island Biogeography and extinction rates. Conservation at the population and species level: Species categories (keystone, indicator, flagship, umbrella and economically important species), Essential concepts and problems of small populations. Applied population biology: Studying populations, population viability analysis, metapopulations, establishing new populations, *Ex Situ* conservation, Conserving Biological Communities: Prioritising, establishing and classifying protected areas, Reserve design and conservation networks, SLOSS model, managing protected areas. Habitat restoration. Biodiversity conservation agreements.

MBL3711 MICROBIAL GENETICS

Module title: **MICROBIAL GENETICS**
Code: **MBL3711**
NQF Level: 7
Contact hours: 4 lecture periods per week for 14 weeks, 1 practical session per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment: **40%** (3 tests and at least 10 practical marks)
Examination: **60%** (1 x 3h examination paper)
Pre-requisites: **MBL3632** Introduction to Microbiology
Module description: This module covers fundamental concepts of microbial genetics and genetic engineering of microorganisms. The Structure of the bacterial DNA, Organization of the bacterial genome, Organization and replication of prokaryotic DNA. Mutations: point mutations, base-pair substitution, frameshift mutations, pyrimidine dimmers. Causes of mutations: UVlight/radiation, chemical base analogues, mutagenesis. Mutation repair mechanisms: SOS repair, post-transcription repair, base excision repair. Recombination: Conjugation, transformation and transduction. Gene expression and regulation, Isolation, specific cleavage and synthesis of DNA. Molecular tools and DNA cloning, bioinformatics and proteomics.Vectors, Transformation, Identifying recombinants. Specifically, the course will deal with the principles of genetic engineering for *Escherichia coli*, gram negative bacteria, gram positive bacteria, yeast, and filamentous fungi.

EBL3721 BIOSYSTEMATICS I

Module title: **BIOSYSTEMATICS I**
Code: **EBL3721**
NQF level: 7
Contact hours: 2 lecture periods / week for 14 weeks and 1 practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment: Continuous assessment 40%: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%).
Examination 60%: (1 x 2 hours theory paper)
Prerequisites: **BLG3612** Plant Form and Function, **BLG 3611** Animal Form and Function
Module description: This module will lay the foundation of biosystematics as follows:
Introduction to biological systematics: Definitions, Importance, Roles and Values
Methods of identification, Taxonomic characters; Taxonomic keys: types (their merits and demerits), use and construction of. Plant Morphology: General Structure Terms, those used for a specific structure/organ; terminology related to vegetative and reproductive structures Angiosperms plant familiesTaxonomic collections (**Specimens, collections, curation** and preservation of specimens, Herbarium collections and their management, The value of Natural History Collections); techniques for collecting and preserving plants; **Plant Collecting Project** (Students will be required to carry out a compulsory mini-project on the collection and preservation of plant specimens from a selection of important plant families. **Nomenclature & Classification -** the data and procedures employed in the practical discovery, naming and description of previously undescribed species. -Principles of biological nomenclature/naming, provisions of International Codes of Botanical and Zoological Nomenclature -their operative principles, interpretation and application of important rules, formation of scientific names of various taxa; Process of typication and different Zoological and Botanical types; PhyloCode**Plant Families** – a survey of plant families with the focus on important taxonomic /distinguishing characters. Common and important families will be selected to represent various groups -Characteristics of important families in the region. flowering plant systematics and diversity**.**Current issues in biosystematics: seminar discussions on current topics in biosystematics (including nomenclature, natural history collections). Each student is required to conduct a theory seminar in which he/she explores a topic of choice from selected list of current topics in Biosystematics in the published literature e.g cases of name change, PhyloCode.

EBL3722 BIOSYSTEMATICS II

Module title: **BIOSYSTEMATICS II**
Code: **EBL3722**
NQF Level: 7
Contact hours: 2 lecture periods / week for 14 weeks and 1 practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment: Continuous assessment **40%**: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%).
Examination **60%**: (1 x 2 hours theory paper)
Pre-requisites: BLG3612 Plant Form and Function; **BLG 3611**Animal Form and Function
Module description: This module will deal with Classification and Phylogeny in animals
Introduction to Phylogeny and systematics: Definition and basic concepts; The tree of Life
Theories of biological classification: various methods of classification systems from the earliest days to modern techniques, especially highlighting cladistics. History and Development (traditional (artificial) vs natural classifications; phenetic classification, Phylogenetic classification, Cladistics) Cladistics: Cladograms -Monophyl, Paraphyly and Polyphyl; sorting Homology and Analogy.Phylogenetic relationships within and amongst taxa: **Sources of data** (Fossil, morphological, molecular) and analytical methods (parsimony, likelihood, Bayesian) employed in phylogeography and phylogeny reconstruction; Molecular systematics reveals new insights Animal phylogeny/classification and diversity a survey of animal taxa with the focus on important taxonomic /distinguishing characters and identification terminology. Common and important taxa will be selected to represent various groups Species and speciation: Species concepts – species category, sub-species and other infra specific categories
Taxonomic collections (**Specimens, collections, curation** and preservation of specimens, Museum collections and theirmanagement, The value of Natural History Collections); techniques for collecting and preserving animals; **Animal Collecting Project** (Students will be required to carry out a compulsory mini-project on the collection and preservation of selected animal specimens.Current issues in biosystematics (including natural history collections, classification and phylogeny, rankless classification)

MBL3701 RECOMBINANT DNA TECHNOLOGY

Module title: **RECOMBINANT DNA TECHNOLOGY**
Code: **MBL3701**
NQF level: 7
Contact hours: 2 L / week for 14 weeks + 3h Practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **40%**: Practicals (at least 6 assessed practicals), Theory (2 tests) Examination **60%:** 1x2 hour theory paper
Prerequisites: MBL3632 Introduction to Microbiology, **MBL3631** Cell Molecular Biology and Genetics
Module description: Recombinant DNA techniques were developed through discoveries in Molecular Biology. Although the experimental techniques used may vary, depending on the objectives of the investigation, a number of experimental protocols have been developed that could be considered to form the basic techniques in recombinant DNA technology. The students will critically assess and analyse the links between the research questions and the techniques to be used in order to develop the student's understanding of and appreciation for molecular biological processes. Students will have hands-on experience in laboratory sessions in both planning and executing experimental procedures. The principles and applications of the following techniques will be discussed: gel electrophoresis, restriction and other modifying enzymes, cloning vehicles and the cloning process, polymerase chain reaction, transformation, identifying recombinants, sequencing and characterizing genes.

MBL3712 BIOTECHNOLOGY

Module title: **BIOTECHNOLOGY**
Code: **MBL3712**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (minimum of 2 tests and 1 assignment) Examination **60%** (1 x 3 hour examination paper)
Prerequisites: MBL3631 Cell Molecular Biology and Genetics,
Co-requisite:MBL3731 Recombinant DNA Technology,
Module description: Introduction to biotechnology: Definitions, scope of biotechnology, principles and techniques in genetics, biochemistry and microbiology, issues around GMOs. **Genomics**: Definitions, concepts of gene expression and analysis, techniques-genomic libraries and analysis, southern blots, applications. **Proteomics:** definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. **Transcriptomics**: definitions, concepts of gene regulation in prokaryotes and eukaryotes and analysis, Techniques- cDNA libraries and analysis, Northern blots, applications. **Metabolomics:** definitions, concepts of metabolism and analysis, primary and secondary metabolites, Techniques-metabolic pathways and analysis.

MBL3732 GENETICS

Module title: **GENETICS**
Code: **MBL3732**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment 40%: Practicals and 2 theory tests. Examination 60%: 1 x 3 hour theory paper.
Prerequisites: Cell Molecular Biology and Genetics **MBL3631**, Introduction to Microbiology **MBL3632**
Module description: Introduction to genetics; heredity and variation; Mendelian genetics; Extensions to Mendelian genetics; chromosome theory and mapping; sex chromosomes and sex determination; genes that regulate development in selected model organisms; population genetics: allele frequencies, Hardy-Weinberg law, natural selection, genetic drift; and evolutionary genetics including speciation.

FOURTH YEAR MODULES

EBL3800 FIELD ECOLOGY

Module title: **FIELD ECOLOGY**
Code: **EBL3800**
NQF level: 8
Contact hours: 4 weeks field trip (2 weeks in each semester)
Credits: 16
Module assessment: Continuous assessment: **100%** (field report)
Pre-Requisites:EBL3711 Aquatic Ecology, **EBL3771** Conservation Biology and Biodiversity, **EBL3712** Ecosystem Ecology, **EBL3752** Ecophysiology
Co-requisites: EBL3811 Environmental Management and **EBL3851** Biogeography, **EBL3852** Behavioural Ecology and **EBL3832** Management of Natural Resources
Module description: This module is designed to provide opportunity for students to acquire more field ecological, computational and analytical and thinking skills to undertake independent research designed to address relevant / specific practical problems. Students will be expected to practically apply knowledge that they have acquired in various modules they will have completed. This module is fully field-based. It will be conducted in various localities, to cover diverse ecosystems in Namibia. During the field module, students will be required to undertake mini-research projects that will require application of various data collection techniques, data analysis, interpretation, discussion and report writing. The mini projects will emphasize application of various ecological techniques, methods and procedures. The field module will be jointly offered by diverse expertise / lecturers / collaborating partners to ensure that multidisciplinary skills are acquired in an integrated manner. During the field module, 75% of the time will be dedicated to activities to enhance acquisition of practical skills. The module will be implemented through two field trips that will be undertaken in the first and second semester. Topics include: Investigating/assessing ecological complexity at different levels of biological organization (from cells to the biosphere), ecosystems approach to addressing ecological and environmental challenges, collecting, analysing and reporting ecological data, communicating scientific information from research, problem-solving procedures to analyse practical ecological and environmental problems. Application of different biotic sampling techniques / methods and application of different methods used to collect abiotic data. The specific skills to be acquired by students will vary from year to year and also depend on the chosen locality and expertise / lecturers that will be available and in charge of each field visit.

BLG3810 RESEARCH PROJECT

Module title: **RESEARCH PROJECT**
Code: **BLG3810**
NQF level: 8
Contact hours: Research project for one year
Credits: 32
Module assessment: Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%)
Prerequisites: BLG3702 Research Methodology
Module description: This module is designed to develop the research skills of students through the completion of a research project on an approved topic in the context of the major. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion.

MBL3811 IMMUNOLOGY

Module title: **IMMUNOLOGY**
Code: **MBL3811**
NQF level: 8
Contact hours: 4 lecture periods per week and 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment 40% (minimum of 2 tests and 1 assignment) Examination 60% (3 hour exam paper)
Prerequisites: MBL 3711 Microbial Genetics
Module description: Theory: The module will introduce the immune system by addressing processes and components such as: immunoglobulin classes, structure and functions of antibody molecules, lymphoid organs, antigen processing, cells involved in the immune system, T-cell receptors, Major-Histocompatiblity Complex and complement pathways. Different types of immunity such cellular mediated immunity, humoral immunity and autoimmunity will also be addressed in the module. Various human diseases caused by viruses, bacteria and parasites such as HIV/AIDS tuberculosis and malaria will then be discussed in order to give an applied perspective of immunology. Related aspects like vaccination and drug efficacy will also be covered as complementary components of the module. Contemporary issues pertaining to immunology such as gene therapy, and stem cell research will also be looked at.**Practical:** Preparation of serum from whole blood, Doing the Enzyme Linked Immono-Sorbent Assays(ELISA)Doing Agglutination Tests, Antibody Conjugation Assays, Innoculation of laboratory animals and monitoring of antibody titre

MIC3811 MYCOLOGY

Module title: **MYCOLOGY**
Code: **MIC3811**
Course Equivalent: none
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks and one three hour practical session per week per semester
Credits: 16
Module assessment: Continuous assessment: **40%** Theory (not less than 2 tests and 2 assignments), Practicals (not less than 10 marked assignments) Examination: **60%** (1 x 3 hour examination paper)
Prerequisites: None
Module description: This module will deal with concepts and applications of mycology. Topics will include Morphology, genetics, classification, ecology, and economic importance of Imperfect Fungi, Oomycetes, and Zygomycetes. Emphasis in the laboratory is on isolation, culture, and laboratory techniques. A survey of those fungi classified as Ascomycetes (such as yeasts, morels, powdery mildews and as Basidiomycetes (such as rusts, smuts, boletes, mushrooms, polypores). Emphasi in the laboratory is on anatomy and morphology as well as field identification. Biology of diseases affecting trees in the forest and forest nursery. Emphasis is on field identification using symptoms exhibited by diseases tree and characteristics of the pathogens. This module is intended to introduce the student to a quite diverse group of organisms and the many roles that they play in everyday life. The fungal kingdom and other organisms traditionally considered as fungi profoundly impact humans and the environment in both positive and negative ways. Certain fungi are responsible for production of food, while others have been responsible for devastating famines. Fungi have led to great advances in the treatment of infections through the discovery of antibiotics yet some fungi are the agents that cause many serious illnesses, especially among immuno-compromised patients. One of the most important roles that fungi play is that of recycler of organic material, which reduces complex molecules to simpler ones that can be re-used by other organisms. The module will involve group discussions of recent papers in mycological journals. This module will also include excursions to industries and the lectures will be given in a highly interactive manner.

EBL3841 INTEGRATED NATURAL RESOURCES MANAGEMENT I

Module title: **INTEGRATED NATURAL RESOURCES MANAGEMENT I**
Code: **EBL3841**
NQF level: 8
Contact hours: 2 lecture periods per week, 3 hour practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **40%:** Practicals (at least 5 assessed practicals), Theory (at least 2 tests, 1 assignment); Examination **60%:** (1 x 2 hrs theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology**, EBL3771** Conservation Biology and Biodiversity
Module description: Introduction and Overview (Definitions of management, integrated management, sustainable management, natural resources; Objectives of natural resources management, Concept of adaptive management and adaptive decision-making in natural resources management); Classification of natural resources (stock, flow, renewable, non-renewable, perpetual, exhaustible, non-exhaustible); Measures of stock resource availability (resource base, proven reserves, conditional, reserves, hypothetical resources, speculative resources, ultimately recoverable resources); Measures of flow resource availability (maximum resource potential, sustainable capacity, absorptive capacity, carrying capacity); Causes and consequences of resource scarcity; Indigenous knowledge systems (IKS) in natural resource management (definitions, importance, examples); Community based natural resource management (CBNRM) initiatives in southern Africa (Communal conservancies in Namibia, CAMPFIRE in Zimbabwe, etc.); Human-wildlife conflict (HWC) (causes, consequences, management of the problem).

EBL3852 INTEGRATED NATURAL RESOURCES MANAGEMENT II

Module title: **INTEGRATED NATURAL RESOURCES MANAGEMENT II**
Code: **EBL3852**
NQF Level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (at least 2 tests, 1 assignment, other forms of assessment) Examination **60%:** (1 x 3 hrs theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology**, EBL3771** Conservation Biology and Biodiversity
Co-requisite: **EBL3871** Population Ecology

Module description: This module prepares students for careers in management of natural resources. The following topics will be covered: Wildlife/Game management in Parks and Ranches (management for tourism and harvest, manipulation of animal numbers, concept of maximum sustained yield (MSY) in wildlife management, International and national conventions/legislation/regulations related to wildlife management and trade); Management of forest/woodland resources (definitions, types of forest management (by the State, by local communities, co-management, multi-stakeholder management, non-timber forest products); Fisheries resources management (Concept of a stock, multi-species fishery management, MSY concept in fisheries management, integrated fisheries management); Integrated water resources management (IWRM) (evolution of water management, Principles of IWRM, National and International conventions/regulations/laws/policies on IWRM); Integrated coastal zone management (ICZM) (the need for ICZM, Principles of ICZM; National and International conventions/regulations/laws/policies on ICZM); Environmental management (Principles of environmental management, National and International conventions/treaties/policies on environmental management, Environmental management systems (ISO 14000 series standards); Integrated Environmental Management (Integrated Environmental Management Systems (IMS), Principles of IMS, Environmental impact assessment (EIA), Environmental Audits, Project management); Waste management; Basics of Natural resource economics (economic systems, cost-benefit analysis, placing money on non-market goods, valuation approaches/methods); Basics of Ecological Economics (definitions, outline of some current problems in society, economics and ecology, fundamental principles of ecological economics, introduction to modeling ecological–economic systems).

EBL3851 BIOGEOGRAPHY

Module title: **BIOGEOGRAPHY**
Code: **EBL3851**
NQF level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous Assessment 40% (at least 10 assessed practicals, 1 assignment, 2 tests)Exam 60% (1x3 hours theory paper)
Pre-requisites: EBL3712 Ecosystem Ecology

Module description: This module will introduce students to the science of BIOGEOGRAPHY; a study of the distribution of past and present life on the earth. This module will cover the distribution patterns of wild plants and animals over the earth's surface. It will describe factors that determine temporal (in time) and spatial (in space) patterns of biological diversity (biodiversity). Historical changes in distribution of plants and animals will be examined using data and concepts from different disciplines such as geology, ecology, evolutionary biology and physical geography. Important biogeographic processes such as speciation, dispersal and extinction will be covered. The course will further describe past changes in the physical geography of the earth in an attempt to understand the role of such changes to the present and past distribution of plants and animals. As far as possible, and where applicable, relevant and appropriate examples from Namibia will be used. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Biogeography: definition, relationship with other sciences, philosophy and basic principals, brief history, applications of biogeography, Limits of species distributions: ecological niche, physical limiting factors, limitation by biotic interactions, adaptation and gene flow. Historical biogeography: Past changes in the physical geography of the earth: Geologic time scale, continental drift model, continents of the Paleozoic and early Mesozoic and early past changes in the physical geography of the earth: break-up of Gondwanaland. Speciation and extinctions: speciation, adaptive radiation, extinction, species selection. Dispersal: definition, mechanisms of biotic movement, nature of barriers to biotic movement, establishing a colony, dispersal routes. Invasive species will be used as case studies to illustrate various aspects of dispersal. Endemism, Provincialism & Disjunction: endemism, cosmopolitanism, types of endemics; provincialism – terrestrial biogeographic regions, biogeographic lines, classifying islands, aquatic regions and provinces, quantifying similarity among biota; Disjunction- definition & causes. Biogeographic distribution patterns of terrestrial animals: abilities of land creatures to cross water barriers amphibians, reptiles, mammals. Biogeographic distribution patterns of flying animals: bird, bats and insects. Biogeographic distribution patterns of plants: factors limiting growth and reproductive success of plants, regional endemism and patterns of speciation in plants, distribution patterns of non-vascular plants. Latitudinal taxonomic diversity gradients; latitudinal gradients in species. diversity, factors that may account for geographic patterns of species diversity: historical perturbations, productivity, harshness, climatic stability, habitat heterogeneity, competition, predation, mutualism.

EBL3802 DISTURBANCE AND RESTORATION ECOLOGY

Module title: **DISTURBANCE AND RESTORATION ECOLOGY**
Code: **EBL3802**
NQF Level: 8
Contact hours: 2 lecture periods per week, 3 hour practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous assessment 40%: (practicals at least 5 assessed practicals); theory (2 tests, 1 assignment)
Examination 60% (1 x 2 hour theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology and **EBL3771** Conservation Biology and Biodiversity

Module description: The world today is grappling with problems of degradation of habitats due to various factors. Such factors are usually referred to as 'disturbance factors' since they make these habitats less suitable for the original species to occupy. Such habitats have to be restored, somewhat, in order to conserve biological diversity. This module is designed to equip students with the knowledge about various disturbance factors and their impacts on the quality of habitats. The module also presents various approaches of restoring degraded/disturbed landscapes. <u>Disturbance ecology</u>: Introduction (definitions, importance of disturbance, natural and anthropogenic disturbance, short-term and long-term aspects of disturbance, temporal and spatial aspects, reversible and non-reversible disturbance, disturbance regimes); resilience and stability in the face of disturbance; susceptibility to disturbance; types of disturbances and their impacts on ecosystem structure, function and productivity (include case examples to demonstrate impacts of fire, pollution, deforestation, unsustainable land management practices, over-exploitation, climate change, volcanoes, alien species, etc on the provision of goods and services by various ecosystems); interactive/synergistic impacts of disturbance factors; responses to disturbance from the organism level upwards the hierarchy, disturbance and biodiversity (include the intermediate disturbance hypothesis); modeling as a tool in disturbance ecology.
<u>Restoration Ecology</u>: Introduction (definitions, the need and importance of restoration); indicators of ecosystem degradation; principles of ecological restoration; planning for ecological restoration (various ecosystems); ecological restoration in practice (include case examples on various ecosystems); natural restoration (recap on the concept of succession); involvement of local communities in restoration work (case examples); Bio-monitoring and evaluation of the restoration process; challenges and opportunities for improving degraded landscapes.

EBL3871 POPULATION ECOLOGY

Module title: **POPULATION ECOLOGY**
Code: **EBL3871**
NQF Level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%:** (1 x 3 hrs theory paper)
Pre-requisites: **None**

Module description: This module provides students with and in-depth knowledge on Populations Ecology. The following topics will be dealt with: Population growth (density-independent growth (exponential, geometric), density-dependent growth (logistic), population fluctuations and cycles and their causes and consequences); Population regulation (mechanisms of population regulation (intra-specific competition, dispersal, social interactions, etc.), key factor analysis); Life history strategies/characteristics (allocation of energy and reproductive effort, importance of body size on population processes, diapause, dormancy, migration and dispersal, r- and k-selection); Inter-specific competition (ecological niche and niche overlap, competitive exclusion principle, resource partitioning, character displacement, Lotka-Volterra equation); Predation (classification of predators, diet width, diet composition and diet preference, foraging theory and models of diet selection, classical predator-prey systems, plant-herbivore interactions, functional response, numerical response, cannibalism and its evolutionary significance); Mutualism (definitions and importance, types and examples of mutualism); Parasitism (classes of parasites and hosts, parasite-host distributions and meta-population dynamics, evolutionary aspects of parasitism, social parasitism); Population genetics (recap Mandelian genetics, genetic variation, natural selection, inbreeding, genetic drift); Aspects of Applied Population Ecology (Introduction to population dynamics modeling (conceptual, simulation), Population Viability analysis).

EBL3812 BEHAVIOURAL ECOLOGY

Module title:	**BEHAVIOURAL ECOLOGY**
Code:	**EBL3812**
NQF level:	8
Contact hours:	4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits:	16
Module assessment:	Continuous Assessment 40%: (at least 10 assessed practicals, 2 tests) Examination 60%: (1x 3 hours theory paper)
Pre-requisites:	**EBL3712** Ecosystem Ecology or only **EBE3772** for education students

Module description: This module will introduce students to the role of behavior in understanding ecology of organisms. Special emphasis will be given to the genetic basis of behavior, how behavior evolved (phylogeny) as well as how it develops in organisms (ontogeny). These will provide a foundation to understand learned and innate behavior and how behavioral ecology is instrumental in applied ecology disciplines such as conservation biology. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Introduction: definition of behavior, nervous system and behavior, simple (reflexes) and complex behavior. Development (Ontogeny) of behaviour: nature and nurture, instinct and learning in their biological setting, maturation-development involving growth, hormones and early development, play, imprinting and early experience. Evolution (Phylogeny) of behaviour: natural selection and behaviour, genetic basis of behaviour, the adaptiveness of behaviour, ritualisation. Diversity of behaviour: Innate behaviour, innate releasing mechanisms, fixed action patterns. Learned behaviour: habituation, conditioned reflex Type 1, trial & error learning, latent learning, insight learning. Communication: definition, evolution and use of signals in communication, information content of signals e.g. honey bees, manipulation in communication, cost, honesty/deceit & handicaps. Sex and sexual selection, advantages of sex (why two sexes), selection on males and females, Mate choice (male/female competition and female/male choice), Intra-and inter-sexual selection, sperm competition and mate guarding. Feeding and anti-predator behaviour: Feeding behaviour, diversity of prey capture techniques (prey detection and capture), optimal foraging behaviour, costs & benefits, optimality models, constraints in foraging efficiency; Anti-predator behaviour: detection of predators, chemical defenses, warning colouration, mimicry, alarm signals, improved vigilance, selfish herd effect. Dilution effect; Social organisation; group living (advantages), types of mating systems (e.g. polyandry, polygyny, monogamy, lek), social dominance, cooperation, aggression, altruism, parental care, territoriality , primate social organisation, insect social organisation.

MIC3852 PARASITOLOGY

Module title:	**PARASITOLOGY**
Code:	**MIC3852**
NQF level:	8
Contact hours:	4 lecture periods and 1x3hour practical period per week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%:** 1x3 hour theory paper
Prerequisites:	None

Module description: Parasites will be studied based on life cycles, host specificity, parasite biochemistry, molecular parasitology and parasites behavior. There will be a substantial basic introduction to endoparasites, ectoparasites, obligate parasites, facultative parasites as well as host-parasite interaction aspects such as symbiosis, commensalisms and mutualism. Zoonoses (diseases transmitted between animals and humans): Rabies and Hantavirus syndromes. Arthropod transmitted diseases: Rickettsial diseases, Lyme disease, West Nile virus, Plaque and others will constitute an important component of the module. The module will also address Veterinary Parasitology to discuss those parasites that are causing economic losses in agriculture or which infect companion animals such as Trypanosomiasis and Leishmaniasis. The general life cycle of arthropods which are main vectors of parasites such as ticks, fleas and locusts will be discussed. The module will also cover integrated pest management. The practical content will include: identification and isolation of endo-parasites using Glucose Flotation Method/Sedimentation. Microscopic preparation and examination of blood parasites. Identification of ectoparasites based on morphological characteristics.

MIC3822 MEDICAL BACTERIOLOGY

Module title:	**MEDICAL MICROBIOLOGY**
Code:	**MIC3822**
NQF level:	8
Contact hours:	2 lectures per week for 14 weeks and one 3-hour practical session every second week for 14 weeks.
Credits:	8
Module assessment:	Continuous assessment (40%): Theory (not less than 2 tests and 2 assignments); Practicals Examination (60%): (1 x 2 hour examination paper)
Prerequisites:	**MBL3711** Microbial Genetics

Module description: This is an applied course equivalent to Clinical Microbiology or Diagnostic Microbiology. It will start with a discussion of the purpose and philosophy of medical bacteriology, laboratory safety, laboratory organization, quality control and assessment, sterilization and disinfection, managing a microbiology laboratory, handling clinical/bacteriological specimens. The course will then look at normal microbial flora versus pathogens, morphology and taxonomy, optical methods for laboratory diagnosis of infectious disease, cultivation and isolation of viable pathogens, conventional and rapid microbiological methods for identification of pathogens. Non-traditional methods for identification and detection of pathogens or their products (particle agglutination, ELISA, flourogenic substrates, genetic probes, blotting techniques, and PCR).

MIC3831 ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY

Module title: **ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY**
Code: **MIC3831**
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment 40% (minimum of 2 tests and 2 Assignments as well as 10 assessed practicals)
Examination 60%: (1 x 3 hour examination paper)
Prerequisites: **MBL3701** Recombinant DNA Technology
Module description: Industrial fermentation: Bioprocess development- isolation and screening of target organisms, strain selection, strain improvement, master culture preservation, media design, scale-up, fermentation vessels, oxygen transfer rate, bioprocess control, downstream processing. Batch culture, fed-batch culture, continuous culture, Crabtree effect, Pasteur effect. Production of antibiotics (eg. Penicillin), vaccines (eg. hepatitis B vaccine), beer, aminoacids (eg. Lysine, glutamate), organic acids (eg. Citric acid) and vitamins (eg. ascorbic acid), algal cultures. Design, operation and monitoring of a facility for manufacture of sterile products. Bioconversions, biodegradation, bioleaching. Factors that may influence sterility in manufacturing. **Environmental microbiology**: The role of microorganisms in the Environment. Terrestrial Environment: soils. Soil microorganism associations with plants. Marine Environment and Freshwater Environment. Sewage treatment: Conventional sewage and wastewater treatment, anaerobic digesters, constructed wetlands, septic tanks. Analysis of water purity. Indicator organisms, biocontrol, Baculovirus as a control agent, biomining, bioremediation, biostimulation, bioaugmentation.

MIC3842 VIROLOGY

Module title: **VIROLOGY**
Code: **MIC3842**
NQF level: 8
Contact hours: 2 lecture periods / week for 14 weeks and one three hour practical session every second week for 1 semester
Credits: 8
Module assessment: Continuous assessment 40%: Practicals (at least 6 assessed practicals), Theory (3 tests) Examination 60%: 1x2 hour theory paper
Prerequisites: **MBL3711** Microbial Genetics
Module description: This module will deal with exciting concepts of virology and is intended to provide students with the latest information in virological methods and provide advanced knowledge. Topics will include an introduction to viruses, their nature and structure. Nomenclature, classification and diversity and evolution of viruses. Principal events involved in replication: Adsorption, penetration, disassembly, nucleic acid and protein synthesis, assembly, maturation and release. Replicative strategies employed by selected DNA and RNA viruses. Identification of virus prototypes associated with different RNA and DNA virus replication schemes. Viral pathogenesis and treatment using examples of common and emerging viruses. Throughout the virology module, emphasis on those infectious diseases that are of great actual or potential importance to humans should be made

MBL3801 BIOINFORMATICS

Module title: **BIOINFORMATICS**
Code: **MBL3801**
NQF level: 8
Contact hours: 2 Lectures per week for 14 weeks + 3h practical every second week for 14 weeks
Credits: 8
Module assessment: Continuous assessment: 40% (3 tests – 60% + at least 10 practical marks – 40%)
Examination: 60% (1 x 3h examination paper)
Prerequisites: **MBL3732** Genetics,
Module description: The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and interactive course in which students will acquire knowledge on information networks, the World Wide Web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed. The information retrieval and analysis tools such as sequence similarity and alignment will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. The module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences The course will consist of lectures, student presentations and assignments

MOL3822 APPLIED GENETICS

Module title:	**APPLIED GENETICS**
Code:	**MOL3822**
Course Equivalent:	**MOL3812** Applied Genetics
NQF level:	8
Contact hours:	2 lecture periods/week for 14 weeks and one three hour practical session every second week per semester
Credits:	8
Module assessment:	Continuous assessment **40%:** Practicals; 2 theory tests. Examination **60%:** 1 x 2 hour theory paper.
Prerequisites:	**MBL3711** Microbial Genetics

Module description: This is a senior undergraduate course designed to allow students to conceptualise the applications of genetics in dealing with day to day situations in agriculture, medicine and the environment. This course will deal with exciting concepts in genetics. Topics will include: Introduction, aims of Applied Genetics, revision of basic genetic concepts and terminology; the inheritance and analysis of qualitative and quantitative characters; regression, transgression, environmental effects and heritability; correlations between characters; genotype, phenotype and breeding values; population genetics: allele frequencies, genetic equilibria, population mixing, genetic drift and gene flow; types and uses of selection; departures from random mating; mutation and its uses; recombination and mapping; structural chromosome aberrations: their origins, properties and uses; changes in chromosome number: their effects and uses; supernumerary ("B") chromosomes; breeding methods and examples; human and medical genetics; genetic engineering in plants, animals and micro-organisms, and human gene therapy; genetic variation in wild and agricultural populations, genetic conservation; genetic methods of insect pest management; applied fungal genetics; ethics.

MIC3872 DEVELOPMENTAL BIOLOGY

Module title:	**DEVELOPMENTAL BIOLOGY**
Code:	**MIC3872**
Course equivalent:	**MOL3852** Animal growth and development, **MOL3832** Plant growth and development
NQF level:	8
Contact hours:	4 lecture periods / week for 14 weeks and 1x3hour practical sessions per week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment **40%** (minimum of 2 tests and 2 Assignments) Examination **60%** (1 x 3 hour examination paper)
Prerequisites:	**MBL 3732** Genetics, Only **SMBE3771**- for education students

Module description This module is designed to provide students with an understanding and appreciation of the complex processes of plant growth and development from a molecular perspective. The module will examine the characteristics of plant growth, with emphasis on the meristematic nature of this growth and growth kinetics, as well as the advantages and disadvantages of different growth parameters. The process of growth will be discussed from a physical perspective taking into account Heyn's concept of cell wall extensibility, the role of pH and expansions, cell growth & water stress and the need for solutes. A number of developmental control mechanisms will be considered with emphasis on the interdependency between genetic, hormonal and environmental control mechanisms, as well as signal perception and transduction. The role of the six classes of plant hormones in the regulation of cell division, cell enlargement, cell differentiation, seed development, shoot & root development, senescence and abscission, as well as flower and fruit development will be investigated, mainly from results obtained from mutagenic studies. The module will further examine the structure, characteristics and functions of phytochrome, cryptochrome and phototropin with emphasis on photocontrol of seed germination, the processes of etiolation & de-etiolation, canopy shading & end-of-day signals and photoreceptor signal transduction. The module will conclude with an investigation of flowering by considering aspects such as floral induction and floral development. Animal growth, including the genetic control of cell growth, differentiation and morphogenesis, development of the gametes, fertilization, all stages of pre-embryonic and post-embryonic development. The two developmental paths followed by animals namely regulative development and mosaic development will be discussed. Aging: Telomere-deletion hypothesis, wear-and-tear hypothesis, Gene-clock hypothesis, accumulated mutation hypothesis and effects of various physiological and Environmental factors affecting these processes. Cancer: cell-cycle regulation and genetics of cancer, causes and development of cancer. Stem cells: embryonic stem cells, somatic stem cells, therapeutic stem cell cloning etc. Animal tissue culture and Cloning: tissue culture techniques, tissue culture media, cloning.

EBL3822 ENTOMOLOGY

Module title:	**ENTOMOLOGY**
Code:	EBL3822
Course equivalent:	None – new module
NQF level:	8
Contact hours:	2 lecture periods / week for 14 weeks and 1x3hour practical sessions every second week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment: **40%;** practicals (at least 5 practicals), at least 2 tests, and 10% of CA for insect collection/identification project. Examination **60%:** 1x2 hour theory paper
Prerequisites:	None

Module description Introduction to entomology; Why study entomology. Structure: segment morphology; internal and external insect structures; Physiology: insect growth, development and physiology; Insect senses and behavior (including communication); pheromones.Insect diversity: Common insect Orders and their representatives; Orthoptera; Isoptera Hemiptera; Neuroptera; Coleoptera; Diptera; Lepidoptera; Hymenoptera. Pests and beneficial insects, key pests in Namibia, secondary pests; insects as vectors of disease; insect vector-parasite relations; secondary plant metabolites and plant-insect relationships; economic damage. Pest management, Crop protection methods; Integrated Insect Pest Management (IIPM).

MBL3850 INTERNSHIP

Module title:	**INTERNSHIP**
Code:	MBL3850
Course equivalent:	None – new module
NQF level:	8
Contact hours:	This module will provide opportunities for students to spend 4 weeks at various university laboratories, research institutions and industries in order to gain hands-on experience. Students can choose any time during the year to do their internship, as long as it does not interfere with their classes or practicals.
Credits:	8
Module assessment:	Continuous assessment (100%). Students will be graded based on comprehensive reports which they must submit upon the completion of the internship. In addition a report based on a standard format designed by the department will be submitted by the supervisors of the student during the internship.
Prerequisites:	**BLG3702** Research Methodology

Module description during the internship period students will be attached to different relevant scientific institutions in Namibia, in the SADC region as well as identified institutions in other African countries. Students will have to participate in projects and programs which are carried out at the respective institutions. Attached students are also obliged to attend scheduled events such as seminars, tours and lectures at the institutions. Although the department will identify some relevant institutions, the students may suggest institutions of their choice as long as they are in agreement with the department. The type of skills to be learned through the internship will be decided by the students themselves based on their interests.

D.6. SERVICE MODULES FOR EDUCATION STUDENTS ONLY

MBE3771 CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS

Module Title: **CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS**
Code: **MBE 3771**
Module equivalent: SMBE3771
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks and 1x3hour practical session per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (minimum of 2 tests and 2Assignments) Examination **60%** (1 x 3hour examination paper)
Prerequisites: **BLG3612** Plant Form and Function, **BLG3611** Animal Form and Function
Module description: This is a broad based course that will start with an introduction to the chemical basis of cellular processes, an overview of mitosis and meiosis, Mendelian & non-Mendelian Genetics: monohybrid crosses, dihydrid cross, test crosses, chromosomal theory of inheritance, sex determination & sex-linked genes, basic genetic linkage and chromosome mapping, and the genetic code; structure and function of eukaryotic chromosomes and mutations as the basis for genetic variations and their effects and natural selection. Macromolecules : proteins, carbohydrates fatty acids and nucleic acids and their roles in cellular organization; the structure of DNA and genome sizes and complexity; DNA replication; Eukaryotic transcription and RNA processing. The module will include principles of microbiology, importance of microorganisms, microbial cell structure, physiological diversity of microorganisms, prokaryotic diversity, microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and bacterial taxis, staining techniques, microbial nutrition and metabolism, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, Identification of bacteria; Microbial genetics and genetic engineering: conjugation, transformation and transduction; Mutations, causes and uses of mutations; DNA Isolation; molecular cloning, genetic recombination, detection of variation in proteins and DNA. Genetically Modified Organisms: examples, risks and benefits.

EBE3772 ENVIRONMENTAL BIOLOGY FOR EDUCATORS

Module Title: **ENVIRONMENTAL BIOLOGY FOR EDUCATORS**
Module Code: **EBE3772**
Module equivalent: EBE3772 ENVIRONMENTAL BIOLOGY FOR EDUCATORS
NQF Level: 7
Contact hours: 4 lecture periods / week for 14 weeks and 1x3hour practical session per week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment 40%: Practicals (at least 10 assessed practicals), Theory (2 tests)
Examination 60%: 1x3 hour theory paper
Prerequisite: **BLG3611** Animal Form and Function, **BLG3612** Plant Form and Function
Module description: This module is designed to equip students with the necessary understanding of various topics in environmental studies. The main focus of this module is to enhance understanding of relationships of organisms with one another and with their environment including the human dimension. The following will be covered in this module: Ecology and environment: Definitions. Basic components of ecological systems, essential processes of ecological systems: photosynthesis and decomposition. Primary and secondary production, energy flow and flux of matter and trophic structures, food chains and food webs, trophic levels and ecological pyramids, Food chains and poisons in the environment. Biogeochemical cycles (water-, carbon and nitrogen-cycles) and human influence on these cycles. Population Ecology: characteristics of populations- birth, death, immigration, emigration, size, age structure, and sex ratios. Population density, dispersion, mortality, natality and survivorship, population growth, parasitism. Population regulation (mechanisms of population regulation, intra-specific competition, dispersal, social interactions). Ecosystems and Biomes: definitions, classification and characteristics of various biomes of the world. Biomes of Namibia. Climate change: definition, causes, mitigation and adaptations. Desertification: definitions, causes of desertification (proximate or immediate and ultimate or underlying causes), manifestations of desertification, action to combat desertification. Deforestation: causes (proximate or immediate and ultimate or underlying causes) and effects of deforestation, deforestation in Namibia and possible solutions to deforestation. Conservation ecology: definitions, global patterns, distribution and measurement of biodiversity. Sustainable development. Threats to biological diversity (including habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease). Human influences on ecosystems; damage to the environment, urbanization.

EBE 3801 ENVIRONMENTAL EDUCATION

Module Title:	**ENVIRONMENTAL BIOLOGY FOR EDUCATORS**
Module Code:	EBE3801
Module equivalent:	none – New module
NQF Level:	8
Contact hours:	2 lecture periods / week for 14 weeks and 1x3hour practical session every second week for 14 weeks. However this module is taught as a block during the second half of the first semester
Credits:	8
Module Assessment:	Continuous assessment 40%: Practicals (at least 10 assessed practicals), Theory (2 tests) Examination 60%: 1x3 hour theory paper
Prerequisite:	None

Module description: The module will expose eduation students to environmental education. Most of the content is practical and the following will be covered: Definitions: Education for sustainable development; Environmental Education; Sustainability; Biodiversity; Extinction; Endangered species; Conservation.Environmental issues/problems and how culture impact on the environment: Climate change; deforestation; desertification; greenhouse effect; pollution; Solutions and alternatives to environmental issues/problemsEnvironmental protocols; conventions, treaties; charters and agendasDevelopment of learning materials to aid environmental education in the classroom including how to take learning activities to the outdoors and the integration of environmental education into various subjects.

D.7. MSC BIODIVERSITY MANAGEMENT & RESEARCH (11MSCB) (IN COLLABORATION WITH HUMBOLDT UNIVERSITY, GERMANY)

D.7.1. DEPARTMENTAL REGULATIONS

D.7.1.1. ADMISSION REQUIREMENTS

The MSc Biodiversity Management and Research program in the Department of Biological Sciences is open to applicants with at least a Bachelor's degree at NQF level 8 or equivalent with Biology or related majors. The applicants will be accepted on the basis of their undergraduate records with an average mark of at least 60%.

D.7.1.2. DURATION OF STUDY

The Master of Biodiversity Management and Research is offered through coursework and thesis, extending over two years of full-time study. The coursework is conducted during the first academic year of study and is followed by a supervised original research project extending over the second year.

D.7.1.3. CURRICULUM COMPILATION

The curriculum for the Biodiversity Management and Research consists of coursework, internship and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

D.7.1.4. EXAMINATION REGULATIONS

Formal examination will take place at the end of each semester. Examinations will be subject to external assessment. The Admission & Examinations Committee will decide on admission to the module examinations. In addition to module-specific regulations, attendance of at least 80% in a particular module is a requirement for examination admission. Students must pass all modules for them to proceed to the master thesis. A mixture of assessment modes will be used: written, oral or practical examinations, reports and presentations.

D.5.1.5. FORMAT AND EVALUATION OF THESIS WORK

Before a candidate can proceed to the thesis, he/she must first successfully complete the coursework examinations. Each student will submit a Master Thesis/Dissertation during the second year. The thesis must be drafted in English language. The thesis must be in a format given by the Coordinators. The thesis will be evaluated by the supervisor and another examiner within one month after submission. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination.

D.7.1.6. PRACTICALS

Attendance of practical classes, field trips and internship is compulsory.

QUALIFICATION: Master of Science Biodiversity Management & Research (11MSCB)

D.7.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

YEAR 1

SEMESTER	MODULE	CODE	PRE-REQUISITE	CREDIT	COMPULSORY/ ELECTIVE	CORE-REQUISITE
1	Biostatistics, Scientific Presentation & Publication	EBM5911	Admission requirements	18	Compulsory	none
1	Academic Writing for Post Graduate Students	UAE5819	Must be a registered postgraduate student	18	Compulsory	none
1	Assessing Biodiversity	EBM5931	Admission requirements	18	Compulsory	none
1	Evolution of Biodiversity	EBB 5911	Admission requirements	18	Compulsory	none
1	Applied Biogeography	EBB 5931	Admission requirements	18	Compulsory	none
1	Integrated Land use and Water Resources Management	EBL5911	Admission requirements	18	Compulsory	none
2	Natural Resource Economics and Management	EBL5912	Admission requirements	18	Compulsory	none
2	Environmental law	EBL5932	Admission requirements	18	Compulsory	none
2	GIS and Remote sensing	EBL5952	Admission requirements	18	Elective	none
2	Management of Natural History Collections	EBM5912	Admission requirements	18	Elective	none
2	Functional Biodiversity of Arid and Semiarid ecosystems	EBF5912	Admission requirements	18	Elective	none
2	Functional Biodiversity of woodland and forest Ecosystem	EBF5932	Admission requirements	18	Elective	none
2	Functional Biodiversity of Marine Ecosystems	EBF5952	Admission requirements	18	Elective	none
2	Functional Biodiversity of Freshwater Ecosystems	EBF5972	Admission requirements	18	Elective	none
Total Credits				**252**		

YEAR 2

SEMESTER	MODULE NAME	CODE	PRE-REQUISITES	CREDIT	COMPULSORY/ ELECTIVE	CORE-REQUISITE
1	Internship	EBL5902	Students must pass all year 1 modules and register for thesis	9	Compulsory	none
1 & 2	Thesis	EBL5900	Student must pass all year 1 modules	120	Compulsory	none
Total Credits				**129**		

FIRST YEAR MODULES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Module Title: **ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code: **UAE5819**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%**, Examination **60%** (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: This module is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

EBM5931 ASSESSING BIODIVERSITY

Module Title: **ASSESSING BIODIVERSITY**
Code: **EBM5931**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part for continuous assessment mark. Weighting: Continuous assessment **40%**, Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content:A general overview about the history of biodiversity research; important definitions for biodiversity research; introduction to the significance and vulnerability of biodiversity; rational for biodiversity assessment, levels at which biodiversity may be assessed; genetic, species, ecosystem, biome and global scale; latitudinal diversity gradients, global versus regional diversity, ecological processes and habitat heterogeneity, biodiversity indices, introduction into various methodological approaches for assessment of biodiversity (biodiversity assessment methods; Gap analysis, conservation biodiversity workshops, National Conservation review, All Taxa Biodiversity Inventory [ATBI], Rapid Biodiversity Assessment, Rapid Assessment Programme, rapid biodiversity appraisal versus long-term ecological monitoring, line transects versus plot design, spatial and temporal organisation of organisms, species, populations); the concept of bioindicators; functional zoodiversity; scaling, tracking and monitoring procedures; the role of habitat (diversity, abundance and habitat use); ecological niches and inter-specific occurrence (contractors versus empires); radio-telemetry; delineation of research; selected examples of data collection and description; spatial orientation and time (seasonality); behavioural studies for biodiversity research; formulation of hypotheses; testing of hypothesis; designing and need for adaptation of monitoring programs, communities, ecosystems and biomes; humans and the biosphere (human population dynamics, shrinking of resources); scientific nature conservation; IUCN Red List; bioprospecting; buffer zones and migration corridors; working with landowners and local communities; making results available for conservation authorities.

EBM5911 BIOSTATISTICS, SCIENTIFIC PRESENTATION AND PUBLICATION

Module Title: **BIOSTATISTICS, SCIENTIFIC PRESENTATION AND PUBLICATION**
Code: **EBM5911**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and 2 tests during the semester that will form a mark for continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: Revision of Descriptive Statistics (measures of location and spread as well as graphical presentation of data). Statistical Inference: Parametric as well as Nonparametric methods. Agricultural Experimentation: Principles of experimental design for on-station and adaptive field research trails, Repeated measurements; Analysis of data from balanced designs. Some basic designs: Latin squares, Randomized Complete Block Designs, Completely randomised designs, Split-plot designs – applications to field experiments and trails. Methods of analysing multiple experiments, data management. Multivariate analysis – additive main effects and multiplicative interaction models; Spatial Statistics: Basic concepts of time series; exponential smoothing forecasting, ARIMA models. Definition of and reasons for communication and presentation. Modes of communication and presentation. Is there difference between communication and presentation? Why scientific communication and presentation? The Scientific method, communication and presentation. What is research? Ethics of scientific research, Overview of the scientific method. Graphical presentation of research data, Distinction between data analysis and presentation; Graphs, pie charts, tables, figures, photographs, cartoons etc. Oral scientific presentation; Oral presentation, Use of power point. Written scientific communication: Generic components of scientific writing; Title, abstract, introduction, literature review, aims and objectives, hypotheses (null, alternative, research), key questions, materials and methods, results (graphical presentation of research data, citing statistical test outcomes, description of trends of research data), discussion of research results, drawing conclusions based on research results, summary of results, recommendations, references, appendices / annexes; Practical (research) report; Review articles (literature review);, Writing the thesis. How to prepare scientific poster? Posting Information on the Web.

EBB5911EVOLUTION OF BIODIVERSITY

Module Title: **EVOLUTION OF BIODIVERSITY**
Code: **EBB5911**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: Historical background of the theory of evolution, milestones; evidence of past evolution; comparative anatomy and paleontology; homologous and analogous structures; evolutionary biogeography; Mendelian inheritance; molecular and Mendelian genetics; phylogeny and classification of mammals (synapomorphic characteristics, ontogeny of mammals, the mammalian head, olfactory communication, placentation, the status of newborn in Therian mammals); dissection and preparation of selected animals and analyses of diagnostic characters; apomorphic and plesiomorphic traits; co-evolution and inter-specific competition; natural and artificial selection; sexual selection (directional, disruptive, stabilising selection, secondary sexual characteristics, Zahavi's Handicap Principle versus Fisherian runaway principle, sexual dimorphism); life-history strategies (fundamental aspects of life history, K- and r- selected species); synthetic theory of evolution; evolutionary scenarios, human evolutionOrigin of Agriculture: Origin, Domestication and Introduction of Crops and Animals, Evidence for Origins and Spread of Agriculture. Patterns of Evolution of Crop Plants and Domestic Animals: Evolutionary processes and their role, Genetic Erosion and Genetic Vulnerability: Meaning and causes, Conservation of Biodiversity. Centres of diversity and their significance. In situ and ex situ conservation. International Plant Genetic Centres and their mandates. Biodiversity International. Important Biodiversity Conventions. A brief background to aquaculture: Definition of aquaculture, types of organisms cultured, summary of world aquaculture production, culture technologies. The history and evolution of aquaculture: History of aquaculture from prehistoric to modern times, development of aquaculture from extensive to highly intensive water reuse technologies. The use of evolutionary tools in aquaculture: Selective breeding, hybridization, polyploidy, sex manipulation & cloning, molecular genetics. Importance of plant systematic, morphological, typological and Cladistic (Phylogenetic) species concepts. Major problems that plant pose to the Linnean Hierarchical system; intergeneric hybridization, asexual reproduction, apomictic plants, (microspecies), forms of polyploidy (including allopolyploidy and autopolyploidy), polyploidy in crop plants, polyploid swarms and horizontal gene transfer. Review of the International Code of Botanical Nomenclature and rules for naming plants. Interpretation of phylogenetic trees. The meaning of gene trees vs. species trees. Reticulate evolution and its effect on phylogenies. Shortcomings to the Phylogenetic Species Concept. Plant identification resources in Namibia and Southern Africa; local experts, herbaria, and identification materials (books, unpublished keys). Plant pressing and preservation. Acacia species shall be collected in the veld, and pressed and identified with NBRI dichotomous keys, with emphasis on learning important plant identification terminology.

EBB5931 APPLIED BIOGEOGRAPHY

Module Title: **APPLIED BIOGEOGRAPHY**
Code: **EBB5931**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: This module will discuss applications of Biogeography, a study of past and present distribution of plants, animals and other organisms. The content will include the following:- patterns of distribution of plants, animals and communities: distribution on different scales from local to global, distribution maps, general explanation of distribution patterns: environmental factors, species interactions, geographical barriers, plate tectonics and the distribution of organisms, endemism, disjunctions and cosmopolitanism. From species to ecosystems, relations of ecosystems to climate and soils, climate zones and ecoregions: global and African perspectives, environmental gradients, ecotones and ecoclines, forest lines. Biodiversity: aggregation of observations and explanation. Global, regional and local patterns of diversity and explanatory theories. Dynamics: special problems. Species: evolution and extinction, seasonal variations, migration with examples from Namibia. Communities: dispersal, alien invasions and extinctions, disturbance regimes, habitat fragmentation and global change. Humans and the biosphere: special problems. Human geography and biogeography, human habitat alteration, human use of biodiversity. Conservation: red lists, island biogeography and design of nature reserves, ecological landscape design. Bioindication: assessment of the state of natural resources. Environmental impact assessment, environmental monitoring; deforestation, desertification. Climate change: causes and evidence of climate change, climate change adaptation and mitigation, effects of climate change on distribution of organisms and various levels of biological diversity, challenges of climate change in Namibia, Africa and elsewhere.

EBL5911 INTEGRATED LAND USE AND WATER RESOURCES MANAGEMENT

Module Title: **INTEGRATED LAND USE AND WATER RESOURCES MANAGEMENT**
Code: **EBL5911**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: Biodiversity and Agriculture; Eco zones and agriculture, Agriculture and biodiversity: reasons and example for negative and positive impacts on biodiversity. Sustainable land use systems, like Organic Farming, Low-Input-Sustainable Agriculture, Agro-forest systems, Management of biodiversity in agricultural production systems, like crop rotation and integrated pest management. Holistic land use planning – example planning of a biodiversity based agricultural eco system. Demonstration of interactions between agriculture and biodiversity at Neundam. Resource management; Definitions: Resource management; Resource development; biodiversity; sustainable development; Pre-cautionary approach; Objectives of resource management, Global development and the environment. History of conservation in Namibia and present conservation approaches – The Namibian National Biodiversity Programme and Strategy and Action plan. Key elements on which a manager needs information to achieve sustainable exploitation of resources. Social and economic dimensions in resource management. Conflicts that exist amongst different user groups. Management of aquatic resources, management of wildlife, enhancing productivity without resource degradation. The ecosystem approach for resource management. Adaptive management.

EBL5912 NATURAL RESOURCE ECONOMICS AND MANAGEMENT

Module Title: **NATURAL RESOURCE ECONOMICS AND MANAGEMENT**
Code: **EBL5912**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment.Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Provide a list of requirements or courses that should first be completed before this one.
Content: Content will include the following:- Spatial development and management on the local and regional level. Factors and principles of population and economic growth: population development (natural, migration), population pyramid, Malthusian hypothesis, environmental constraints, demographic transition. Economic change in the development process: sectors of the economy, three sector hypothesis, reasons for sectoral change, sector-specific differences between industrial and developing countries. Land use forms: Thünen's land use theory, bid-price curves, modifications to the theory, role of transportation costs. Economic activities in space and their spatial patterns: locational decision-making, footloose industries, central place theory, ranges of goods, locational patterns of services. Locational systems in time: Vance's model, rank size rule, neoclassical models, polarisation models, polarisation-reversal hypothesis, long wave theory, product life cycle theory. Regional multiplier effects: forward, backward and service linkages, external and internal agglomeration effects, spread and backwash effects, agglomeration advantages and disadvantages. Instruments and strategies of regional economic development: targets, basic decisions, instruments, spatial strategies. Spatial development and management on the global level. Global disparities: GDP/GNP, per capita income, economic and social indicators, Human Development Index, ecological indicators. Spatial effects of globalization: globalisation and regionalisation, supranational integration spaces, import substitution and export diversification, institutional framework of globalisation, trade (reasons, global patterns), comparative cost advantages, term of trade, foreign direct investments (positive and negative effects, global patterns). Commodity chains: producer-driven commodity chains, consumer-driven commodity chains, governance and spatial consequences.

Agricultural Value Chains and the proliferation of global standards. Rural Development in the context of globalisation with a special focus on African small scale farmers. Globalisation and the environment: global diversity, environmental hazards, fresh water, pollution shares, economics of biodiversity.

EBL5932 ENVIRONMENTAL LAW

Module Title: **ENVIRONMENTAL LAW**
Code: **EBL5932**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: This module will provide an Introduction to International Law: History, sources, relation to national law, relevance in international relations. Discussing international environmental law it highlights history and concepts of international environmental law focusing on the Stockholm, Rio and Johannesburg Conferences, key principles, common goods and the role of developing countries. The module emphasizes environmental treaties, their drafting, negotiations, conclusion and regimes. Principles and problems of Biodiversity Protection through law will be discussed critically in the light of conservation of land resources, conservation treaties (land), species protection and the Convention on International Trade in Endangered Species (CITES). Matters relating to the implementation, human rights and trade related problems will be highlighted. The Biodiversity Convention (CBD), Desertification and Wetlands will be equally important as conservation of marine resources, fishing, oil pollution, UNCLOS, regional treaties, liability approach. Biodiversity and intellectual property are to be viewed in the light of genetic resources and traditional knowledge, the WIPO and WTO regimes. TRIPS, GMOs, the Cartagena Protocol on Biosafety, the developments of climate change and its effects on biodiversity will be legally discussed within the relevant national legal framework and international conventions and protocols. A comparison of environmental law and policy in Namibia, SADC, the EU and Germany will be undertaken. Concept and Scope of the Environment and its law, Foundations and Functions of International Environmental Law, Sources of international and national Environmental Law, International institutions, Principles of International Environmental Law, Compliance and dispute settlement, Criminal aspects of Environmental Law, Sectoral and trans-sectoral regulation (national, regional and international).

EBL5952 GIS AND REMOTE SENSING

Module Title: **GIS AND REMOTE SENSING**
Code: **EBL5952**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%**, Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: Content will include the following:- Application and benefits of GIS, Elements of GIS, Basic Geographic Concepts, Cartographic concept of the real world, Scale of Measurement, Spatial location and reference, Projections and coordinate systems. GIS Data Models, Relational database management system, Graphic representation of entities, Vector GIS, Raster GIS. Data Input, Storage and Editing, Primary and Secondary data input devices, GPS, Digitizing, Scanning, Data conversions, Remote Sensing data. Data Analysis, Data Query, Classification, Buffers, Neighborhood functions, Comparison of variables among maps. Data Output and Presentation, The designing process, Map design controls, Non-cartographic output. What is meant by remote sensing? Electromagnetic radiation; Platforms and sensors – Remote Sensed data sources, Image processing and analysis, Thematic applications. Display and manipulation of image files; image pre-processing: radiometric and spectral enhancement; geometric corrections; remote sensing for land use/land cover identification; remote sensing for vegetation monitoring. Remote Sensing for hydrosphere. Map composition and GIS integration (raster/vector).

EBM5912 MANAGEMENT OF NATURAL HISTORY COLLECTIONS

Module Title: **MANAGEMENT OF NATURAL HISTORY COLLECTIONS**
Code: **EBM5912**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: The module will discuss several aspects of the management of natural history collections. Students will be trained in the principles of establishing, developing, maintaining, and information redistribution in biological reference and research collections. Topics will include:- purpose of collections (introduction, definition of collections, ethics, operational planning); specimen acquisition (field preservation, preservation fluids and fixatives, specimen labelling, microscope preparation, vertebrate preparation, botanical preparation, skeletal reconstruction, gene and tissue banks); collection management (infrastructure management, record keeping, specimen management, information extraction, information management, digital information capture, electronic information processing, collection development planning); information dissemination (exhibitions and education, practical display techniques, practical education techniques); specimen identification (character sets, paper based identification media, morphometric identification media, electronic identification media, building character sets for identification keys, constructing keys) Overview of herbaria and museums, their functions and importance: Definition, objectives and importance of herbaria and museums; use of collections in research, exhibits and educational programs, and how collections can be used to help educators meet science education goals; Types of herbaria: National, Private, University and combinations of these; Types of collections: Type specimens, Main collection, Carpological collection, Bulky specimens, Xylarium, Bryophytes & Lichens, Macrofungi, Fossils, Spirit collection, Illustrations, Photographs & Copies of specimens, Microscope slides. Herbarium and museum curation: Collection management procedures and preservation techniques including acquisitions and accessions, specimen preparation, exchanges, loans, access and use, documentation, storage, conservation, pest control, profiling, cataloging, digitization, and administration. Database use and management: Types of databases used, practices and procedures of information capture, entry and retrieval; importance of back-ups; uses of the data on the system. Challenges faced by herbaria and museums, and opportunities to be explored to enhance their functions.

EBF5912 FUNCTIONAL BIODIVERSITY OF ARID AND SEMI-ARID ECOSYSTEMS

Module Title: **FUNCTIONAL BIODIVERSITY OF ARID AND SEMI-ARID ECOSYSTEMS**
Code: **EBF5912**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: This module will introduce and discuss the functional aspects of the biodiversity of arid and semi-arid ecosystems with emphasis on arid and semi-arid systems in Southern Africa and in particular Namibia. The module will introduce hot arid lands of the world and Namibia. Special attention will be given to understand ecophysiology in conditions of limitations of factors such as water, food etc. Students will learn how organisms adapt to desert conditions. The biodiversity in deserts shall be explored including factors that enhance and those that limit biodiversity in deserts. The module shall further discuss natural resources found in deserts and how they should be managed. Students shall also learn about desertification. The module shall have a large component of practical field work during which students will collect data and use this for their reports, oral presentations and a mini-research project. These will be undertaken during the compulsory Field Course for the module. Topics will include:- Introduction to Hot Arid Lands of the World and Namibia, geographic & climatological background, with emphasis on Namib. Ecophysiology in conditions of water limitation, food limitation, and heat: sources, limitations, time-space windows. Desert Ecology: life history patterns, community and population processes, food-webs, autecology, Biodiversity in deserts: source-sink effects, patchiness, speciation processes and local extinction/persistence, biogeography (connect to other courses). Introduction to natural resources and their management in deserts. Desertification: causes, occurrence, criteria for indicators, possibilities of combating. Optional integration of a 2-days-seminar with emphasis on the specific problems of another arid region e.g. Land Degradation and Desertification in the Sahel – Examples from the Butana Region in the Rep. of the Sudan.

EBF5932 FUNCTIONAL BIODIVERSITY OF WOODLAND AND FOREST ECOSYSTEMS

Module Title: **FUNCTIONAL BIODIVERSITY OF WOODLAND AND FOREST ECOSYSTEMS**
Code: **EBF5932**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: Definition of functional ecology and functional biodiversity; Definitions of woodland and forest ecosystems; Global and regional distribution of forest and woodland ecosystems; Classification of woodland and forest ecosystems; Overview of White's Phytochoria/Regional Centres of Endemism (with special emphasis on southern African Woodlands and Forests); Brief overview of the importance of woodland and forest biodiversity. Biodiversity and ecosystem function: Plant Functional Types; The intermediate disturbance hypothesis; Hypotheses on ecosystem function; Consequences of changing biodiversity on ecosystem functioning. Determinants of forest and woodland dynamics and functioning: Overview of determinants; Primary determinants (precipitation and temperature, soil moisture, soil nutrients, geology and soils); Secondary determinants (fire, herbivores (including invertebrates), other anthropogenic influences); Interactions among determinants; Savanna structure and functioning (in view of the above determinants). Threats to woodland and forest biodiversity: Impacts of Deforestation and Fragmentation on biodiversity of forests and woodlands; Impact of Climate and Variability on biodiversity of forests and woodlands; Unsustainable forest/woodland management practices (overgrazing, shifting cultivation, harvesting regimes, poor fire management, etc.); impacts of invasive alien species on biodiversity of forests and woodlands; impacts of Infrastructure development, mining and pollution on biodiversity of forests and woodlands. Management of woodland and forest ecosystems: Forest and woodland management approaches (management by the State; management by local communities; Co-management of forests and woodlands; Resource-sharing; multi-stakeholder management of forests and woodlands); Conservation of forest and woodland genetic resources (in situ; ex situ); Convention on Biological Diversity (CBD) as it relates to conservation of forest and woodland biodiversity. Modeling woodland and forest ecosystem structure and function: Introduction to Conceptual and Simulation modeling of forest and woodland dynamics (use case example(s) from moist forests; case example(s) from savanna ecosystems). Gradient analysis in vegetation ecology: Hierarchical classification methods; Indirect gradient (ordination) analysis methods; Direct gradient (ordination) analysis methods.

EBF5952 FUNCTIONAL BIODIVERSITY OF MARINE ECOSYSTEMS

Module Title: **FUNCTIONAL BIODIVERSITY OF MARINE ECOSYSTEMS**
Code: **EBF5952**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements

Content: This module will provide an insight into structural biodiversity (spatial levels) and functional biodiversity. properties, circulation (deep circulation and upwelling). Marine organisms: function and the environment – the effects of different abiotic factors (temperature, nutrients, light, pressure, salinity) on the distribution and abundance of marine organisms; life in a fluid medium (plankton and nekton). Organisms and processes in the open ocean. Marine aquatic food webs and key players: Distribution of species in the multidimensional niche-space. Primary producers: Patchy distribution of plankton; density dynamics of plankton and the role of upwelling; biological production in the ocean and its assessment; harmful algal blooms (HABs). Zooplankton: density dynamics; diurnal vertical migrations. Benthos: Organisms inhabiting soft substrates and hard substrates; the intertidal zone environment (sandy- and rocky shores, exposed- and sheltered shores); estuaries as dynamic environments; marshes; mangroves; coral reefs; the deep sea bed (hydrothermal fauna). The benthic communities in these various habitats are discussed with the focus on their feeding and reproductive ecology. Top predators: Their ecological role in marine food webs; effects of losing top predators in marine ecosystems – case studies. The microbial loop: ecological significance; the role of microorganisms in nitrogen, carbon, phosphorus and sulfur cycling in marine ecosystems, the microbial loop and climate change; significance of microorganisms in sulfidic events off the Namibian coast and the ecological significance of these sulfidic events.

EBF5972 FUNCTIONAL BIODIVERSITY OF FRESHWATER ECOSYSTEMS

Module Title: **FUNCTIONAL BIODIVERSITY OF FRESHWATER ECOSYSTEMS**
Code: **EBF5972**
NQF Level: 9
Contact hours: 42
Credits: 18
Module Assessment: CA: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment.Weighting: Continuous assessment **40%**, Examination **60%** (1 x 3 hour paper)
Prerequisites: Admission requirements
Content: Definitions and examples of different freshwater ecosystems: global distribution, Namibian situation, impacts. Physical and chemical characteristics (temperature, dissolved gases, light intensity, transparency, nutrients concentration) of lentic and lotic freshwater ecosystems and how these factors create a multi-dimensional niche system, affecting the ecology of organisms. Definition and determination of functional biodiversity: Introduction to basic molecular-biological techniques used in biodiversity studies, functional richness (the number of functional groups derived from a combination of functional feeding groups and habit trait groups), Functional diversity – the number of functional groups and division of individuals among these groups, functional evenness - the division of individuals among functional groups, and functional structure - the composition and abundance of functional groups in a habitat. The importance of functional biodiversity. Effects of environmental gradients in lotic systems on functional richness and biodiversity. The river continuum concept - relationships of the functional biodiversity of stream macro-invertebrates to major environmental and spatial gradients in lotic ecosystems. Vertical stratification and gradients in lentic ecosystems and how it affects functional biodiversity. Major functional groups in freshwater ecosystems: 1. Producers – factors affecting productivity; primary producers in lentic systems and in lotic systems; interaction of producers and consumers. 2. Consumers – major consumers in lotic and lentic systems; factors affecting the functional role of consumers in freshwater ecosystems. 3. Decomposers – major biogeochemical cycles in freshwater ecosystems and the microorganisms playing a role in these cycles. Manifestation of various food webs, including microbial loop. Effects of invasive alien species on functional biodiversity - evaluation of changes in freshwater fauna in terms of composition, structure and function: Case studies.

EBF5902 INTERNSHIP

Module Title: **INTERNSHIP**
Code: **EBF5902**
NQF Level: 9
Contact hours: None: 6 weeks attachment
Credits: 9
Module Assessment: Assessment will be done through continuous assessment: **100%**. Each student will submit a comprehensive report. Supervisor where student will be attached shall submit a report outlining skills that the student acquired and assessment of the student's performance at assigned tasks. The student will be awarded a pass for satisfactory report and recommendation from the supervisor.
Prerequisites: Student must pass all year 1 modules and register for thesis
Content: The content of the module will be determined by the needs, requirements and interests of the respective students. This is a student-centered module. The place of attachment and nature of knowledge sought and skills acquired will be determined by the students and as advised by the lecturers.

EBL5900 THESIS

Module Title: **THESIS**
Code: **EBL5900**
NQF Level: 9
Contact hours: 42
Credits: 120
Module Assessment: 100% The viva voce and written thesis are assessed and make up 25% and 75% of the final thesis mark respectively.
Prerequisites: Student must pass all year 1 modules
Content: The content and nature of research for the thesis will depend on the topic of research selected by the student.

E. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY (NEW DEGREE PROGRAMMES)

E.1. DEPARTMENTAL REGULATIONS

E.1.1 PURPOSE AND RATIONALE OF THE QUALIFICATIONS

The purpose of this qualification is to provide students with an all-round view of the interlink between chemistry and other applied fields. Holders of this qualification will be able to operate at the interface of geochemistry, medical chemistry and environmental chemistry.

The Biochemistry component is design to provide students with the knowledge to study the structure, composition, chemical components and processes of living systems plants, insects, viruses, microorganisms, and mammals to explain how and why chemical reactions occur. study such topics as how living things obtain energy from food, the chemical basis of heredity, industrial application of biochemistry, drug design and development, biotechnology, micro-and nanotechnology and what fundamental changes occur in disease. Students will get opportunity to apply biochemistry knowledge to, medicine, food science, pharmacology, physiology, microbiology, and clinical chemistry. Enzymes and their kinetics and mechanisms are covered in detail. Metabolic pathways are examined from thermodynamic and regulatory perspectives.

The department seeks to facilitate students' progression towards fulfilling and exciting careers in academia, industry, and/or government and also to develop their skills as future leaders in science and society. Successful candidates can be successful entrepreneurs or take employment in the education, public or private sectors especially in fields like, Mining, Industrial Manufacturing, Forensics, Medicine, etc where a balanced Chemistry knowledge is important.

E.1.2. ADMISSION REQUIREMENTS

To register for Bachelor of Science in Chemistry (Honours) or Bachelor of Science in Biochemistry (Honours) degree programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification. English is a compulsory subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol, or English as a First Language at NSSC (O level) with a minimum D symbol. In addition at least a C symbol on NSSC or equivalent qualification in Mathematics and Physical Science is required. A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics, English, and Physical Science must be included) to be admitted to undergraduate studies (Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook). Obtaining the minimum number of points, however, does not necessarily ensure admission. Admission is based on availability of places and is awarded on the basis of merit.
The Faculty reserves the right to subject candidates to additional selection procedures before admission. Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the General Regulations (in the General Information and Regulations Yearbook). A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is considered.

E.1.3. ASSESSMENT CRITERIA

All practical sessions are compulsory. Tutorial sessions are compulsory in the modules where they are offered. To qualify for the supplementary examination, the student needs a final mark of between 45 – 49 %, and a subminimum of 40 % examination mark. The final mark is composed of 50% continuous assessment mark and 50% examination mark. In their final year, all students are required to do a research project.

E.1.4. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

Minimum requirements for re-admission into the Faculty of Science
To be re-admitted to the Faculty of Science for a particular year of registration, a student must have passed the minimum number of modules required as indicated below:

- 64 credits of total 160 credits by the end of the first year (about 40%); 2 of these modules (equivalent to 32 credits) must be non-core
- 8 full modules (equivalent to 128 credits of 288 cumulative credits) by the end of the second year (about 45%)
- 15 full modules (equivalent to 240 credits of 424 cumulative credits) by the end of the third year (about 57%)
- 24 full modules (equivalent to 384 credits of 544 cumulative credits) by the end of the fourth year (about 69%)

E.1.5. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the modules of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases, prerequisites for modules have to be passed before a student can proceed to register for modules.
• **From year 1 to year 2:** At least 7 full modules (equivalent to 112 credits of 160 credits at level 5) prescribed for year 1.
• **From year 2 to year 3:** All first year modules plus at least 5 full modules (equivalent to 80 credits of 128 credits at level 6).
• **From year 3 to year 4:** All second year modules plus at least 5 full modules (equivalent to 80 credits of 128 credits at level 7).

E.1.6. REQUIREMENTS FOR QUALIFICATION AWARD

To be awarded a Bachelor's degree by the Faculty, a student must pass all the modules prescribed in the programme including the electives. The qualification will be awarded to students who have obtained a total number of 544 credits in this programme.

E.2. BSC IN CHEMISTRY (HONOURS) MEDICINAL: 11BSCC

QUALIFICATION: B.Sc. in CHEMISTRY (HONOURS) 11BSCC

Students opting for a MEDICINAL CHEMISTRY application must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication and Study Skills	LCE3419	16		none
1	Physics for Physical Sciences I	PHY3511	16		none
1	Introduction to Biology	BLG3511	16		none
2	Chemistry 1B	CHM3512	16		none
2	Precalculus	MAT3512	16		none
2	English for Academic Purposes	LEA3519	16		none
2	Contemporary Social Issues	CSI3580	8		none
2	Computer Literacy	CLC3509	8		none
2	Diversity of Life	BLG3512	16		none
Total Credits			**160**		

Year 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM3512	none
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	none
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	none
1	Calculus I	MAT3611	16	MAT3512	none
2	Physics for Physical Sciences II	PHY3512	16		none
2	Introduction to Statistics	STS3522	8		none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none

2	Biomolecules and Catalysis	CHB3632	16	CHM3511; CHM3512; CHM3651	none
2	Introduction to microbiology	MBL3632	16	BLG3511; BLG3512	none
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none
1	Inorganic Chemistry II	CHM3751	16	CHM3611 MAT3512	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Bioenergetics and Metabolism	CHB3731	16	CHB3632	none
1	Drug Discovery and Development	CHP3721	8	CHM3651	none
1	Medicinal Chemistry I	CHP3741	8	CHM365	CHP3721
1	Biochemical Analysis	CHB3741	8	CHB3632	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year compulsory modules	none
2	Transmission of Genetic Information	CHB3722	8	CHB3632	none
Total Credits			**124**		

YEAR 4

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Physical Chemistry III	CHM3831	16	CHM 3631; MAT3611	none
1	Research Project	CHM3810	16	Pass in all third year modules and at least one statistics module	none
1	Natural Product Chemistry I	CHM3821	8	CHM3752, CHM3702	none
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	none
2	Inorganic Chemistry III	CHM3862	8	CHM3751, CHM3752	none
2	Research Project	CHM3810	16	Pass in all third year modules and at least one statistics module	none
2	Natural Product Chemistry II	CHM3822	8	CHM3752, CHM3801	none
2	Medicinal Chemistry II	CHP3842	8	CHP3741, CHM3851, CHP3721	none
2	Medical Bacteriology	MIC3822	8	MBL 3711	none
Total Credits			**128**		

TABLE FOR ALL MODULES IN BSC IN CHEMISTRY (HONOURS) WITH THE ENVIRONMENTAL CHEMISTRY APPLICATION: 11BSEC

Students opting for ENVIRONMETAL CHEMISTRY application must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication and Study Skills	LCE3419	16		none
1	Physics for Physical Sciences I	PHY3511	16		none
1	Introduction to Biology	BLG3511	16		None
2	Chemistry 1B	CHM3512	16		none
2	Precalculus	MAT3512	16		none
2	English for Academic Purposes	LEA3519	16		none
2	Contemporary Social Issues	CSI3580	8		none
2	Computer Literacy	CLC3509	8		none
2	Diversity of Life	BLG3512	16		None
Total Credits			**160**		

Year 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM 3512	none
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	none
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	none
1	Calculus I	MAT3611	16	MAT3512	none
1	Radiochemistry	CHP3621	8	CHM3511; CHM3512	none
2	Physics for Physical Sciences II	PHY3512	16		none
2	Introduction to Statistics	STS3522	8		none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none
2	Introduction to Earth Systems	GLY3502	8		none
2	Introduction to microbiology	MBL3632	16	BLG3511;BLG3512	none
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none
1	Inorganic Chemistry II	CHM3751	16	CHM3611 MAT3512	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Water Analysis	CHP3701	8	CHM3602	none
1	Environmental Chemistry I	CHP3711	16	CHP3621	none
1	Microbial Genetics	MBL3711	16	MBL3632	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year compulsory modules	none
2	Crystallography & Mineral Chemistry	GLY3632	16	MAT3512 & CHM3512	none
Total Credits			**136**		

YEAR 4

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Physical Chemistry III	CHM3831	16	CHM 3631; MAT3611	none
1	Research Project	CHM3810	16	Pass in all third year modules and at least one statistics module	none
1	Wastewater Treatment	CHP3811	16	CHP3701, CHP3711	none
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	none
2	Inorganic Chemistry III	CHM3862	8	CHM3751, CHM3752	none
2	Research Project	CHM3810	16	Pass in all third year modules and at least one statistics module	none
2	Environmental Chemistry II	CHP3822	8	CHP3711	none
Total Credits			**120**		

E.10 TABLE FOR ALL MODULES IN BSC IN CHEMISTRY (HONOURS) WITH THE GEOCHEMISTRY APPLICATION: 11BSGC

Students opting for a GEOCHEMISTRY application must take all of the following modules:

YEAR 1

SEMESTER 1	MODULE NAME	COURSE CODE	Credits	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication and Study Skills	LCE3419	16		none
1	Physics for Physical Sciences I	PHY3511	16		none
1	Intro. To Phys. Geol. & Surface Proc.	GLY3521	8		none
2	Chemistry 1B	CHM3512	16		none
2	Precalculus	MAT3512	16		none
2	English for Academic Purposes	LEA3519	16		none
2	Contemporary Social Issues	CSI3580	8		none
2	Computer Literacy	CLC3509	8		none
2	Intro. To Earth Systems	GLY3502	8		none
Total Credits			**144**		

Year 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM 3512	none
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	none
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	none
1	Calculus I	MAT3611	16	MAT3512	none
1	Field Geology I	GLY3600	8	GLY3521	none
2	Physics for Physical Sciences II	PHY3512	16		none
2	Introduction to Statistics	STS3522	8		none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none
2	Stratigraphy& Geological Map.	GLY3612	16		none
2	Intro. to Petrology	GLY3652	16		none
Total Credits			**136**		

YEAR 3

SEMESTER 1	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none

1	Inorganic Chemistry II	CHM3751	16	CHM3611 MAT3512	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Sedimentology & Palaeontology	GLY3731	16	GLY3521; GLY3662	none
1	Regional Geology of Namibia	GLY3761	8	GLY3521	none
1	Mineralogy	GLY3711	16	GLY3632 ; CHM3512;PHY3601	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year compulsory modules	none
2	Exploration Geochemistry and Geostatistics	GLY3782	8	GLY3642	none
2	Igneous Petrology	GLY3722	8	GLY3662 & GLY3642 & GLY3600	none
Total Credits			**136**		

YEAR 4

SEMESTER 1	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Physical Chemistry III	CHM3831	16	CHM 3631; MAT3611	none
1	Research Project	CHM3810	16	Pass in all third year modules and at least one statistics module	none
1	Igneous Petrogenesis	GLY3821	8	GLY3722;GLY3711	none
1	Industrial Minerals and Gemstones	GLY3801	8	GLY3711	none
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	none
2	Inorganic Chemistry III	CHM3862	8	CHM3751, CHM3752	none
2	Research Project	CHM3810	16	Pass in all third year modules and at least one statistics module	none
2	Coal, Gas and Petroleum	GLY3802	8	GLY3751	none
Total Credits			**120**		

E.3. BACHELOR OF SCIENCE IN APPLIED BIOCHEMISTRY (HONOURS) 11BCAC

TABLE FOR ALL MODULES IN BSC IN APPLIED BIOCHEMISTRY (HONOURS) WITH THE BIOMEDICAL APPLICATION: 11BCAC

Students opting for a BIOMEDICAL application must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication and Study Skills	LCE3419	16		none
1	Physics for Life Sciences 1	PHY3501	8		none
1	Computer Literacy	CLC3509	8		none
1	Introduction to Biology	BLG3511	16		none
2	Chemistry 1B	CHM3512	16		none
2	Precalculus	MAT3512	16		none
2	English for Academic Purposes	LEA3519	16		none
2	Contemporary Social Issues	CSI3580	8		none
2	Introduction to Statistics	STS3522	8		none
2	Diversity of Life	BLG3512	16		none
Total credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM3512	none
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	none
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	none
1	Calculus I	MAT3611	16	MAT3512	none
1	Statistics for Life Sciences I	STS3621	8	STS3522	none
2	Biomolecules and Catalysis	CHB3632	16	CHM3511 CHM3512 CHM3651	none
2	Introduction to microbiology	MBL3632	16	BLG3511 BLG3512	none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none
Total credits			**112**		

YEAR 3

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Bioenergetics and Metabolism	CHB3731	16	CHB3632	none
1	Biochemical Analysis	CHB3741	8	CHB3632	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Microbial Genetics	MBL3711	16	MBL3632	none
1	Drug Design and Development	CHP3721	8	CHM3651	none
1	Medicinal Chemistry I	CHP3741	8	CHM3651; CHP3721 (co-requisite)	none
2	Transmission of Genetic Information	CHB3722	8	CHB3632	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year compulsory modules	none
2	Innovation and Entrepreneurship	CHB3762	8	CHP3721, CHB3741	none
Total credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Bioinformatics	CHB3831	16	CHB3711, MBL3631	none
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Research Project	CHM3810	16	Pass in all third year modules	none
1	Natural Product Chemistry I	CHM3821	8	CHM3752, CHM3702	none
1	Organic Chemistry III	CHM3851	16	CHM3752	none
1	Clinical Biochemistry	CHB3821	8	CHP3721	none
2	Biotechnology, Micro and Nanotechnology	CHB3842	8	CHB3722	none
2	Industrial Pharmaceutical Biotechnology	CHB3862	8	CHB3722, CHP3721	none
2	Research Project	CHM3810	16	Pass in all third year modules	none
2	Natural Product Chemistry II	CHM3822	8	CHM3752, CHM3801	none
2	Medicinal Chemistry II	CHP3842	8	CHP3741, CHM3851, CHP3721	none
2	Medical Bacteriology	MIC3822	8	MBL 3711	none
2	Health and Nutritional Biochemistry	CHN3842	8	CHB3632, CHB3741	none
Total credits			**136**		

TABLE FOR ALL MODULES IN BSC IN APPLIED BIOCHEMISTRY (HONOURS) WITH THE ENVIRONMENTAL APPLICATION: 11BSAB

Students opting for an ENVIRONMENTAL application must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication and Study Skills	LCE3419	16		none
1	Physics for Life Sciences 1	PHY3501	8		none
1	Computer Literacy	CLC3509	8		none
1	Introduction to Biology	BLG3511	16		none
2	Chemistry 1B	CHM3512	16		none
2	Precalculus	MAT3512	16		none
2	English for Academic Purposes	LEA3519	16		none
2	Contemporary Social Issues	CSI3580	8		none
2	Introduction to Statistics	STS3522	8		none
2	Diversity of Life	BLG3512	16		none
Total credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM 3512	none
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	none
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	none
1	Calculus I	MAT3611	16	MAT3512	none
1	Statistics for Life Sciences I	STS3621	8	STS3522	none
1	Radiochemistry	CHP3621	8	CHM3511 CHM3512	none
2	Biomolecules and Catalysis	CHB3632	16	CHM3511 CHM3512 CHM3651	none
2	Introduction to microbiology	MBL3632	16	BLG3511 BLG3512	none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none
Total credits			**120**		

YEAR 3

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Bioenergetics and Metabolism	CHB3731	16	CHB3632	none
1	Biochemical Analysis	CHB3741	8	CHB3632	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Microbial Genetics	MBL3711	16	MBL3632	none
1	Water Analysis	CHP3701	8	CHM3602	none
1	Environmental Chemistry I	CHP3711	16	CHP3621	none
2	Transmission of Genetic Information	CHB3722	8	CHB3632	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year modules	none
2	Innovation and Entrepreneurship	CHB3762	8	CHP3721, CHB3741	none
Total credits			**136**		

YEAR 4

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Bioinformatics	CHB3831	16	CHB3711, MBL3631	none
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Research Project	CHM3810	16	Pass in all third year modules	none
1	Wastewater Treatment	CHP3811	16	CHP3701, CHP3711	none
1	Environmental and Industrial Microbiology	MIC3811	16		none
2	Biotechnology, Micro and Nanotechnology	CHB3842	8	CHB3722	none
2	Industrial Pharmaceutical Biotechnology	CHB3862	8	CHB3722, CHP3721	none
2	Research Project	CHM3810	16	Pass in all third year modules	none
2	Chemical Xenobiotics and Toxicology	CHB3832	16	CHP3711, CHP3701	none
Total credits			**120**		

E.4. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY MODULE DESCRIPTIONS

FIRST YEAR MODULES

CHM3511 CHEMISTRY 1A

Module Title:	**Chemistry 1A**
Module Code	CHM3511
NQF Level	5
NQF Credits	16
Contact Hours	4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 75%, laboratory component 15% and tutorial 10%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	
Compulsory/Elective	Compulsory

Module Descriptor : The following topics are covered:Introduction: Matter, Measurement and Molecules; Stoichiometry: Calculations with Chemical Formulae and Equations; Aqueous Reactions and Solutions Stoichiometry; Electronic Structure of Atoms; Periodic Properties of the Elements and Relationships Among Elements; Basic Concepts of Chemical Bonding; Basic Molecular Geometry and Bonding Theories.

CHM3512 CHEMISTRY 1B

Module Title:	**Chemistry 1B**
Module Code	CHM3512
NQF Level	5
NQF Credits	16
Contact Hours	4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 75%, laboratory component 15% and tutorial 10%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	
Compulsory/Elective	Compulsory

Module Descriptor: The following topics are covered:Gases; Intermolecular Forces, Liquids and Solids; Properties of Solutions; Thermochemistry and Further Aspects of Chemical Thermodynamics; Chemical Kinetics; Chemical Equilibrium; Acid-Base Equilibria Additional Aspects of Aqueous Equilibria: The Common-Ion Effect, Buffer Solutions, Acid-Base Titrations; Electrochemistry.

SECOND YEAR MODULES

CHM 3611 INORGANIC CHEMISTRY I

Module Title:	**Inorganic Chemistry I**
Module Code	CHM 3611
NQF Level	6
Contact Hours:	4 lecture periods per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511 (Chemistry 1A), CHM 3512 (Chemistry 1B)
Compulsory/Elective	Compulsory

Module Descriptor: This is an introductory course to inorganic chemistry. It builds upon what is covered in the First Year chemistry courses. Students are expected to review the structure of the atom on their own, then the course progresses into its reactivity to form simple and complex molecule. The following topics are covered:In-depth studies of chemical bonding; (valence bond theory (VBT), shapes of molecules and hybridization; molecular orbital theory (MOT) in diatomic and polyatomic molecules); Delocalized multiple bonding. S-block elements: The chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides;

CHM3651 ORGANIC CHEMISTRY I

Module Title:	**ORGANIC CHEMISTRY I**
Module Code	CHM3651
NQF Level	6
NQF Credits	16
Contact Hours	4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 68%, laboratory component 20% and tutorial 12%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)
Compulsory/Elective	Compulsory

Module Descriptor: Basic concepts: bonding, structural representation, molecular shapes, introduction to stereochemistry, functional groups and their interchangeability, acid-base reactions of carboxylic acids and amines; Alkanes and cycloalkanes: nomenclature, physical properties, conformational analysis, bicyclic and polycyclic alkanes, reactions and synthesis of alkanes. Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, racemates, meso compounds, optical activity, resolution. Nucleophilic substitution and elimination: nucleophiles and electrophiles, S_N2 and S_N1 reactions; carbocations and carbanions, E1 and E2 reactions. Alkenes and alkynes: physical properties and synthesis, hydrogenation, index of hydrogen deficiency, preparation, addition reactions, Markovnikov's rule, hydroboration, oxidation reactions. Radical reactions: free radicals, halogenation of alkanes, chain reactions. Alcohols and ethers: synthesis, reactions, mesylates and tosylates, epoxides, crown ethers, phase transfer catalysis, synthesis and reactions of epoxides.

CHM3631 PHYSICAL CHEMISTRY I

Module Title:	**Physical Chemistry I**
Module Code	CHM3631
NQF Level	6
Contact Hours:	4 lecture periods per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511(Chemistry 1A), CHM3512 (Chemistry 1B), MAT3511 (Basic Mathematics), MAT3512 (Precalculus)
Compulsory/Elective	Compulsory

Module Descriptor: The properties of gases: the perfect gas; real gases. The First Law of Thermodynamics: work, heat, and energy; the change in internal energy; expansion work; heat transactions; enthalpy; adiabatic changes; thermochemistry; state functions and exact differentials. The Second Law of Thermodynamics: the direction of spontaneous change and the dispersal of energy; entropy; Carnot cycle; entropy changes accompanying specific processes. The Third Law of thermodynamics. The Helmholtz and Gibbs energies. Standard reaction Gibbs energies. Combining the First and Second Laws of Thermodynamics. Physical transformations of pure substances: phase diagrams; phase stability and phase transitions. Simple mixtures: the thermodynamic description of mixtures; the properties of solutions. Chemical equilibrium: spontaneous chemical reactions; the response of equilibria to different conditions.

CHP3621 RADIOCHEMISTRY

Module Title:	**Radiochemistry**
Module Code	CHP3621
NQF Level	6
Contact Hours:	2 lecture periods per week for 14 weeks
NQF Credits	8
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 75% and Assignment plus laboratory component 25%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511; CHM3512
Compulsory/Elective	Elective

Module Descriptor: Radiochemistry: Stability of the nucleus, modes of radioactive decay, kinetics of decay, secular and transient equilibrium, methods of measurement, statistics, health and safety, applications of ionising radiation in chemistry and biochemistry.

CHB3632 BIOMOLECULES AND CATALYSIS

Course Title:	**Biomolecules and Catalysis**
Course Code	CHB3632
NQF Level	6
Contact Hours:	4 lecture periods per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511 (Chemistry 1A, and CHM3512 (Chemistry 1B)
Compulsory/Elective	Compulsory

Module Descriptor: The following topics are covered:

Composition and structure of biomolecules; Biochemical reactions in aqueous solutions; Energy and biochemical reactions; The medium of Life – Water; Isomers/Stereoisomers and chirality in biochemical systems; Thermodynamics of Biological Systems; Carbohydrates: Structure and Chemistry; Glycoproteins and their functions; Reactions; **Lipids:** classification and structure; terpenes and steroids; fatty acids; triacylglycerols; glycerophospholipids and glycosphingolipids; **Amino acids and proteins:** structure and properties; reactions; separation and analysis of mixtures of amino acids; **Proteins:** structure of amino acids, structure of proteins; physical and chemical properties; ionisation; folding and conformation; **Membranes and membrane transport:** chemical and physical properties of membranes; structure and chemistry of membrane proteins; Transport across biological membranes; importance of light energy in transport processes; **Nucleotides and Nucleic acids:** structure and chemistry of nitrogenous bases; nucleosides; structure and chemistry of nucleotides; different classes of nucleic acids; structures of nucleic acids; **Introduction to Enzymes:** nomenclature; proteins as catalysts; kinetics and specificity; kinetics of enzyme-catalysed reactions; inhibition of enzyme activity; **Introduction to Mechanisms of enzyme action and enzyme regulation**

CHM3602 ANALYTICAL CHEMISTRY I

Module Title:	**Analytical Chemistry I**
Module Code	CHM3602
NQF Level	6
NQF Credits	8
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)
Compulsory/Elective	Compulsory

Module Descriptor: Review of some fundamental concepts; sampling and sample preparation; expressions of concentration and content; evaluation of analytical data; measures of accuracy and precision; random and systematic errors; aqueous equilibria; mass and charge balance equations; principles of titrimetry; acid-base titrations; titration curves and indicators; applications of acid-base titrations; distillation, extraction, gravimetric methods of analysis; common ion and diverse ion effects; precipitation titrations; indicators used in precipitation titrations; introduction to chromatographic methods; gas chromatography; principles of gas-liquid chromatography; and basic information about spectroscopic methods of analysis.

THIRD YEAR MODULES

CHB3741 BIOCHEMICAL ANALYSIS

Course Title:	**Biochemical Analysis**
Course Code	CHB3741
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Biomolecules and Catalysis (CHB3632)
Compulsory/Elective	Compulsory

Module Descriptor: Review of Amino Acids, Peptides and Proteins**; Separation Methods:** Principles of Separation techniques, Methods based on: polarity, ionic nature, size and shape; Chromatography and Spectroscopy; **Immunological Methods:** Antigen-Antibody reactions, precipitation reaction, immunoassay: **Enzymes:** enzyme assay methods; **Carbohydrates:** chemical and enzymatic methods; identification of carbohydrate mixtures; **Amino Acids:** n-terminal analysis, reactions and separation of amino acids, amino acid analyser; **Proteins:** methods of separation and quantitation; **Lipids:** Sample preparation and handling, separation and quantitation; **Nucleic Acids**: Isolation and purification, analysis, vectors and sequencing, matrix-assisted laser desorption-ionization mass spectroscopy MALDI-MS, (MALDI-TOF)

CHP3701 WATER ANALYSIS

Module Title:	Water Analysis
Module Code	CHP3701
NQF Level	7
NQF Credits	8
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Analytical Chemistry I (CHM3602)
Compulsory/Elective	Elective

Module Descriptor: Surface water, Ground water, drinking water quality, physical properties of ground water and its occurrence, water analysis: physical properties of water, determination of chlorides, sulphates, carbonates, bicarbonates, acidity, turbidity, pH, metal ions, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), suspended solids (SS), Total Dissolved Solids (TDS), residual chlorine, Water management.

SCHB3731 BIOENERGICS AND METABOLISM

Course Title:	**Bioenergics and Metabolism**
Course Code	SCHB3731
NQF Level	7
Notional Hours	160
Contact Hours:	4 lecture periods per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3511 (Chemistry 1A,), CHM3512 (Chemistry 1B), Biomolecules and Catalysis CHB3632
Compulsory/Elective	Compulsory

Module Descriptor: The following topics are covered:

Introduction to metabolism: metabolic pathways and organic reaction mechanisms; experimental approaches in metabolism; thermodynamics of phosphate groups and thermodynamics of life**; Glucose metabolism:** Glycolysis; pathways; reactions; fermentation; other hexoses metabolism; **Other pathways of carbohydrate metabolism: Glycogen** breakdown; -synthesis; - control; -storage diseases; gluconeogenesis; Glyoxylate cycle; Biosynthesis of Oligosaccharides and glycoproteins; pentose phosphate pathway; **Citric Acid Cycle:** Cycle overview; Conversion of pyruvate to acetyl-CoA; Enzymes of the citric acid cycle; catabolic and anabolic of the citric acid cycle; Regulation of the citric acid cycle; **Lipid metabolism:** lipid digestion, absorption and transport; fatty acid oxidation and ketone bodies; fatty acid synthesis; synthesis of other lipids; cholesterol metabolism; phospholipid and glycolipid metabolism; **Amino acid metabolism:** amino acid deamination; amino acid biosynthesis; Nitrogen fixation and assimilation; transamination; Metabolic breakdown of individual amino acids; amino acids as metabolic precursors; nitrogen fixation; **Nucleotide metabolism:** synthesis of purine ribonucleotidees; synthesis of pyrimidine ribonucleotides; formation of deoxyribonucleotides; nucleotide degradation; biosynthesis of nucleotide Coenzyme

CHP3741 MEDICINAL CHEMISTRY I

Module Title: **Medicinal Chemistry I**
Module Code CHP3741
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Module Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite CHM3651(Organic chemistry I, prerequisite), SCHP3721 (Drug Discovery & Development, co-requisite)
Compulsory/Elective Elective
Module Descriptor: Design, discovery, and preparation of biologically active compounds; mechanisms of drug action; pharmacokinetics: absorption, distribution, drug metabolism, excretion; prodrugs and drug delivery systems; lead optimization: retrosynthetic analysis, functional groups and isosteres, functionalisation of aromatic rings, construction of rings, heterocyclic chemistry; stereoselective synthesis and stereochemistry in drug design. Structure-activity relationships and quantitative structure-activity relationships. Molecular targets for drugs: receptors, enzymes, ion channels, DNA and unexplored targets revealed by the human genome project.

CHP3721 DRUG DISCOVERY & DEVELOPMENT

Module Title: Drug Discovery & Development
Module Code CHP3721
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Module Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite CHM3651 (Organic chemistry I)
Compulsory/Elective Elective
Module Descriptor: History of drug discovery; stages in the drug development process; classification of drugs; sources of drugs and lead compounds; bioassays; pharmacophores; target-based and structure-based drug design; clinical trials; ethics, patents; strategies in drug discovery for communicable and non-communicable diseases; impact of genomics, combinatorial chemistry and other modern techniques on drug research; case studies to outline the drug development process; Substances Derived from Bacteria, Plants, Insects, and Animals, Sources of Active Principles, Assay Systems and Models (e.g., Knock-out Mice)

CHP3711 ENVIRONMENTAL CHEMISTRY I

Module Title: Environmental Chemistry I
Module Code CHP3711
NQF Level 7
NQF Credits 16
Contact Hours 4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Module Assessment **Continuous Assesment (**minimum of three tests which counts 75% and laboratory component 25%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite Radiochemistry (SCHP3621)
Compulsory/Elective Elective
Module Descriptor: Environmental radioactivity, radiochemical methods of analyses of environmental samples, radiological protection, dosimetry and the associated legislation Perceptions of the Environment, Natural Environments, Environmental Variation, The atmosphere and atmospheric chemistry, soil chemistry, Environmental Assessment Process, An Introduction to Climate Change, Climate Change Adaptation

CHM3721 ANALYTICAL CHEMISTRY II

Module Title: **Analytical Chemistry II**
Module Code CHM3721
NQF Level 7
NQF Credits 8
Contact Hours 2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Module Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite CHM3602 (Analytical Chemistry I)
Compulsory/Elective Compulsory
Module Descriptor: Complexometric methods and EDTA titrations; oxidation reduction, oxidation states and balancing redox equations, the half-cell concept; voltaic cells and the Nernst equation; redox titrations and redox titration curves; applications of redox titrations, coulometric and potentiometric methods of analysis.

CHM3751 INORGANIC CHEMISTRY II

Module Title:	**Inorganic Chemistry II**
Module Code	CHM3751
NQF Level	7
Contact Hours:	4 lecture periods per week for 14 weeks and1 practical session per week for 14 weeks
NQF Credits	16
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3611 (Inorganic Chemistry I), SMAT3512 (Precalculus)
Compulsory/Elective	Compulsory

Module Descriptor: The following topics are covered:
Transition metal chemistry: transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Bonding-Application of Valence Bond Theory (VBT); Crystal Field Theory (CFT); Ligand Field Theory (LFT). Molecular Orbital Theory (MOT); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes

CHM3761 INDUSTRIAL CHEMISTRY I

Module Title:	**Industrial Chemistry I**
Module Code	CHM3761
NQF Level	7
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
NQF Credits	8
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3611 (Inorganic Chemistry I), CHM3651 (Organic Chemistry I)
Compulsory/Elective	Compulsory

Module Descriptor: The following topics are covered: **Sources of chemical industry:** inorganic chemicals, organic chemicals from biomass, coke, natural gas, crude oil. **The world's major chemical industries:** introduce the major companies and products. **Environmental pollution control:** the techniques of pollution control including physic, chemical and biological methods. **Material and energy balance:** the methods of mass and energy balance, the calculation process of industrial chemistry. **Technological economics:** cost and profit of producing processes, effects of scale and flow rate of operation. **Oil and fat industry:** structure, isolation, additives, applications. **Coatings industry:** composition, pigments, binders, solvents. **Soap and domestic industry:** soap, surfactant, detergent. **Leather industry**: softening, evaluating effects of fat in leather. **Flavor industry:** vehicles, fixatives, synthetics used in perfume and flavors; perfume formation. **Pharmaceutical industry:** type of drugs, antibacterial agents, steroids, analgesics, antihistamines. **Meat industry:** kinds of meat, prepared and preserved products. **Fish industry:** categories of fish, prepared and preserved products. **dairy industry:** prepared and preserved products. **Biotechnology industry:** beer, cheese. **Sulfuric acid and fertilizer industry:** manufacture of sulfuric acid and fertilizer. **Salt industry:** manufacture of caustic. **Uranium industry:** extraction, concentration and purification of uranium. **Cement industry:** the compositions and manufacture of cement, processes in the solidification cement.

CHB3722 TRANSMISSION OF GENETIC INFORMATION

Course Title:	Transmission of Genetic Information
Course Code	CHB3722
NQF Level	7
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
NQF Credits	8
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Biomolecules and Catalysis (CHB3632)
Compulsory/Elective	Compulsory

Module Descriptor: This module is designed to teach the students the Expression and transmission of genetic information: The following topics are covered:**DNA Metabolism:** DNA Replication, Recombination and Repair; **RNA Metabolism:** Transcription and RNA Processing; **Protein Metabolism:** Translation and Posttranslational Modification; Genes and Chromosomes, Regulation of Gene Expression; Recombinant DNA technology

CHM3752 ORGANIC CHEMISTRY II

Module Title:	**ORGANIC CHEMISTRY II**
Module Code	CHM3752
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 68%, laboratory component 20% and quiz 12%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3651 (Organic Chemistry I)
Compulsory/Elective	Compulsory

Module Descriptor: Carbonyl compounds: structure and reactions with nucleophiles, Oxidation-reduction in organic chemistry, alcohols by reduction, oxidation of alcohols, organometalic compounds. Basic spectroscopy: IR, NMR, MS. Conjugated systems: allyl radical and allyl cation, alkadienes and polyunsaturated hydrocarbons, 1,2- and 1,4-addition, Diels-Alder reaction. Aromatic compounds: Hückel's rule, aromatic-, antiaromatic-, nonaromatic-classification; annulenes, fullerenes, Heterocyclic compounds. Electrophilic aromatic substitution: halogenation of benzene, nitration, sulfonation, Friedel-Crafts-alkylations and acylations. Protecting and blocking groups. Aldehydes and ketones: synthesis; addition to carbon-oxygen double bond, hydride, hydrogen cyanide, alcohols, derivatives of ammonia, oxidation; Wittig reaction. tautomers, enolates, aldol reactions, aldol reactions.

CHM3712 PHYSICAL CHEMISTRY II

Module Title:	**Physical Chemistry II**
Module Code	**CHM3712**
NQF Level	7
Contact Hours:	4 lecture periods per week for 14 weeks, 1 tutorial session per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Module Assessment	**Continuous Assesment (**minimum of three tests which counts 70%, laboratory component 20% and Quiz 10%). **Examination:** 1 x 3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM 3631 (Physical Chemistry I), MAT3611 (Calculus I)
Compulsory/Elective	Compulsory

Module Descriptor: The rates of chemical reactions: rate expressions; order and molecularity. Integrated rate equations. Methods of determining order or reaction and rate coefficient. Temperature dependence of rate coefficients (Arrhenius equation). Complex reactions – parallel, opposing, consecutive and chain reactions. Reaction mechanism. Enzyme kinetics. Theories of reaction rates: collision theory; transition state theory. Experimental methods for studying slow and fast reactions. Definition and measurement of conductivity and molar conductivity. Kohlrausch's law. Strong and weak electrolytes. Ostwald dilution law. Ionic mobilities and transport numbers. Applications of conductivity measurements – dissociation constant, solubilities and solubility products of sparingly soluble salts, conductometric titrations. Thermodynamics of electrolyte solutions. Thermodynamics of electrochemical cells, Surface chemistry and colloids: Chemical, biological and medicinal applications of colloids. Surface tension and interfacial tension, Spreading of one liquid on another. Insoluble monolayer films and their application in water evaporation control. Detergency. Formation and stability of emulsions. Chemisorption and Physisorption. Adsorption isotherms: Langmuir, Freundlich and BET adsorption equations. Processes at electrodes: The electrode-solution interface. The rate of charge transfer. Butler-Volmer equation.

CHB3762 INNOVATION AND ENTREPRENEURSHIP

Course Title:	**Innovation and Entrepreneurship**
Course Code	CHB3762
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks
Module Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and Internship and or Innovation project applied component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Drug desing and development CHP3721, Biochemical Analysis, CHB3741
Compulsory/Elective	Compulsory

Module Descriptor: Introduction to innovation and entrepreneurship; Entrepreneurship in biotechnology (Context specific); Organizational Structures; Virtual and Real Enterprises; R & D Networks; Outsourcing Registrations/Permissions: **Markets and Factors:** Products and Services, Economies, Manpower, Resources **Research and Development;** product life cycle, R&D cycle and organizational life cycle; Biology, Medicine, and Genetics, Pre-clinical and Clinical Development, Processes, Pilot Plants, Engineering, Fermentation Process Development; **Safety:** Medical Safety, Biological Safety, Chemical Safety, Equipment Safety, **Intellectual assets** –capital in biotechnology firms; managing IP in biotechnology firms; **biotechnology value chain**; Biotechnology industry and firm structures; Product development and innovation diffusion

CHB3742 BIOSAFETY, BIOETHICS AND IPR

Course Title:	**Biosafety, Bioethics and IPR**
Course Code	CHB3742
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Bioenergics and Metabolism (CHB3731)
Compulsory/Elective	Compulsory

Module Descriptor: Principles of biosafety, bioethics and bio-law: Environmental and food safety Risk assessment, ethics; philosophy; Regulation of human tissue and stem cells; International environmental law; Intellectual property law and the biosciences, Patenting Life; Surveying of Methods and Uses of Animal Biotechnology. Legal and socio-economic considerations regarding biotechnology; human safety; animal welfare; Public policy, regulatory and ethical challenges facing the entrepreneurial biotechnology firm

CHM3702 INSTRUMENTAL ANALYSIS I

Module Title:	**Instrumental Analysis I**
Module Code	CHM3702
NQF Level	7
NQF Credits	8
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3602 (Analytical Chemistry I), CHM 3651 (Organic Chemistry I)
Compulsory/Elective	Compulsory

Module Descriptor: ultraviolet spectroscopy; infrared absorption spectroscopy; theory and applications of IR; flame emission and atomic absorption spectrometry; molecular fluorescence and phosphorescence; NMR spectroscopy; theory and experimental methods of NMR spectroscopy; applications of proton NMR spectroscopy and mass spectrometry.

CHM3722/ SCHB3722 RESEARCH METHODOLOGY

Module Title:	**Research Methodology**
Module Code	CHM3722
NQF Level	7
Contact Hours:	2 lecture periods per week for 14 weeks
NQF Credits	8
Continuous Assesment	**(**minimum of two tests which counts 65%, Assignments, Oral & Poster presentation 15%, a minimum of two equally weighted statistics exercises (10%),oral presentation using PowerPoint (5%) and a Poster presentation (5%)). **Final:** 100% CA
Prerequisite	Pass in all second year compulsory modules
Compulsory/Elective	Compulsory

Module Descriptor: Ethics of Research and Plagiarism; The scientific method: Logic and scientific, natural observations, asking questions and formulation of hypotheses, Predictions, Types of hypotheses (null, alternative, research); Chemostatics Topics: Handling experimental data; Processing and reporting; Significant tests; Regression analysis; Validation of experimental data (quality control); Optimization of parameters; Use of existing literature; Using the internet and the university library; Finding and using literature references; Citation of references; Writing a literature review; Report Writing; Oral presentation using state-of-the-art equipment; Presenting results as posters

FOURTH YEAR MODULES

CHM3821NATURAL PRODUCT CHEMISTRY I

Module Title:	**Natural Product Chemistry I**
Module Code	CHM3821
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3752 (Organic Chemistry II), CHM3702
Compulsory/Elective	Compulsory

Module Description: This module explores the basic biosynthesis pathway of secondary metabolites. We will learn how natural products are normally classified according to their biosynthetic origins and chemical properties. A special emphasis will be placed on chemical structure and how it affects the physiological function of various natural products. The following will be covered. **Topics include:** Classification of natural products. Primary and secondary metabolites; NMR techniques in biosynthesis studies (^{13}C-NMR, isotope incorporation). Polyketide pathway: fatty acids, cyclization of polyketides to aromatics, skeletal types of polyketides. The shikimic acid pathway: biosynthesis of shikimic acid and aromatic amino acids, biosynthesis of phenylpropanoids and other metabolites from the shikimate pathway. Isoprenoids: biosynthesis of mevalonic acids, monoterpenes, sesquiterpenes, diterpernes, sesterterpenes, triterpenes, tetraterpenes and steroids.

CHM3801 INSTRUMENTAL ANALYSIS II

Module Title:	**Instrumental Analysis II**
Module Code	CHM3801
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3702 (Instrumental Analysis I)
Compulsory/Elective	Compulsory

Module Descriptor: Separation methods; solvent extraction; introduction to chromatographic methods of separation; general description of chromatography. GC, GLC, LC, TLC, HPLC; qualitative and quantitative analysis by chromatography; high performance liquid chromatography, column efficiency and chromatographic mobile phases; partition chromatography; adsorption chromatography ion-exchange chromatography; size exclusion chromatography; planar chromatography; ^{13}CNMR spectra and ^{1}HNMR: 1-dimensional NMR (DEPT, NOE), 2 dimensional NMR (COSY, HETCOR, NOESY) theory, experimental methods and interpretation of spectra.

CHM3851 ORGANIC CHEMISTRY III

Course Title:	**ORGANIC CHEMISTRY III**
Course Code	CHM3851
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Continuous Assesment	**(**minimum of three tests which counts 68%, laboratory component 20% and Quiz 12%). **Examination:** 1x3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3711 (Organic Chemistry II)
Compulsory/Elective	Compulsory

Module Descriptor: Enolates: tautomerism, racemisation, halogenations, haloform reaction, Aldol reactions, Claisen-Schmidt reactions, addition to α,β-unsaturated systems. Carboxylic acids and their derivatives: preparations and reactions of acids, acyl chlorides, acid anhydrides, esters, lactones, amides and imides, lactams. β-dicarbonyl compounds: Claisen condensations, crossed Claisen condensations, "active hydrogen" syntheses, direct alkylations of esters and nitriles, simple and conjugate additions to α,β-unsaturated systems, Mannich reactions; Amines: preparations, reactions, Hofmann and Cope elimination reactions. Phenols: physical properties, preparations, O-reactions, C-reactions, rearrangements, nucleophilic aromatic substitutions. Selected examples of multistep synthesis of organic compounds.

CHB3821 CLINICAL BIOCHEMISTRY

Course Title:	**Clinical Biochemistry**
Course Code	CHB3821
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Bioenergetics and Metabolism (CHB 3731), Medicinal Chemistry I
Compulsory/Elective	Compulsory

Module Descriptor: Biochemistry of Hormones: Blood and Transport Proteins, Hemostasis and Thrombosis. Bioenergetics and Oxidative Metabolism. Anaerobic Metabolism of Glucose in the Red Cell. Carbohydrate Storage: Synthesis in Liver and Muscles; obesity. Biosynthesis of Cholesterol in Liver. Special Liver Function. Muscle: Energy Metabolism and Contraction. Glucose Homeostasis and Fuel Metabolism. Water and Electrolyte Balance: Kidney Function. Diseases of the Lung and Kidneys: The Control of Acid-Base Balance. Calcium and Bone: osteoporosis; Metabolism. Neurochemistry. Neurotransmitters: psychosis and other nervous disorders Pathology: scientific investigation of the biology of human disease, 'Genes and the cell in health and disease' and 'Infection, Inflammation and immunity, Histochemistry, Immunocytochemistry. Oncology: Biochemical and molecular basis of cancer: Cell Cycle, Programmed Cell death, multistage nature of cancer, including the roles of the environment and somatic mutation, explore the known genetic mechanisms leading to cancer, Discuss approaches to targeted therapies for different cancers, current advances in HIV testing, diagnosis and treatment

CHM3831 PHYSICAL CHEMISTRY III

Module Title:	**Physical Chemistry III**
Module Code	CHM3831
NQF Level	8
Contact Hours:	4 lecture periods per week for 14 weeks, 1 tutorial session per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Continuous Assesment	**(**minimum of three tests which counts 60%, laboratory component 20%, Quiz 10% and Assignments 10%). **Examination:** 1x3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM 3631 (Physical Chemistry I), MAT3611 (Calculus I)
Compulsory/Elective	Compulsory

Module Descriptor: Failures of classical mechanics and the birth of quantum mechanics. Wave and particle nature of light and electron. Postulates of quantum mechanics. Schrödinger equation and application to simple model systems. Hydrogen atom and multi-electron atoms. Vibrational spectroscopy of diatomic and simple polyatomic molecules. Microwave spectroscopy. Electronic spectroscopy. Calculation of thermodynamic properties from partition functions.

CHM3810 / CHB3810 RESEARCH PROJECT

Module Title:	**Research Project**
Module Code	CHM3810 / CHB3810
NQF Level	8
Contact Hours:	2 consultation periods per week for 14 weeks
NQF Credits	32
Continuous Assesment	1 Oral presentation counts 30%, Consultation and efforts counts 20%, 1 Project report counts 50%
Prerequisite	Pass in all third year modules and at least one statistics module
Compulsory/Elective	Compulsory

Module Descriptor: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The completed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by an oral examination.

CHP3811 WASTEWATER TREATMENT

Module Title:	**Wastewater Treatment**
Module Code	CHP3811
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week for 14 weeks; 1 practical session per week for 14 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHP3701 (Water Analysis), CHP3711 (Environmental Chemistry I)
Compulsory/Elective	Elective
Semester Offered	First semester

Module Descriptor: The principles of coagulation, flocculation, sedimentation, filtration, biological treatment, solids handling, disinfection, and advanced treatment processes are presented. Physical and Chemical Processes for Water and Wastewater treatment. Biological Processes for Water and Wastewater treatment, characteristics, domestic versus industrial wastewater. Types of industries and their wastewater ,Sampling of wastewater Analysis of industrial wastewater. Examples of wastewater from different industries, BOD, COD, Toxicity, Heavy metals, Dissolved, suspended solids. Uses of water in industry. Cooling, conveying, process, boilers, water heaters, etc. Pretreatment of water for industrial use, Water pretreatment processes as sources of wastewater (Reverse Osmosis, softening, desalination, etc). Pretreatment of waste waters: equalization, settling, coagulation, filtration, pH adjustment, neutralization, flocculation, grit removal, treatment for sewer discharges, treatment for reuse. Agricultural reuse options, Community reuse options, Industrial reuse options. Chemical wastewater treatment: Coagulation, flocculation, precipitation, heavy metals removal, Oxidation, chlorination, other processes. Physical waste water treatment: Reverse Osmosis, Activated charcoal, distillation / evaporation, Biological wastewater treatment, Elementary Microbiology.

CHB3862 INDUSTRIAL PHARMACEUTICAL BIOTECHNOLOGY

Course Title:	**Industrial Pharmaceutical Biotechnology**
Course Code	CHB3862
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Drug design and development
Compulsory/Elective	Compulsory

Module Descriptor: Biotechnology and Medicine: Diagnostics, Therapeutics, Gene Therapy, Implantates, Medical Devices, Technology, Complex Traits; **Molecular Pharma-Biotechnology,** Bioinformatics, Biological Systems and Models, Assay Systems, High-throughput Screening, Automation, Combinatorial Synthesis: Chemistry, Biology, and Biotechnology, Genotyping: Genetic Pre-Disposition, and Heterogeneity, Sequencing, Pharmaco-Genomics **Pharmaceutical Production:** GenePharming (Animals and Plants); Vitamins , Amino Acids, Proteins, Antibiotics, Biocatalysis, Natural Compounds, Recovery/(Bio-) Processing, Chemical–Biotechnological Syntheses, Gene Therapy Vectors/Systems, Production: Safety, Efficacy, Consistency, and Specificity, Registration; **Environment:** Pharmaceuticals and the Environment; Biological Containment; Physical/Chemical Containment, Process-Integrated Environmental Protection, Waste/Effluent Treatment and Recycling

CHN3842 HEALTH AND NUTRITIONAL BIOCHEMISTRY

Course Title:	**Health and Nutritional Biochemistry**
Course Code	CHN3842
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHB3612 (Biochemistry II), MBL3632 (Introduction to Microbiology)
Compulsory/Elective	Compulsory
Semester Offered	1

Module Descriptor: The following topics are covered: Digestion and Absorption: digestive tract, secretion of digestive materials, stimulation of digestive system, molecules important to digestion and absorption, digestion of biomolecules. **Nutrients that resist or escape digestion**: resistance of proteins to digestion, carbohydrates that escape digestion, dietary fibers, microorganisms and digestion, malabsorption syndromes. **Obesity**: types of fat, techniques for measuring fat, signaling pathways for regulating adipocyte formation and genetic factors in obesity. **Diet and Cancer**: cancer of the large bowel, genetic changes that result in cancer, RAS and MAP kinase signaling pathway, mutations in the RAS gene and cancer, Cadherin proteins and Epidemiology of diet and colon cancer, Vitamins and inorganic nutrients.

CHP3842 MEDICINAL CHEMISTRY II

Module Title: **Medicinal Chemistry II**
Module Code CHP3842
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Continuous Assesment **(**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite CHM3851 (Organic chemistry III, prerequisite), CHP3731 (Medicinal Chemistry I, prerequisite), CHP3721 (Drug Discovery and Development, **prerequisite)**
Compulsory/Elective Elective

Module Descriptor: Disease targeting, Assay Systems and Models (e.g., Knock-out Mice); molecular modelling; stereoselective synthesis; structural analysis of drugs; combinatorial synthesis; physico-chemical aspects and principals of drug action; anti-infective agents; anti-viral agents; antibacterial agents; cardiovascular agents; case studies: drug and drug targets in the pathogenesis of selected infectious diseases (malaria, HIV/AIDS, tuberculosis) and non-infectious diseases (cancer);

CHM3822 NATURAL PRODUCT CHEMISTRY II

Module Title: **Natural Product Chemistry II**
Module Code CHM3822
NQF Level 8
NQF Credits 8
Continuous Assesment **(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite CHM3752 (Organic Chemistry II); CHM3801 (Instrumental Analysis II)
Contact Hours 2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Compulsory/Elective Compulsory

Module Description: This is the continuation of natural products chemistry I. In this module, the student will be provided with sound knowledge on principles and techniques involved in the extraction and isolation of chemical constituents from natural sources and how to determine their structures. **Topics include:** classification of alkaloids; alkaloids derived from ornithine, lysine, tyrosine, and tryptophan; pseudoalkaloids; metabolites of mixed biosynthetic origin: metabolites derived from acetate and mevalonate; metabolites derived from shikimate and mevalonate; metabolites derived from acetate and shikimate; and metabolites derived from tryptophan and mevalonate. Extraction and purification of natural products: Phytochemical screening for different classes/groups of natural products. Bioassay-directed isolation of natural products. Determine the chemical structure of isolated compounds by applying IR, UV, one- and two-dimensional NMR and mass spectroscopy techniques.

CHP3822 ENVIRONMENTAL CHEMISTRY II

Module Title:	**Environmental Chemistry II**
Module Code	CHP3822
NQF Level	8
Contact Hours	2 lecture periods per week for 14 weeks
NQF Credits	8
Continuous Assesment	**(**minimum of two tests which counts 70%, Student led discussions contributes 15%, Paper Review Proposal contributes 5%, Paper Review contributes 5% and Paper peer Review contribute 5%.
Prerequisite	Environmental Chemistry I (SCHP3711)
Compulsory/Elective	Elective

Module Descriptor: Climate in the Spotlight: Spectrum of Scientific Opinion, Greenhouse Gases: An overview of the role of Carbon dioxide and Methane, Carbon dioxide reservoirs, Climate cycles: Determining the past climates, Climate change and Political realm, Relationships between Technological Innovation and Climate Change, Physical and Social Impacts of Climate Change, Climate Change Adaptation strategies, Implications of the introduction of new technologies for Adaptation and Sustainability, Current international efforts to address climate change.

CHB3842 BIOTECHNOLOGY, MICRO AND NANOTECHNOLOGY

Course Title:	**Biotechnology, Micro and Nanotechnology**
Course Code	CHB3842
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	Transmission of Genetic information (CHB3722)
Compulsory/Elective	Elective

Module Descriptor: Introduction to "omics"; **Genomics**: techniques-genomic libraries and analysis, southern blots, applications. **Proteomics:** definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. **Transcriptomics:** definitions, Techniques- cDNA libraries and analysis, Northern blots, applications. **Metabolomics:** Techniques-metabolic pathways and analysis. **Cytomics**: Biochemical processes at the cellular; **Agricultural Biotechnology:** Technology Studies: Pesticide producing crops; Herbicide-tolerant transgenic crops; Insect-resistance transgenic crops. **Micro- and Nanotechnologies for Medicine**: Scope, principles and techniques of nanotechnology; preparation of nano particles and their properties, application of nanotechnology in biotechnology: Oligonucleotide microarray, 'lab-on-a-chip' nanocomposites; Cellular Cloning; Tissue Engineering (Organ Cultivation); **Food Biotechnology:** Enzyme application in food and feed; probiotics - prebiotics and nutraceuticals;

CHM3862 INORGANIC CHEMISTRY III

Module Title:	**Inorganic Chemistry III**
Module Code	CHM3862
NQF Level	8
Contact Hours:	2 lecture periods per week for 14 weeks and 1 practical session per week for 7 weeks
NQF Credits	8
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3701 (Inorganic Chemistry II), CHM3711(Organic Chemistry II)
Compulsory/Elective	Compulsory

Module Descriptor: Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds.

CHM3812 INDUSTRIAL CHEMISTRY II

Module Title:	**Industrial Chemistry II**
Module Code	CHM3812
NQF Level	8
Contact Hours	4 lecture periods per week for 14 weeks and 1 practical session per week for 14 weeks
NQF Credits	16
Continuous Assesment	**(**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1x3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM3712 (Physical Chemistry II); CHM3761 (Industrial Chemistry I)
Compulsory/Elective	Compulsory

Module Descriptor: Petroleum industry: technologies and equipments of producing petrochemicals including ethylene, propylene, aromatics. **Fluid mechanics:** fluid statics and its applications; fluid-flow phenomena; Basic equations of fluid flow; Flow of incompressible fluids in conduits and thin layers; Flow past immersed bodies; transportation of fluid. **Heat transfer and its applications:** heat transfer by conduction in solids; principles of heat flow in fluids; heat transfer to fluids without phase change; heat transfer to fluids with phase change; radiation heat transfer; heat-exchange equipment and its applications. **Mass transfer and its applications:** equilibrium-stage operations; distillation: flash distillation, continuous distillation, operating lines, design and operating characteristics of plate columns, enthalpy balances for fractionating columns.

E.5. POST GRADUATE (MSC) PROGRAMMES

E.5.1. ADMISSION REQUIREMENTS

The MSc programme in the Department of Chemistry is open to all BSc graduates with Chemistry as one of their majors. The admission to the MSc programme of the holders of the B.Sc. (Chemistry) degree is not automatic. The applicants will be accepted on the basis of their undergraduate record. An average mark of **60%** is required. The course normally extends over a minimum period of two years for full-time students.

E.5.2. DURATION OF STUDY

The duration of the MSc in Chemistry is two (2) years for full-time students and three (3) years for part-time students. Relevant committees may grant an extension of registration up to six (6) months beyond the stipulated period if valid reasons are advanced.

E.5.3. CURRICULUM COMPILATION

The curriculum for the MSc Chemistry consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

E.5.4. ASSESSMENT CRITERIA

The curriculum for the MSc programme in the Department of Chemistry consists of coursework and research leading to a thesis. Coursework component in the first year will be assessed through written tests, laboratory work, seminar presentation and final examination. Each module assessment is based on continuous assessment mark (50%) and examination mark (50%). Continuous assessment mark is computed as 60% test and 40% practical mark. In order to pass a module, a student must obtain a final mark of at least 50%. Refer to specific modules for detailed assessment criteria.

MSC THESIS IN THE SECOND YEAR:
A candidate must first successfully complete the coursework examinations before commencing thesis work. The thesis must be drafted in English language and submitted to the supervisor. It must be in a university approved format. The thesis will be evaluated by UNAM approved internal and external examiners. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination. Refer to the General Information and Regulations Prospectus and Postgraduate Prospectus for detailed information.

E.5.5. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates credited with a minimum of 264 credits, and who have met all the requirements of the degree programme.

E.5.6. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme in line with the General Information and Regulations Prospectus.

E.5.7. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Hundred percent attendances of practical classes are required.

E.5.8. MASTER OF SCIENCE IN INDUSTRIAL BIOCHEMISTRY

TABLE FOR ALL MODULES IN MASTER OF SCIENCE IN INDUSTRIAL BIOCHEMISTRY

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDIT	PRE-REQUISITE	CO-REQUISITE
1	Academic Writing for Post Graduate Students	UAE 5819	24		None
1	Advanced Analytical and Instrumental Methods	CHM5911	24		None

1	Research Methodology and Project Proposal	CHM5921	12		None
1	Enzymology and Enzyme Technology	CHB5921	12		None
1	Nutrition, Metabolism and Cell Signaling	CHB5941	12		None
1	Neurobiochemistry and Clinical Biochemistry	CHB5961	12		None
2	Instrumental Methods and Techniques in Biochemical analysis	CHM5962	12		CHM5911
2	Biochemistry Seminars	CHB5942	12		CHM5921
2	Strategic Resource Management	CHB5962	12		CHM5921
2	Bioinformatics and Industrial Biotechnology	CHB5902	12		CHB5921
2	Environmental Toxicology and Management	CHC5942	12		CHB5941
2	Natural products and Pharmaceutical Production	CHN5942	12		CHB5961
Total Credits			**168**		

Year 2

SEMESTER	Module name	Course code	Credit	Pre-requisite	CO-REQUISITE
1&2	M.Sc. Thesis	CHB5900	120	Pass in all year 1 modules	none
Total Credits			120		

E.5.9. M.SC. CHEMISTRY (11MSCC)

Summary Table for all Courses in the Programme

Course code	Course name	NQF Level	Credits	Compulsory (C) /Elective (E)	Prerequisites
	Year 1 Semester 1				
UAE 5819	Advanced Academic Writing for Post Graduate Students	8	24	[1]C	
CHM5961	Chemistry Seminars	9	12	C	
CHM5911	Advanced Analytical and Instrumental Methods	9	24	C	
CHM5991	Research Methodology and Project Proposal	9	12	C	
	Electives (Any two modules)				
CHM5931	Advanced Organic Chemistry	9	24	E	
CHM5951	Advanced Inorganic Chemistry	9	24	E	
CHM5971	Advanced Physical Chemistry	9	24	E	
CHI5931	Advanced Industrial Chemistry	9	24	E	
				Total credits Semester 1	**96**
	Year 1 Semester 2: Electives (Any two modules)				
CHM5912	Current Topics in Analytical Chemistry	9	24	E	CHM5911
CHM5932	Current Topics in Organic Chemistry	9	24	E	CHM5931
CHM5972	Current Topics in Physical Chemistry	9	24	E	CHM5971
CHM5952	Current Topics in Inorganic Chemistry	9	24	E	CHM5951
CHI5932	Current Topics in Industrial Chemistry	9	24	E	CHI5931
				Total credits Semester 2	**48**
				Total credits Year 1	**144**
	Year 2				
CHM5900	M.Sc. Thesis		120	C	Pass in all year 1 modules
				Total credits Year 2	**120**

[1] **Please note**: Advance academic writing for postgraduate students is required but doesn't contribute to the total programme credits.

Total credits for the programme	**264**

Course Details Year 1: Semester

CHM5911 Advanced Analytical and Instrumental Methods

Module Title:	Advanced Analytical and Instrumental Methods
Code:	**CHM5911**
NQF Level:	9
Contact Hours:	4 lectures per week for 14 weeks and 36h Practical or mini project
Credits:	**24**
Compulsory/Elective:	**Compulsory**
Module Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards. **Examination:** There is a one 3hr examination **Final Mark:** 50% CA mark and 50% Examination mark
Prerequisites:	

Module Description: (Selected topics of the following will be covered)**:** Electro-analytical chemistry: Ion selective electrodes, potentiometry, polarography, coulometry and electro-gravimetry. Advanced techniques in electro-analytical chemistry; solution electrode interface, Buttler-Volmer relationships, Chromatography - Theory of chromatography, High Performance Liquid Chromatography (HPLC), ion chromatography, supercritical fluid chromatography. Mass Spectrometry: (GC-MS) and Liquid Chromatography – Mass Spectrometry (LC-MS). Advanced mass spectrometry, basic instrumentation, ionization techniques, analyzers and detectors, vacuum technology, detailed ion fragmentation patterns and the practical application of electron impact, chemical ionization and other auxiliary mass spectrometry techniques, e.g. FABMS and electro spray MS, to the structure elucidation of both small and large organic molecules. X-ray analysis methods: Theory of X-ray Spectra. Conventional X-ray fluorescence analysis.Methods and instrumentation for excitation, dispersion detection and interpretation.Matrix effects and their avoidance.Energy dispersive X-ray analysis.Alternative X-ray analysers.Electron microprobe analyser.Single crystal X-ray analysis.Crystallography (theoretical principles, theory of crystals, X-rays, crystallographic techniques, structure determinations. NMR-Practical application of 1D and 2D Fourier transform NMR techniques. ^{1}H NMR and ^{13}C NMR. Non-first order spectra, basic experiments in DEPT, J-Mod. NOE diff. 2D homo-nuclear NMR- COSY, NOESY, TOCSY; hetero-nuclear direct (1J)- HECTOR, HMQC,HSQC; hetero-nuclear long range HMBC, LR HECTOR and COLOC.; selective 1D experiments: SEL TOCSY and SEL NOESY. Application of Analytical techniques to food science, pesticide analysis, forensic analysis, bio-analytical chemistry as well as other topics that are of interest.

CHB5921 ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Title:	**Enzymology and Enzyme Technology**
Course Code	CHB5921
NQF Level	9
Contact Hours	2 lectures per week for 14 weeks and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark counts 40%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark
Prerequisite	
Compulsory or Elective	Compulsory

Module Descriptor: Amino Acids and Peptides; Introduction to amino acids, peptides and proteins; Structures and properties of peptides; enzymes; Analysis of peptides and proteins; End group analysis of peptides; Solution phase peptide synthesis; Enzymes and Enzyme Inhibitors; Inhibition of hydrolases and peptidases, ACE inhibitors, Enzyme Technology - Large scale production of enzymes, enzyme reactors, immobilization of enzymes by chemical and physical methods, Effect of partition on kinetics and on changes in pH and hydrophobicity. Applications: synthetic organic chemistry, industry, food technology, medicines. Synzymes, enzyme electrodes and biosensors, Enzyme Engineering.

CHM5921 RESEARCH METHODOLOGY AND PROJECT PROPOSAL

Course Title:	**Research Methodology and Project Proposal**
Course Code	CHM5921
NQF Level	9
Contact Hours	2 lectures per week and 2h consultation per week for 14 weeks

NQF Credits 12

Continuon Assessment Research proposal counts 80% and Statistics assessed by a test, assignment or report count 20%. **Final Mark:** 100% CA from which 20% is statistics component.

Prerequisite

Compulsory or Elective Compulsory

Module Descriptor: The lecturers will present some chemostatistics topics i.e. handling experimental data, processing and reporting, e.g. significance tests. Analysis of variance (ANOVA), regression analysis methods, validation experimental data (quality control) and experimental design and optimization of parameters. The student will write a comprehensive research proposal for his/her MSc research work in a particular field of national interest, under the supervision of an academic researcher. The evaluation will be done in accordance with UNAM Post-graduate School guidelines.

CHB5961 NEUROBIOCHEMISTRY AND CLINICAL BIOCHEMISTRY

Course Title: **Neurobiochemistry and Clinical Biochemistry**

Course Code CHB5961

NQF Level 9

Contact Hours 2 lectures per week for 14 weeks and 18h (cumulative) practical

NQF Credits 12

Continuon Assessment A minimum of two tests which counts 60%, Laboratory Mark counts 40%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark

Prerequisite

Compulsory or Elective Compulsory

Module Descriptor: Muscle Biochemistry – Skeletal muscle structure. Actin, myosin, tropomyosin, troponin. Molecular mechanism of contraction. Functional classification of skeletal muscle fibers. Twitch. The motor unit.Role of calmodulin. Neuromorphology – Organisation of neuron, dendrites and axons. Glial cells – astrocytes, oligodendrocytes, ependymal cells, Schwan cells. Nerve fiber types and functions. Neurophysiology – Generation and conduction of monophasic action potential, saltatory conduction. Synaptic transmission, Neurotransmitters and their action. Blood Brain CSF barrier – Characteristics. Transport across membranes – Types of transport (simple diffusion, passive-facilitated diffusion), active transport – primary and secondary group translocation, transport ATPases, transport by vesicle formation. **Neurological disorders** – Headache, facial pain, migraine, epilepsy, multiple sclerosis, Myasthenia Gravis. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes. **Diagnostic Enzymes** – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH. **Abnormalities in Nitrogen Metabolism** – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance. Blood Clotting – Disturbances in blood clotting mechanism – hemorrhagic disorders – hemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants. Cancer – Cellular differentiation, carcinogens and cancer therapy

CHB5941 NUTRITION, METABOLISM AND CELL SIGNALING

Course Title: **Nutrition, Metabolism and Cell Signaling**

Course Code CHB5941

NQF Level 9

Contact Hours 2 lectures per week for 14 weeks and 18h (cumulative) practical

NQF Credits 12

Continuon Assessment A minimum of two tests which counts 60%, Laboratory Mark counts 40%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark

Prerequisite

Compulsory or Elective Compulsory

Module Descriptor: Disorders of Carbohydrate Metabolism - Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia. **Disorders of Lipids** – Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia. **Inborn Errors of metabolism** – Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, histidinemia. **Digestive diseases** – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea. **Disorders of liver and kidney** – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance.

CHI5931 Advanced Industrial Chemistry

Module Title: Advanced Industrial Chemistry

Code: CHI5931

NQF Level: 9

Contact Hours: 4 lectures per week for 14 weeks and 36h Practical or mini project

Credits: **24**

Compulsory/Elective: **Elective**

Module Assessment: **CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards. **Examination:** There is a one 3hr examination **Final Mark:** 50% CA mark and 50% Examination mark

Prerequisites:
Module Description: Selected topics of the following will be covered: Momentum transfer, Mass transfer, Heat transfer, mixing process of liquids, chemical reaction kinetics, reactor design, Homogeneous chemical reaction, Heterogeneous chemical reaction and Industrial process equipment.

CHM5951	**Advanced Inorganic Chemistry**
Module Title:	Advanced Inorganic Chemistry
Code:	CHM5951
NQF Level:	9
Contact Hours:	4 lectures per week for 14 weeks and 36h Practical or mini project
Credits:	**24**
Compulsory/Elective:	**Elective**
Module Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination:	There is a one 3hr examination **Final Mark:** 50% CA mark and 50% Examination mark
Prerequisites:	

Module Description: Selected topics of the following will be covered:The chemistry of 17(halogens) and 18(noble gases). Lanthanides and Actinides Solid State Chemistry: Lattice energy; bonding in solids – bond model. Electrical properties of semiconductors; doped semiconductors. Defects and non-stoichiometry. Low-dimensional solids: one-dimensional solids; two-dimensional solids. Optical properties of solids; optical fibres. Magnetic properties of solids; Superconductors: theory, magnetic properties, Josephson effects. Isolobal analogies and relationships. Metal-metal bonds. Cluster compounds. Bioinorganic Chemistry.

CHM5931	**Advanced Organic Chemistry**
Module Title:	Advanced Organic Chemistry
Code:	CHM5931
NQF Level:	9
Contact Hours:	4 lectures per week for 14 weeks and 36h Practical or mini project
Credits:	**24**
Compulsory/Elective:	**Elective**
Module Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination:	There is a one 3hr examination **Final Mark:** 50% CA mark and 50% Examination mark
Prerequisites:	

Module Description: *Stereochemistry*: definition of terms, representations, conformational analysis; *Stereoselective synthesis:* strategies in stereoselective synthesis (substrate control, chiral auxiliary control, reagent control and catalyst control); *Pericyclic reactions:* the frontier orbital theory, orbital symmetry study and application to electrocyclic reactions, sigmatropic hydride shifts and cycloaddition reactions; *Retrosynthetic analysis:* definitions, functional group interconversion, synthons, umpolung, protective groups, one-group disconnections, two-group disconnections; *Organometallic compounds in synthesis:* organo-sulphur chemistry, organolithium compounds, direct ortho-metallation, synthetic applications; *Polymer chemistry:* the polymerization process, condensation polymers, addition polymers, block, graft and ladder polymers, selected applications, recycling: *Natural product chemistry*: classification of natural products, approaches to the study of natural products, selected natural products, biosynthesis, total synthesis.

CHM5971	**Advanced Physical Chemistry**
Module Title:	Advanced Physical Chemistry
Code:	CHM5971
NQF Level:	9
Contact Hours:	4 lectures per week for 14 weeks and 36h Practical or mini project
Credits:	**24**
Compulsory/Elective:	**Elective**
Module Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination:	There is a one 3hr examination **Final Mark:** 50% CA mark and 50% Examination mark
Prerequisites:	

Module Description: Selected topics of the following will be covered: Advanced kinetics: rates of chemical reactions; reactions in the gas and solution phases; complex reactions. Quantum Chemistry. Computational Chemistry: practical applications of electronic structure methods [Density Functional Theory (DFT) and Ab-initio Methods]; Molecular dynamics. Biophysical Chemistry. Statistical Mechanics.

CHM5961 Chemistry Seminars

Module Title: Advanced Physical Chemistry
Code: CHM5961
NQF Level: 9
Contact Hours: 2 lectures/consultations per week for 14 weeks
Credits: **12**
Compulsory/Elective: **Compulsory**
Module Assessment: Presentations are graded by staff members and count toward the CA mark. **Final Mark:** 100% CA mark
Prerequisites:
Module Description: The main component of this module involves the application of presentation skills through seminars, review of scientific literature and communication of recent developments in chemistry and biochemistry.

CHM5991 Research Methodology and Project Proposal

Module Title: Research Methodology and Project Proposal
Code: CHM5991
NQF Level: 9
Contact Hours: 2 lectures per week and 2h consultation per week for 14 weeks
Credits: **12**
Compulsory/Elective: **Compulsory**
Module Assessment: Research proposal is graded and counts 80% toward the CA mark.Statistics component t is assessedby a test, assignment or report and count 20% towards the CA mark.
Final Mark: 100% CA from which 20% is statistics component.
Prerequisites:
Module Description: The lecturers will present some chemostatistics topics i.e. handling experimental data, processing and reporting, e.g. significance tests. Analysis of variance (ANOVA), regression analysis methods, validation experimental data (quality control) and experimental design and optimization of parameters. The student will write a comprehensive research proposal for his/her MSc research work in a particular field of national interest, under the supervision of an academic researcher. The evaluation will be done at departmental level.

Semester 2

CHM5912 Current Topics in Analytical Chemistry

Module Title: Current Topics in Analytical Chemistry
Code: CHM5912
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Compulsory/Elective: **Elective**
Module Assessment: A minimum of two independent study reports (or one report and one test) which counts 80% towards
the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review 2500 words) and 50% Examination
Prerequisites: Advance Analytical and Instrumental Method (SCHM5911)
Module Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Topic 1- inductive coupled plasma M.S. and atomic

absorption spectroscopy, Topic 2- application of analytical techniques in environmental monitoring., Topic 3- ion-exchange, size-exclusion and reversed phase HPLC., Topic 4- supercritical–fluid chromatography, affinity and chiral chromatography and capillary-electro chromatography. Topic 5- voltametric, potentiometric and polarographic methods. Topic 6- atomic mass spectrometry {spark source M.S, glow discharge M.S} and atomic fluorescence spectroscopy.

CHM5932 Current Topics in Organic Chemistry

Module Title: Current Topics in Organic Chemistry
Code: CHM5932
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Compulsory/Elective: **Elective**
Module Assessment: A minimum of two independent study reports (or one report and one test) which counts 80% towards
the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review 2500 words) and 50% Examination
Prerequisites: Advance Organic Chemistry (SCHM 5931)
Module Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Amide coupling reagents: applications & limitations Recent advances in C-C bond formation reactions; Natural Products in Drug Discovery; Advances in Biomimetic Organic Synthesis Advances in the Huisgen 1,3-dipolar cycloaddition reaction and its application in drug discovery; Advances in multicomponent reactions (mcr) and their application in drug discovery; Complex natural product synthesis; Chiral auxiliaries: principles, preparations and recent applications; Advances in chemoenzymatic synthesis; Advances in the synthesis of heterocycles; Introduction of Quaternary stereogenic centers; Biosynthetically inspired approaches to natural product synthesis; Stereoselective Aldol reactions; Advances in Physical Organic Chemistry; Advances in Functional group transformations; Advances in the synthesis of Alkene, Alkynes, Allenes, etc Functional group protection

CHM5972 Current Topics in Physical Chemistry

Module Title: Current Topics in Physical Chemistry
Code: CHM5972
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Compulsory/Elective: Elective
Module Assessment: A minimum of two independent study reports (or one report and one test) which counts 80% towards the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review 2500 words) and 50% Examination
Prerequisites: Advanced Physical Chemistry (SCHM5971
Module Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Topic 1; quantum and computational chemistry, topic 2 molecular spectroscopy, topic 3 chemical kinetics and dynamics, topic 4 statistical thermodynamics; topic 5 interstellar chemistry.

CHM5952 Current Topics in Inorganic Chemistry

Module Title: Current Topics in Inorganic Chemistry
Code: CHM5952
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Compulsory/Elective: **Elective**
Module Assessment: A minimum of two independent study reports (or one report and one test) which counts 80% towards
the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review2500 words) and 50% Examination
Prerequisites: Advanced Inorganic Chemistry (SCHM5951
Module Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Reactions of coordinated diatomic ligands NO, CO and NO_2, Boron hydrides compounds, fullerenes chemistry of transition metals, transition metal complexes containing s-based ligands

CHI5932 Current Topics in Industrial Chemistry

Module Title: Current Topics in Industrial Chemistry
Code: CHM5952

NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Compulsory/Elective: **Elective**
Module Assessment: A minimum of two independent study reports (or one report and one test) which counts 80% towards the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review 2500 words) and 50% Examination
Prerequisites: Advanced Industrial Chemistry (SCHI5931)
Module Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change); technical processes invented in industrial chemistry; nanomaterials created in industrial chemistry; chemical reaction, equipment designed and used; newly invented substances and technical method.

CHM5962 INSTRUMENTAL METHODS AND TECHNIQUES IN BIOCHEMICAL ANALYSIS

Course Title: **Instrumental Methods and Techniques in Biochemical analysis**
Course Code CHM5962
NQF Level 9
Contact Hours 2 lectures per week for 14 weeks and 18h (cumulative) practical
NQF Credits 12
Continuon Assessment A minimum of two tests which counts 50%, Laboratory Mark (Mini project) counts 50%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark
Co-requisite CHM5911
Compulsory or Elective Compulsory
Module Descriptor: **Extraction of Organic Analytes**: Sampling; Proximate Analysis of the Major Food Components; **Partition:** Gas/Liquid Partition (GLP), Liquid/Liquid Partition (LLP); Solid/Liquid Partition (SLP); **Solvation:** Solvent Extraction; Matrix Solid-phase Dispersion; Sub-critical Fluid Extractions; Supercritical Fluid Extraction; Distillation Steam Distillation; Organic Solvent Distillation–Extraction; Adsorption. **Solid-phase Extraction:** application of HPLC, GC, FTIR, AA, AFS, MS and NMR to food analysis. **TRACE METAL DETERMINATIONS IN BIOLOGICAL SAMPLES:** Bioavailability; Methods for Assessing Folate and Vitamins Bioavailability; Physicochemical Analytical Techniques for Vitamins. **Recombinant DNA methods** –Construction and analysis of c-DNA and genomic libraries - Protocols and strategies for c-DNA cloning, preparation of radio-labeled DNA and RNA probes, synthetic oligonucleotide probes, expression of cloned genes in cultured cells, screening expression with antibodies and oligonucleotides, DNA sequencing. **Application of recombinant technology:** production of insulin, drugs, vaccines, diagnostic probe of genetic diseases, Ggne therapy. **Cell Culture and Antibody Technology:** production, maintenance and applications of animal cell cultures and antibodies (both monoclonal and polyclonal), and the use of immunochemical techniques (e.g. ELISA, Western blotting and immunocytochemistry) for analysis and therapy, investigate the use of cellular systems for the study of mechanisms of toxicity and cell signalling pathways. Electrophoretic techniques, Electron microscopy .

CHB5962 STRATEGIC RESOURCE MANAGEMENT

Course Title: **Strategic Resource Management**
Course Code CHB5962
NQF Level 9
Contact Hours 2 lectures per week for 14 weeks
NQF Credits 12
Continuon Assessment A minimum of two tests which counts 80%, Laboratory Mark counts 20%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark
Co-requisite CHM5921
Compulsory or Elective Compulsory
Module Descriptor: Plant breeders' rights, the impact of genetically modified organisms and environmental monitoring, Biological safety conventions, environmental risk assessments and managment; Definitions and classifications of projects. Objectives in project management - time, costs, quality; Resources and resource management; Critical Path Methods and resource scheduling; Performance measurement and costs; Project lifecycles; Project teams and leadership in project management; Managing risk in projects; Analysis of project successes and failures; Case studies in project management; Project Management software. Examine innovation from an industrial perspective, showing how innovations of product, process and organisational structure can create and destroy markets. Focus on innovation from an organisational perspective, showing how innovation can create and sustain a powerful competitive advantage. Highlight the managerial perspective, illustrating the skills and systems required to maintain innovation within different organisations and markets. Consumer's attitudes and risk assessment: Risk assessment and avoidance: general principles; Assessing the impact of genetically modified crops;

CHB5902 BIOINFORMATICS AND INDUSTRIAL BIOTECHNOLOGY

Course Title:	**Bioinformatics and Industrial Biotechnology**
Course Code	CHB5902
NQF Level	9
Contact Hours	2 lectures per week for 14 weeks and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark counts 40%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark
Co-requisite	CHB5921
Compulsory or Elective	Compulsory

Module Descriptor: Genomics, Transcriptomics, Proteomics: Introduction to Programming using Java; Theory and Algorithms in Bioinformatics; Genomes to Systems; Biocomputing; structure-based drug design. Conventional and non-conventional techniques of plant hybridisation, Agrobacterium-induced transformation using wild-type and engineered strains of A. tumefaciens and A. rhizogenes; **Tissue culture,** micropropagation and protoplast fusion; DNA isolation for RAPD analysis and confirmation of hybridity; Evaluation of RAPD fragments patterns for **phylogeny analysis**; Analysis of transgenic plants and GMO testing. Direct DNA uptake into protoplasts; flow cytometric analysis for ploidy. **plant products for non-food uses**, toxicology of natural pharmacologically active constituents and the use of transgenic plant technology for medical purposes. **molecular approaches to varietal profiling**, seed quality testing, transformation technology for modifying plant metabolism and modern breeding perspectives and strategies in a commercial context. comparisons of mutant with wild-type of model plant and crop species Arabidopsis and Maize lines, bioinformatics analysis of the genes involved in these phenotypes is undertaken. **Fermentation technology** – Fermentors, general design of fermentor, fermentation processes, production of alcohols, antibiotics, steroids and enzymes; biotransformation, biomass & production of single cell protein. **Hybridoma technology** – Monoclonal antibodies, selection of hybrids, hybridomas, purification and application of monoclonal antibodies. **Major Products of Industrial Microbiology:** Antibiotics, Penicillin, Streptomycin, Amino Acids, Organic Acids, Biopolymers, Biosurfactants; Bioconversion Processes

CHB5942 BIOCHEMISTRY SEMINARS

Course Title:	**Biochemistry Seminars**
Course Code	CHB5942
NQF Level	9
Contact Hours	2 lectures per week for 14 weeks
NQF Credits	12
Continuon Assessment	Presentations are graded by all the programme lecturers and count toward the CA mark. **Final Mark:** 100% CA mark
Co-requisite	CHM5921
Compulsory or Elective	Compulsory

Module Descriptor: The main component of this module involves the application of presentation skills through seminars, review of scientific literature and communication of recent developments in biochemistry.

CHN5942 NATURAL PRODUCTS AND PHARMACEUTICAL PRODUCTION

Course Title:	**Natural products and Pharmaceutical Production**
Course Code	CHN5942
NQF Level	9
Contact Hours	2 lectures per week for 14 weeks and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (Mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark
Co-requisite	CHB5961
Compulsory or Elective	Compulsory

Module Descriptor: GenePharming (Animals and Plants) Vitamins, Amino Acids, Proteins Antibiotics, Biocatalysis. **Natural Compounds** Recovery/(Bio-Processing, Chemical–Biotechnological Syntheses, Gene Therapy. **Vectors/Systems Production:** Safety, Efficacy, Consistency, and Specificity Registration. Terpenes, occurrence, nomenclature and classification; Biosynthesis and structure of the steroids; Fatty acids and cell wall structures; The prostaglandins; The alkaloids. Cell wall structure and peptidoglycan targets b-Lactam antibiotics: action and b-lactamase chemistry, Sulfonamides, **Metabolic targets:** pyridoxal dependent groups, Gastric acid secretion as a target for chemotherapy, Chemical regulation of acid secretion.

CHC5942 ENVIRONMENTAL TOXICOLOGY AND MANAGEMENT

Course Title:	**Environmental Toxicology and Management**
Course Code	CHC5942
NQF Level	9
Contact Hours	2 lectures per week for 14 weeks and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark counts 40%, **Examination**: 1x2hr examination. **Final Mark:** 50% CA mark and 50% Examination mark
Co-requisite	CHB5941
Compulsory or Elective	Compulsory

Module Descriptor: Microbial Growth in Complex Environments: Biodegradation Using Natural Microbial Communities; Changing Environmental Conditions to Stimulate Biodegradation; **Subsurface Engineered Bioremediation** System; Stimulating Hydrocarbon Degradation in Waters and Soils; Phytoremediation; Stimulation of Metal Bioleaching from Minerals; **Biosensors:** Detection of pollution, and microbial contamination of water. Fermentation analysis and control Monitoring of industrial gases and liquids Measurement of toxic gas in mining industries Direct biological measurement of flavors, essences, and pheromones; **Biopesticides; Xenobiotic metabolism** – Biodegradation, detoxification of xenobiotics by micro-organisms, biodegradation of hydrocarbons, pesticides, surfactants, polyaromatic hydrocarbons, dyes; role of cytochrome P450 in detoxification.

SECOND YEAR

CHB5900/ CHM5900 **MSC THESIS**

Course Title:	**MSc Thesis**
Course	CHB5900/ CHM5900
NQF Level	9
Contact Hours	Face to face consultations with supervisor(s) on regular bases
NQF Credits	120
Prerequisite	Pass in all year 1 modules is required before a student can start with the research project.
Compulsory or Elective	Compulsory

Module Assessment: A candidate must first successfully complete the coursework examinations before commencing thesis work. The thesis must be drafted in English language and submitted to the supervisor. It must be in a format given by the coordinators. The thesis will be evaluated by the supervisor and another examiner within one month after submission. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination. Refer to the General Information and Regulations Prospectus for detailed information.

Module Descriptor: Students will present their findings in the form of a written thesis. Poster and seminar presentations are encouraged. This module tests a student's ability to design and implement a research programme, and communicate the findings to an informed audience in a comprehensive thesis, written in an appropriate scientific style. The timing of assessments and assessment deadlines have been planned to ensure that the volume of work is balanced throughout the programme. These do not only enable students to acquire in-depth practical training under the supervision of experienced research staff but they also help to develop their capacity for independent investigation and report writing. Most projects are laboratory-based although some data review, computer-based projects may be available. Research projects are carried out for a minimum period of 1 year for full time students or 2 years for part time students.

F. DEPARTMENT OF COMPUTER SCIENCE

F.1. DEPARTMENTAL REGULATIONS

In addition to the Faculty of Science entry requirements, students wishing to major in Computer Science will be expected to pass a Departmental Entry Requirement test. This test is an aptitude test and will in no way affect students that are coming from backgrounds without Computer Studies as a subject. The test is normally taken a week after the registration, but before subject changes for the Faculty are closed, to enable students who do not qualify to select other programmes.
All fourth years are required to do a Research Project: CMP3810 (prerequisite for this course the student should have passed all third year modules).
The MSc Infromation Technology (IT) Programme (11MSCI) is based on a pool of taught courses and the completion of a dissertation.

F.1.1. COMPILATION OF THE CA MARK

Details on how the CA for each module is compiled are given under the respective modules.

F.1.2. WEIGHTING OF CA AND EXAM MARKS

Unless otherwise indicated, the relationship between the CA mark and the Examination mark is **50:50**.

F.2. DIPLOMA IN COMPUTER SCIENCE, CURRICULUM AND PREREQUISITES

To register for an undergraduate Diploma at the University of Namibia, a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognized equivalent qualification, obtained in not more than two examination sittings with a minimum of 22 points in five subjects on the UNAM Evaluation Scale. English is a compulsory subject and should have been obtained on a First or second Language Ordinary Level with symbol D or higher. **In addition to the University requirements, candidates wishing to register for a Diploma in Computer Science also need to have obtained a minimum of a D-symbol in NSSC Mathematics, or equivalent qualification.**Obtaining the minimum number of points, however, **does not necessarily ensure admission**. **Admission is based on places available in modules, subjects and programmes and is awarded on the basis of merit**.
The Faculty reserves the right to subject the candidate to additional selection procedures.
Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the General Information and Regulations Prospectus. A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is granted.

F.2.1. DURATION OF STUDY

The Diploma in Computer Science cannot be completed in less than two (2) years. All students registering for this qualification must complete their studies within three (3) years of full-time study, unless special permission is granted for this period to be exceeded.

F.2.3. EXAMINATION REGULATIONS

The Diploma in Computer Science programme will initially be offered on a full-time (face-to-face) mode. After the second year of implementation however, a distance mode will be considered. In order to allow full-time working candidates to attend lectures, and to allow participation of the lecturers that are already engaged in Bachelor of Science degree modules, lecture sessions scheduled in the evening.

For detailed examination and promotion rules see the General Prospectus: Information, Regulations and Fees. A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of **40%**. Examination will be administered at the end of each semester.

F.2.4. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To register for an undergraduate Diploma at the University of Namibia, a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognized equivalent qualification, obtained in not more than two examination sittings with a minimum of 22 points in five subjects on the UNAM Evaluation Scale. English is a compulsory subject and should have been obtained on a First or second Language Ordinary Level with symbol D or higher. **In addition to the University requirements, candidates wishing to register for a Diploma in Computer Science also need to have obtained a minimum of a D-symbol in NSSC Mathematics, or equivalent qualification.**

Obtaining the minimum number of points, however, **does not necessarily ensure admission**. **Admission is based on places available in modules, subjects and programmes and is awarded on the basis of merit**.
The Faculty reserves the right to subject the candidate to additional selection procedures. Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the General Information and Regulations Prospectus. A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is granted

F.2.5. ADVANCEMENT AND PROGRESSION RULES

A student advances to the second academic year of study when at least 6 modules (96 credits) of the curriculum for a first year have been passed.

F.2.5. ARTICULATION ROUTE

Successful completion of this diploma serves as an entry point to the Bachelor of Science in Information Technology (Honours) and for the Bachelor of Science in Computer Science (Honours). Students who successfully complete the Diploma in Computer Science will be exempted from the following modules in the first year of Bachelor of Science in Information Technology (Honours) or Bachelor of Science in Computer Science (Honours):

SUBJECT PASSED	MODULE TO BE EXEMPTED
CLC3509 Computer Literacy	CLC3509 Computer Literacy
CMP2571 Programming I	CMP3511 Programming Fundamentals I
CMP2572 Programming II	CMP3512 Programming Fundamentals II
CMP2552 Network Administration	CIT3511 Fundamentals of Information Technology I

QUALIFICATION: Diploma in Computer Science (11DCMP)

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1 &2	English for General Communication	LEG2410	32		None
1	Computer Literacy	CLC3509	8		None
1	Introduction to Computer Systems	CMP2411	16		None
1	Principles of Information Systems I	CMP2421	8		None
1	Basics of Statistics	STD2431	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Mathematics	STD2432	8		None
2	Programming Principles	CMP2412	16		CMP2421
2	Information Systems Management	CMP2432	16		CMP2421
Total Credits			**128**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Fundamentals of Database Systems	CMP2511	16	CMP2411	none
1	Fundamentals of System Administration	CMP2531	16	CMP2411	none
1	Fundamentals of Computer Networks	CMP2551	16	CMP2411	none
1	Programming I	CMP2571	16	CMP2412	none
2	Database management	CMP2512	16	CMP2411	CMP2511
2	System Administration	CMP2532	16	CMP2411	CMP2531
2	Network Administration	CMP2552	16	CMP2411	CMP2551
2	Programming II	CMP2572	16	CMP2412	CMP2571
Total Credits			**128**		

Credits Grand Total: 256

F.3. DIPLOMA IN COMPUTER SCIENCE MODULE DESCRIPTIONS

CMP2411 INTRODUCTION TO COMPUTER SYSTEMS

Module Title:	**INTRODUCTION TO COMPUTER SYSTEMS**
Module Code	CMP2411
NQF Level	4
Contact Hours	4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits	16
Prerequisite	None
Compulsory/Elective	Compulsory

Module description: History of Computers; Parts of a computer; Number System: Binary, Decimal, Octal, Hexadecimal; Input and Output devices; Introduction to machine programs; Memory: memory units, memory hierarchy, memory allocation, virtual memory, signals, input and output. Secondary Storage: Operating System, Basic construction of a PC, Power Considerations, Computer Terminology, Essentials of System Backups, File Essentials, Folder/Directory System Essentials, The Internet, Machine language. Data processing. Arithmetic unit: Carry look-ahead adders, Subtractors, and shifters. Logic unit.Combinational and sequential multipliers and dividers.Floating-point number representation and arithmetic.Data path design. Control unit design. Microprogramming.Pipelining.Memory Hierarchy.

CMP2421 PRINCIPLES OF INFORMATION SYSTEMS

Module Title:	**PRINCIPLES OF INFORMATION SYSTEMS**
Module Code	CMP 2421
NQF Level	5
Contact Hours	2 lectures + one practical session every second week for 14 weeks
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory

Module description: Information systems components: Hardware, Software, Data, Networks, Facilities, Personnel, Services, Partners; Information systems in organizations; Cost/value information, Quality of information, Competitive advantage of information, Information Systems and organizational strategy; The Internet and WWW : E-business, Intranets, Internet, extranets, Web 2.0; Technologies: e.g., wikis, tags, blogs, netcasts, self-publishing; New forms of collaboration: social networking, virtual teams, virtual marketing, crowd-sourcing; Security of information systems: Threats to information systems, Technology-based safeguards, Human-based safeguards, Information systems security planning and management; Business intelligence: Organizational decision making, functions, and levels, Executive, managerial, and operational levels, Systems to support organizational functions and decision making; Information systems ethics and crime: Information privacy, accuracy, property, and accessibility, Computer crime, Cyberwar / cyber terrorism

CMP2412 PROGRAMMING PRINCIPLES

Module Title:	**PROGRAMMING PRINCIPLES**
Module Code	CMP2412
NQF Level	4
Contact Hours	4 lectures plus a 3 hour practical session per week for 14 weeks
NQF Credits	16
Prerequisite	CMP2431 Computer Fundamentals
Compulsory/Elective	Compulsory

Module Description: Problem Solving Strategies, Program Development Steps: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. Programming Constructs: Primitive Data Types, Variables, Expressions & Assignment, Strings And String Processing, Arrays, Records, Files, Scope And Lifetime Of Variables, Strategies For Choosing The Right Data Structures. Conditional And Iteration Constructs: The Selection Structure, Comparison Operators, Logical Operators, Nested Selection Structures, The Case Selection Structure, The Repetition Structure, The For…Next Statement, The Do…Loop Statement.

CMP2412 PROGRAMMING PRINCIPLES

Module Title:	**PROGRAMMING PRINCIPLES**
Module Code	CMP2412
NQF Level	4
Contact Hours	4 lectures plus a 3 hour practical session per week for 14 weeks
NQF Credits	16
Prerequisite	CMP2431 Computer Fundamentals
Compulsory/Elective	Compulsory

Module Description: Problem Solving Strategies, Program Development Steps: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. Programming Constructs: Primitive Data Types, Variables,Expressions & Assignment, Strings And String Processing, Arrays, Records, Files, Scope And Lifetime Of Variables, Strategies For Choosing The Right Data Structures. Conditional And Iteration Constructs: The Selection Structure, Comparison Operators, Logical Operators, Nested Selection Structures, The Case Selection Structure, The Repetition Structure, The For…Next Statement, The Do…Loop Statement.

CMP2532 INFORMATION SYSTEMS MANAGEMENT

Module Title: **INFORMATION SYSTEMS MANAGEMENT**
Module Code CMP2532
NQF Level5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Module Description: Project Management Basics, Managing Project Scope, Estimating Project Time, Developing a Project Schedule, Analyaing the Cost of a project, Measuring the Project Quality, Managing Human Resources, Analysis Risks, Integrating Project Workflows.

YEAR 2: SEMESTER 1

CMP 2551 FUNDAMENTALS OF COMPUTER NETWORKS

Module Title: **FUNDAMENTALS OF COMPUTER NETWORKS**
Module Code CMP 2551
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Prerequisite CMP2411 Introduction to Computer Systems
Compulsory/Elective Compulsory
Module Description: Introduction to Networking , Networking Fundamentals, Networking Media , Cable Testing, Cabling LANs and WANs, Ethernet Fundamentals, Ethernet Technologies, Ethernet Switching, TCP/IP Protocol Suite and IP Addressing, Routing Fundamentals and Subnets, TCP/IP Transport and Application Layer, Case Study: Structured Cabling, WANs and Routers, Introduction to Router , Configuring a Router, Learning about Other Devices , Managing Cisco IOS, Routing and Routing Protocols, Distance Vector Routing , TCP/IP Suite Error and Control Messages, Basic Router Troubleshooting, Intermediate TCP/IP, Access Control Lists (ACLs).

CMP2511 FUNDAMENTALS OF DATABASE SYSTEMS

Module Title: **FUNDAMENTALS OF DATABASE SYSTEMS**
Module Code CMP2511
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Prerequisite CMP2411 Introduction to Computer Systems
Compulsory/Elective Compulsory
Module Description: Fundamentals of Databases; Types of databases; Evolution of Database technologies;Database Design; Conceptual Data Modeling; Types of entities; ER diagrams; Writing SQL statements; Using PL/SQL; Managing Databases; Administering a Database.

CMP2531 FUNDAMENTALS OF SYSTEMS ADMINISTRATION

Module Title: **FUNDAMENTALS OF SYSTEMS ADMINISTRATION**
Module Code CMP2531
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Prerequisite CMP2411 Introduction to Computer Systems
Compulsory/Elective Compulsory
Module Description: Introduction to Systems administration, basic issues in systems administration, Essential Administrative Tools. Creating and managing User Accounts, Installing, administering and configuring a multi-user and multi-tasking operating system like Linux. Overview of the UNIX / Linux system including advantages, directory structure, starting up and shutting down, Simple shell scripting, Structure of a file system, Administering secondary storage management, TCP / IP Network Management, Data Management, standards and best practices in systems administration.

CMP2571 PROGRAMMING I

Module Title: **PROGRAMMING I**
Module Code CMP2571
NQF Level 5
Contact Hours 4 Lectures per Week + 3 hour practical per week for 14 weeks
NQF Credits 16
Prerequisite CMP2412 Programming Principles
Compulsory/Elective Compulsory
Module Description: Problem Solving Strategies, Program Development Steps: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. Programming Constructs: Primitive Data Types, Variables, Expressions & Assignment, Strings And String Processing, Arrays, Records, Files, Scope And Lifetime Of Variables, Strategies For Choosing The Right Data Structures. Conditional And Iteration Constructs: The Selection Structure, Comparison Operators, Logical Operators, Nested Selection Structures, The Case Selection Structure, The Repetition Structure, The For…Next Statement, The Do…Loop Statement.

CMP2512 DATABASE MANAGEMENT

Module Title:	**DATABASE MANAGEMENT**
Module Title:	CMP2512
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits	16
Prerequisite	CMP2411 Introduction to Computer Systems
Compulsory/Elective	Compulsory

Module Description: Overview of the Oracle Architecture, Understanding Instances, Managing Tablespaves and Datafiles, Managing Tables and Indexes, Managing Udo Data, Managing Users and Security, Networking, Backup and Recovery, loading and moving data, Globalization Support.

CMP2532 SYSTEM ADMINISTRATION

Module Title:	**SYSTEM ADMINISTRATION**
Module Code	CMP2532
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits	16
Corequisite	CMP2531 Introduction to System Administration
Prerequisite	CMP2411 Introduction to Computer Systems
Compulsory/Elective	Compulsory

Module Description: Introduction to Systems administration, basic issues in systems administration, Essential Administrative Tools. Creating and managing User Accounts, Installing, administering and configuring a multi-user and multi-tasking operating system like Linux. Overview of the UNIX / Linux system including advantages, directory structure, starting up and shutting down, Simple shell scripting, Structure of a file system, Administering secondary storage management, TCP / IP Network Management, Data Management, standards and best practices in systems administration.

CMP2552 CMP2552

Module Title:	**NETWORK ADMINISTRATION**
Module Code	CMP2552
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits	16
Prerequisite	CMP2411 Introduction to Computer Systems
Compulsory/Elective	Compulsory

Module Aims

This modules aims to consolidate the concepts introduced in Introduction to Computer Networks. Its content is equivalent to that of CCNA3 and CCNA4, enabling the students that complete the module to go for CCNA certification. Particular emphasis is given to students being able to demonstrate the ability to apply what they learned in Introduction to Computer Networks and to be able to explain how and why a particular network strategies can be employed.

CMP2572 PROGRAMMING II

Module Title:	**PROGRAMMING II**
Module Code	CMP2572
NQF Level	5
Contact Hours	4 Lectures per Week + 3 hour practical per week for 14 weeks
NQF Credits	16
Prerequisite	CMP2412 Programming Principles
Compulsory/Elective	Compulsory

Module Description: Introduction to OOP applications: Design and Implementation of the .NET Framework, The Common Language Runtime, The .NET Framework Class Library, Creating a .NET Application. Designing windows based applications using the Visual Studio.NET IDE: Organizing a Windows based application, Using controls (e.g. Scroll Bar, groupbox, etc), Introduction to event handlers, Dynamic event handling. Creating programs using component based programming: Introduction to Component Based Programming, Controlling Visibility with Access Modifiers, Introduction to Classes, Object Oriented Programing concepts; Inheritance; polymorphism, abstraction, Exception Handling.

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY, CURRICULUM AND PREREQUISITES

QUALIFICATION: Bachelor of Science in Information Technology (Honours) (11BSIT)
Students opting for a Bachelor of Science in Information Technology must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		none
1	Basic Mathematics	MAT3511	16		none
1	Computer Literacy	CLC3509	8		none
1	Programming Fundamentals I	CMP3511	16		none
1	Introductions to Digital Electronics	CIT3511	16		none
1	Fundamentals of Information Technology I	CIT3521	8		none
2	English for Academic Purposes	LEA3519	16		none
2	Contemporary Social Issues	CSI3580	8		none
2	Programming Fundamentals II	CMP3512	16	CMP3511	none
2	Pre-calculus	MAT3512	16		none
2	Introduction to Statistics	STS3522	8		none
2	Fundamentals of Information Technology II	CIT3512	16	CIT3521	none
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Introduction to Databases	CMP3611	16		CMP3512
1	Object Oriented Programming I	CMP3691	16		CMP3512
1	Discreet Mathematics Concepts	CIT3631	16		SMAT3512 and SMAT3511
1	Computer Networks I	CIT3611	16		CIT3511
2	Advanced Databases	CMP3612	16	CMP3611	CMP3511
2	Object Oriented programming II	CMP3692	16	CMP3691	CMP3692
2	Telecommunications	CIT3632	16		CMP 3521and CIT3511
2	Computer Networks II	CIT3612	16	CIT3611	CMP 3511
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Advanced Computer Networks	CIT3711	16		CIT3612 and CIT3632
1	Software Engineering	CMP3731	16		CIT3512 and CMP3692
1	Information Security	CIT3731	16		CIT3612
1	Systems Administration and Maintenance	CIT3771	16		CIT3512 and CIT3612
2	Internet Technologies and Applications	CMP3712	16		CIT3632 and CIT3612
2	Human Computer Interaction	CMP3792	16		CMP3692
2	Research Methodology	CMP3732	16		STS 3522
2	Platform Technologies	CIT3732	16		CIT3711 and CIT3632
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Research Project	CIT3810	32	Pass all Third Year Modules	none
1	Network System Security	CMP3821	8	CIT3711 and CIT 3712	none
1	Wireless and Mobile Computing	CMP3841	8	CIT3711 and CIT 3712	none
1	IT Project Management	CIT3811	16	CMP3712 and CMP3731	none
1	Distributed Systems	CMP3851	16	CIT 3612	none
1	Artificial Intelligence	CMP3871	16	CMP3512	none
2	Research Project	CIT3810	0	Pass all Third Year Modules	none
2	Entrepreneurship and Management of IT Systems	CMP3832	16	CMP 3751	none
2	Automation	CIT3812	16	CIT3631 and CMP3792	none
2	Real Time Multimedia	CMP3812	16	CIT 3612	none
2	Cloud Computing	CIT3812	16	CMP 3612 and CIT3771	none
Total Credits			**160**		

F.4. BACHELOR OF SCIENCE IN COMPUTER SCIENCE, CURRICULUM AND PREREQUISITES

QUALIFICATION: Bachelor of Science in Computer Science (Honours) (11BSCO)
Students opting for a Bachelor of Science in Computer Science must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Programming Fundamentals I	CMP3511	16		None
1	Introductions to Digital Electronics	CIT3511	16		None
1	Fundamentals of Information Technology I	CIT3521	8		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Programming Fundamentals II	CMP3512	16		CMP3511 Programming Fundamentals I
2	Fundamentals of Information Technology II	CIT3512	16		CIT3521 Fundamentals of Information Technology I
2	Introduction to Statistics	STS3522	8		None
Total credits			**160**		

YEAR 2

SEMESTER	MODULE	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Introduction to Database Systems	CMP3611	16	CMP 3512	None
1	Object Oriented Programming I	CMP3691	16	CMP3512	None
1	Mathematics for Computer Science	CMP3651	16	MAT3511 and MAT3512	None
1	Computer Networks I	CIT3611	16		None
2	Advanced Databases	CMP3612	16	CMP3511	CMP3611
2	Object Oriented programming II	CMP3692	16	CMP3511	CMP3691
2	Computer Networks II	CIT 3612	16	CIT3511	CIT3611
2	Computer Organization & Architecture	CMP3672	16	CIT3511	none
Total credits			**128**		

YEAR 3

SEMESTER	MODULE	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Computer Theory	CMP3711	16	CMP3651	None
1	Software Engineering	CMP3731	16	CIT3512 CMP3692	None
1	Emerging Technologies	CMP3751	16	CIT3612	None
1	Data Structures and Algorithms	CMP3791	16	CMP3692	None
2	Operating Systems	CMP3732	16	CIT3612 and CMP3672	None
2	Human Computer Interaction	CMP3792	16	CMP3692	None
2	Research Methodology	CMP3752	16	CMP3692	None
2	Web Design & Programming	CMP3772	16	CMP3692	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Research Project	CMP3810	32	Pass all third year	None
1	Network Security	CMP3821	8	CIT3612 and CMP3751	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3792 and CMP3751	None
1	Numerical Methods and Operations Research	CMP3811	16	CMP 3651	None
1	Distributed Systems	CMP3851	16	CIT3612 and CMP 3791	None
1	Artificial Intelligence	CMP3821	8	CMP3711 and CMP 3791	None
2	Entrepreneurship and Management of IT Systems	CMP3832	16	CMP3751	None
2	Real Time Multimedia	CMP3812	16	CIT3612 and CMP3751	None
2	Database Programming	CMP3872	16	CMP3612 and CMP3692	None
2	Data warehousing and Data Mining	CMP3822	8	CMP3612	None
Total Credits			**144**		

F.4. BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY/COMPUTER SCIENCE, MODULE DESCRIPTIONS

YEAR 1: SEMESTER 1

CMP3511 PROGRAMMING FUNDAMENTALS I

Module title:	**Programming Fundamentals I**
Code	CMP3511
NQF level:	5
Contact hours:	4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits:	16
Module Assessment:	Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Final Examinations 50%
Prerequisites:	Departmental Entry Test

Module description: This module introduces the students to the foundational skills for all computing disciplines. It develops the student's skills and concepts that are essential to good programming practice and problem solving. The module will cover the following topics: -PROBLEM SOLVING STRATEGIES: The role of algorithms in the problem solving process, Implementation strategies for algorithms, Debugging strategies, The concept and properties of algorithms. PROGRAM DEVELOPMENT STEPS: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. PROGRAMMING CONSTRUCTS: Primitive data types, Variables, Expressions & assignment, Strings and string processing, Arrays, Records, Files, Scope and lifetime of variables, Strategies for choosing the right data structures. CONDITIONAL AND ITERATION CONSTRUCTS: The Selection structure, Comparison operators, Logical operators, Nested selection structures, The Case selection structure, The Repetition structure, The For…Next Statement, The Do…Loop Statement. EVENT-DRIVEN PROGRAMMING CONSTRUCTS: Event-handling methods, Event propagation, Exception handling, Functions and Parameter passing, Structured Decomposition.

CMP3521 FUNDAMENTALS OF DIGITAL ELECTRONICS

Module title:	**Fundamentals Of Digital Electronics**
Code:	**CMP3521**
NQF level:	5
Contact hours:	2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits:	8
Module Assessment:	Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites:	Departmental Entry Test

Module Description: This module introduces the student to the basic theory of semi-conductor electronics. The student is able to appreciate the functional characteristics of the various semi-conductor devices that form the building blocks of integrated digital circuits. These include diodes, BJT transistors, FET etc. The topics covered in the module are; The atomic structure: - The molecule; atomic and molecular bonds; ionic binding; covalent binding; metallic bonds; insulators and semiconductors. Band model; intrinsic semiconductors; conduction by electrons and holes; carrier concentration. Extrinsic semiconductors; Photo-conduction and voltaic effects:- The P-N junction; V-I characteristics; diode resistance; Zener, tunnel, photo and light emitting diodes; Diode circuits; The bipolar junction transistor; common base, common emitter, common collector configurations and their characteristics; Transistor circuits; The transistor as a switch; Field effect transistors.

CIT3521 FUNDAMENTALS OF INFORMATION TECHNOLOGY I

Module Title:	**Fundamentals of Information Technology I**
Module Code	CIT3521
NQF Level	5
Notional Hours	80
NQF Credits	8
Contact Hours	2 lecture periods per week and half a practical session per week for 14 weeks
Prerequisite	
Compulsory/Elective	Compulsory

Module Descriptions: Pervasive Themes in IT, History of Information Technology, IT and Its Related and Informing Disciplines, Application DomainsHistory of the Internet; Communications media; Data transmission; Networking fundamentals; Telecommunication Fundamentals; Industry standards, topologies and protocols; Information technology security; Operating systems; web technologies

YEAR 1: SEMESTER 2

CMP3512 PROGRAMMING FUNDAMENTALS II

Module title:	**Programming Fundamentals II**
Code	**CMP3512**
NQF level:	5
Contact hours:	4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits:	16
Module Assessment	Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-Requisites:	CMP3511 Programming Fundamentals I

Module description: This module is a follow up on Programming Fundamentals 1 and provides the student with a rich set of tools to create advanced programs as required in today's business environment. The module will cover the following topics: Introduction to vb.net applications: Design and Implementation of the .NET Framework, The Common Language Runtime, The .NET Framework Class Library, Creating a .NET Application. Designing windows based applications using the Visual Studio.NET IDE: Organizing a Windows based application, Using controls (e.g. Scroll Bar, groupbox, etc), Introduction to event handlers, Dynamic event handling. Creating programs using component based programming: Introduction to Component Based Programming, Controlling Visibility with Access Modifiers, Introduction to Classes, Introduction to the Object-Oriented Paradigm, Exception handling.

YEAR 2: SEMESTER 1

INTRODUCTION TO DATABASE SYSTEMS

Module Title:	**Introduction To Database Systems**
Module Code	CMP 3611
NQF Level	6
Notional Hours	160
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Prerequisite	CMP3512 Programming Fundamentals II
Compulsory/Elective	Compulsory

Module Content: Types of databases; Evolution of Database technologies; Database technology versus conventional file-processing systems; The enterprise data model; Conceptual Data Modeling; Types of entities; ER diagrams to relation transformation; Business rules; Integrity Control Statements; Writing SQL statements; Functional Dependencies; Normalization and Denormalization.

CMP3691 OBJECT ORIENTED PROGRAMMING I

Module Title	**Object Oriented Programming I**
Module Code	CMP3691
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Prerequisites	CMP3512 Programming Fundamentals II
Compulsory/Elective	Compulsory

Module Aims This module aims to: advance the understanding of object-oriented programming; develop knowledge and skills in OOP design , program development; introduce the principles of reusability; illustrate object-oriented design and modelling techniques.Module Content: The module will cover the following topics: Classes: Interfaces and Abstract classes; Exceptions and I/O Streams ; Vectors and Iterators; Introducing Abstract Data (ADT). Lists: Stacks, queues and recursion; Trees; Heaps and hash tables; Priority queues; hash tables; Graphs.

MATHEMATICS FOR COMPUTER SCIENCE

Course Title	**Mathematics For Computer Science**
Course Code	CMP3651
NQF Level	6
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	SMAT 3512 Precalculus and SMAT3511 Basic Mathematics
Compulsory/Elective	Compulsory

Course Content: Representation of Numbers in the Computer; Logical Statements and Truth Tables; Predicate Logic; Relations; Functions or Mapping; domain; Sequences; Graphs; Computational Geometry; Number Theory and Methods of Proof; coordinate Geometry; Numerical and Algebraic Expressions; Monomials and Polynomials; Partial fractions; Equations; Inequalities; Vectors; Matrices and Determinants; Fundamental Principles of Counting; Permutations and Combinations; Binomial Theorem; Multinomial Theorem; Variables and Functions; Review of Basic Elementary Functions and Derivative; Complex Numbers; Differential Equations; Integrals.

DISCRETE MATHEMATICS CONCEPTS

Module Title:	**Discrete Mathematics Concepts**
Module Code	CIT 3631
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%, Examination 50% (1 x 3 hour paper)
Prerequisite	SMAT 3512 Precalculus& SMAT 3511 Basic mathematics

Module Content: Fundamentals: This part contains a miscellany of basic material in the module.
Logic: This part covers logic and related material, including methods of proof and mathematical induction. Counting: This part deals with permutations, combinations, the pigeon-hole principle, elements of probability, and recurrence relations. Relation: This part presents basic types and properties of relations, along with their representation as directed graph. Functions: This part deals with the notion of a function and gives important examples of functions, including functions of special interest in computer science Simple linear Function and Equation. Trees: directed and undirected trees along with applications of these ideas. Graphs and Finite-State Machines: This part focuses on elementary graph theory and devoted to finite-state machines. Sets and Random Experiments: Union, intersection, Venn diagram.

COMPUTER NETWORKS I

Module Title:	**Computer Networks I**
Module Code	CIT 3611
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%, Examination 50% (1 x 3 hour paper)
Prerequisite	CMP 3531 Introduction to Digital Electronics

Module Content: ISO reference models; TCP/IP; modulation techniques; networking devices; compute Error detection, error and flow control; baseband and broadband communications; HDLC; network topologies; Ethernet; network architecture; protocols; client server and peer to peer paradigms; network standards; physical and data link layer (error control, framing, flow control); internetworking and routing; frame relay networks; services of the network layers; network security.

YEAR 2: SEMESTER 2

ADVANCED DATABASES

Module Title:	**Databases II**
Module Code	CMP 3612
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Prerequisite	CMP 3512 Programming Fundamentals II

Module Aims This module aims to: strengthen database principles covered in Databases I; emphasize impact of using techniques for query performance; consolidate design and use of databases; strengthen database security and other advanced aspects of database systems.

OBJECT ORIENTED PROGRAMMING II

Module Title	**Object Oriented Programming II**
Module Code	CMP 3692
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Pre-requisite	CMP3531 Introduction to Digital Electronics and CMP3512 Programming Fundamentals II
Co-requisite	CMP3691 Object Oriented Programming I

Module Content: Review of Object-orientation and Abstract Data Types; Modifiers; Linked Lists and Doubly linked lists; Utility Classes; Vectors and Type Parameters; Abstract Classes; Exceptions ;Threads; Class Invariants; Applets; Unit testing; Class and inheritance s; Generic methods; Class and inheritance; Basic design patterns for classes; Class design; Design by contract; Design by abstraction; Project: requirements; Frameworks and GUI; GUI program; GUI collections and I/O ; GUI layouts; design patterns; object-oriented design and specification ; Basic design patterns for classes; Encapsulation; Unit testing of classes; Automated testing tools; Exception handling; Inheritance and Polymorphism; Design for inheritance. ; Generalized containers and iterators; Interfaces; Applets, Streams and file manipulation.

TELECOMMUNICATIONS

Module Title	**Telecommunications**
Module Code	CIT 3632
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP 3522 Fundamentals of Information Technology I & CMP 3531 Introduction to Digital Electronics

Module Content: Introduction to the principles and practice of wireless communications. The module presents the concepts of frequency reuse and cellular structure and covers propagation effects, multipath fading, digital and analog modulation, diversity and equalization, multiple access and wireless networks. The module also presents modern wireless systems and standards. The focus of the module is to understand wireless communications at a systems level and is designed as a senior elective for IT majors. Basic understanding of electromagnetic spectrum: wave **propagation** and communication theory is expected. The module includes a project related to new technological advances in wireless systems.

COMPUTER NETWORKS II

Module Title	**Computer Networks II**
Module Code	CIT 3612
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Pre-requisite	CMP 3671 Computer Networks I&CMP 3531 Introduction to Digital Electronics

Module Aims: This module aims to: cover the skills of operating the networking devices; configure and manage networking devices; create VLAN's and VPN's; restrict access using access control lists(ACL's) and standard access lists; apply different commands to troubleshoot the network; manage addressing technologies.

COMPUTER ORGANISATION AND ARCHITECTURE

Course Title:	**Computer Organization and Architecture**
Course Code	CMP 3672
NQF Level	6
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP 3531Introduction to Digital Electronics and CMP3522 Information Technology
Compulsory/Elective	Compulsory

Course Content: Advance Digital Design : Combinational and Sequential Circuit Design; Control unit, Stored program, addressing schemes; Memory organization; Input-Output Organization; principles of serial and parallel, synchronous and asynchronous communications; Interrupt handling, Input and output Channels, DMA and IOP, Standard I/O Interfaces; Machine language addressing methods and Instructions, Program Sequencing with respect to Microprocessors or Microcontrollers; discuss different computer architectures; Design and modeling of disks and redundant Arrays; interrupts and DMA; illustrates Peripheral interfaces;

YEAR 3: SEMESTER 1

ADVANCED COMPUTER NETWORKS

Module Title	**Advanced Computer Networks**
Module Code	CIT3711
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP3672 Computers Networks II

Module Contents: Introduction to Routing and Packet Forwarding - the router, its role in the networks, its main hardware and software components, and the packet forwarding process. You will also be given an overview of directly connected networks, static routing, and dynamic routing protocols, along with a brief introduction to the routing table. Static Routing - the role and configuration of static routes. The routing table process is introduced, Discovery Protocol, which is a tool that you can use to help verify network operations. Overview of routing protocol concepts and the various dynamic routing protocols available for routing in IP networks. Routing protocols. Comparing and contrasting the different protocols. Two different types of routing protocols: distance vector and link-state. Distance vector concepts and operations, including network discovery, routing table maintenance, and the issue of routing loops. The concepts used in RIPv1, RIPv2, and EIGRP routing protocols. Specific dynamic routing protocol.The first IP routing protocols, the characteristics, operations, and limitations of RIPv1.RIPv1 configuration, verification, and troubleshooting techniques.VLSM (Variable Length Subnet Mask) and CIDR (Classless Inter-Domain Routing) concepts that were presented in the Network Fundamentals module.The benefits of VLSM along with the role and benefits of CIDR in today's networks. Next, the role of classless routing protocols. Classless routing protocols RIPv2, EIGRP. RIPv2. RIPv2 is a classless, distance vector routing protocol. You will see how RIPv2 demonstrates the advantages and operations of a classless routing protocol. The limitations of the classful routing protocol, RIPv1. Then RIPv2 is introduced, to show how a classless routing protocol can be used to overcome these limitations. The structure of the routing table. The routing table, the lookup process, how the routing table process determines the best match with a packet's destination IP address, and how to enter a route in the routing table.

COMPUTER THEORY

Course Title:	**Computer Theory**
Course Code	CMP 3711
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP 3651 Mathematics for Computer Science CMP 3632 Object Oriented Programming II
Compulsory/Elective	Compulsory

Course Content: Functions, Relation, Sets, Propositional and Predicate logic; quantifiers; graphs and trees; algebraic structures; Tautologies, contradictions and contingencies; Proofs; Recursive definitions and recurrence relations; Program correctness; Huffman codes; Algebraic structures; Error-detecting/correcting capabilities of codes; Syndromes; Languages; Regular expressions; Automata theory; Push-down Automata (PDAs) theory; context-free grammars; Pumping lemma theory; Universal Turning theory; computability, decidability and tractability.

EMERGING TECHNOLOGIES

Course Title:	**Emerging Technologies**
Course Code	CMP 3751
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP 3671 Computer Networks I
Compulsory/Elective	Compulsory

Module Content: Emerging Technology, Telecommunication Convergence, Convergence in Evolutionary Computing, Leading Technologies, Emerging mobile and web technologies; Networking solutions and status; Cloud computing; Network evolution to support new services; Current Applications and Markets.

DATA STRUCTURES AND ALGORITHMS

Course Title	**Data Structures and Algorithms**
Course Code	CMP 3791
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Pre -Requisite	CMP 3632 Object Oriented Programming II
Compulsory/Elective	Compulsory

Module Content: Review of object-oriented framework; Data Objects; Data Structures and Complex Data Structures; List; Algorithm Analysis; Sorting; Searching; Advanced Tree Structures; Hash tables; Hash function; Re-hashing; Priority Queues (Heaps); File compression; Huffman coding; Graphs; Adjacency Matrix and List; Connectivity; Topological sort; Shortest path algorithms; minimum Spanning Tree; hard or Intractable problems; dynamic Algorithms; dictionaries; traveling Salesman's Problem.

SOFTWARE ENGINEERING

Module Title	**Software Engineering**
Module Code	CMP 3731
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP3672 Computers Networks II

Module Description: The nature of software engineering; software process models; the rational unified process; agile software development; requirements engineering; analysis and system modeling; architectural design; component level design; object oriented design; user interface design; software testing strategies and principles of quality management; review techniques; software metrics; formal methods; software maintenance; re-engineering and reuse; capability Maturity Model; project management techniques; future trends in software engineering.

INFORMATION SECURITY

Module Title	**Information Security**
Module Code	CIT3731
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3612 Computer Networks II and CMP3712 Internet Technologies and Applications

Module Description: Malware: viruses, trojans, worms, denial of service attacks, phishing, and even Wiki leaks. Confidentiality, integrity, and availability. Information Classification: security awareness, IP Practitioners, Enterprise Security Architecture .Policy Development, policy Development. Secure Systems Architecture, microcomputer and LAN Security, Systems Integrity Engineering. Ethics, legal and Regulatory Issues, Computer Abuse Methods and Detection.Federal and State Computer Crime Laws.Computer Crime Investigation and Computer Forensics.

SYSTEM ADMINISTRATION AND MAINTENANCE

Module Title	**System Administration And Maintenance**
Module Code	CIT3771
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	SCME 3522 Fundamentals of Information Technology I and CIT3612 Computer Networks II

Module Content: Windows Client Installation, Configuration and Administration; Windows Server Management and Maintenance; UNIX Use, Configuration and Administration; Computer Upgrade and Maintenance. Processes and scheduling, Peripheral Management, Disk Management. System Maintenance .System Management Interface Tool - SMIT • AIX Review .User & Group Management .System Startup& Shutdown .Backups and security.

YEAR 3: SEMESTER 2

INTERNET TECHNOLOGIES AND APPLICATIONS

Module Title	**Internet Technologies And Applications**
Module Code	CMP3712
NQF Level	7
NQF Credits	16
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP 3521 Fundamentals of Information Technology I and CIT3612 Computer Networks II

Module Content: OSI Model: OSI Reference Layer model. Internet Protocols: TCP&TCP/IP- HTML & XTML codes -Use HTML to Create Simple Web Page. Security Implementation: Secure Protocols. Digital Certificate and Signature. Use my SQL. Oracle & Data Base (Link three Tables in Data Base). ASP Techniques- PHP Techniques.Packet Switching – HTTP-URL.Basic Internet Tools.Using FTP.The Domain Name Systems.The internet Protocol Suite.

OPERATING SYSTEMS

Course Title:	**Operating Systems**
Course Code	CMP 3732
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP 3672 Computer Organization and Architecture
Co-requisite	CMP 3771 Data Structures and Algorithms
Compulsory/Elective	Compulsory

Module Description: This module introduces the student to the concepts that underlie Operating Systems (OS).It is essential for a computer scientist to know what operating systems are,what they do and how they are designed.

The module will cover the following topics: Processes in OS, synchronization, Interprocess communication, scheduling, deadlocks, memory management, virtual memory, secondary storage, device management and security.

HUMAN COMPUTER INTERACTION

Module Title	**Human computer interaction**
Module Code	CMP 3751
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Pre-requisite	CMP 3692 Object Oriented Programming II and CMP3731 Software Engineering

Module Description: Human Aspects of HCI; Guidelines, Principles and Theories of HCI; Usability of Interactive Systems; Interaction Styles; Models and metaphors; Managing the Design Process; predictive and heuristic evaluation of interfaces; HCI with non-traditional interfaces(vision-based interaction, multimodal interaction, ubiquitous computing, augmented and virtual reality, interaction in gaming, mobile interaction);Current Research trends :ubiquitous and context-aware computing; tangible interfaces; haptic interaction; and mobile interfaces.

RESEARCH METHODOLOGY

Module Title	**Research Methodology**
Module Code	CMP 3732
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	STS 3522 Introduction to Statistics
Co-Requisite:	CMP 3751Human Computer Interaction

Module Description: The nature and need for research in science; scientific method; historic overview of research driven scientific progress; research methods and design; qualitative and quantitative research methods; experimental, quasi-experimental and non-experimental methods; selection of research topics ; writing a research proposal; conducting a literature review; sampling methods; design of questionnaires; interviews and observation techniques; independent and dependent variables; correlation and causation; validity of conclusions;' statistical methods of data evaluation and data analysis; methods of presenting data and conclusions; report writing; ethical considerations in research.

PLATFORM TECHNOLOGIES

Module Title	**Platform Technologies**
Module Code	CIT 3732
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Pre-requisite	CMP3712 Internet Technologies and Applications
Co-requisites	CIT Advanced Computer Networks

Module Description: Advanced Computer Architecture: computer memory hierarchy and its implementation, input/output operations, use of assembly language programming, instruction sets, arithmetic and logical operations, addressing modes and macro definition. A fundamental theory and design methods for digital systems.Architecture-machine performance relationships, computer classifications, and computer description languages. Parallel Architecture: development of broad working knowledge of probability, petri net, asynchronization parallelism: MIMD System, synchronous parallelism: SIMD System, computer systems simulation, and empirical analysis techniques as applied to computer systems modeling.

WEB PROGRAMMING & PROGRAMMING

Module Title:	**Web Programming & Programming**
Course Code	CMP3772
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP3632 Object Oriented Programming II
Compulsory/Elective	Compulsory

Course Description: XML; DTD; XML Namespaces; MySQL; Cascading Style Sheets; Client-Side Programming; Document Object Model (DOM); Server-Side Programming with PHP; server-side backend databases; pattern matching with regular expressions; Ajax; JpGraph; JSON; PHP's image functions; PHP's JSON functions; Web Security; JavaScript Libraries; Pseudo-Classes; client-Side Scripts; Traversing the DOM Tree; PHP; enterprise Web development; web applications; web services; web service description language (WSDL); Simple Object Access Protocol (SOAP); UDDI; 3rd party packages; extensive style sheet language (XSL); XSL transformation (XSLT);XMLT; XML parsers.

YEAR 4: SEMESTER 1

RESEARCH PROJECT

Module Title: **Research Project**
Module Code CMP3810
NQF Level 8
Contact Hours 4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits 32
Assessment Continuous Assessments100%
Pre-requisite Pass All Third Year Modules

Module Content : This module provides the framework for the development of the necessary research skills through the completion of a supervised research project in the context of the major. Students will be expected to develop a research proposal under the guidance of the supervisor, present the proposal in the written and oral form, collect and analyze relevant data in order to prepare a requirements document, prepare the relevant design documentation for the project, produce workable software, test the software and implement it. The student is expected to produce a report on the project according to the accepted format adopted by the Department of computer Science. The student is expected to present the final report orally and in the written form.

NETWORK SECURITY

Module Title **Network Security**
Module Code CMP3821
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week and 1 practical session every second week for 14 weeks
Assessment Continuous 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite CIT Advanced Computer Networks & CIT 3712 Information Security

Course Description: Security services, digital signature, key management, network security: IPsec, SSL/TLS, PGP, VPN, firewalls and intrusion detection systems. Cryptography: symmetric, asymmetric and digital signature. email security: SMIME. Malware: viruses, worms, Trojan horses, spy ware, rootkit and dishonest adware. security in wireless and Ad-hoc networks, Secure remote access, electronic payment, web security

WIRELESS AND MOBILE COMPUTING

Module Title **Wireless And Mobile Computing**
Module Code CMP3841
NQF Level 8
Contact Hours 2 lecture periods per week and 1 practical session every second week for 14 weeks
NQF Credits 8
Assessment Continuous 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite CIT Advanced Computer Networks & CIT 3712 Information Security

Module Description: Wireless networks; cellular systems; medium access techniques; radio propagation models; power control and error control techniques; hard and soft handoffs; protocols(AMPS, IS-95, IS-136); radio resources and network management; wireless antennas ; wireless propagation; wireless local loop(WLL); integrated architectures for mobile services; mobile transmission; network performance and traffic engineering; wireless security.

IT PROJECT MANAGEMENT

Module Title **IT Project Management**
Module Code CIT 3811
NQF Level 8
NQF Credits 16
Assessment Continuous 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite CMP2751 Internet Technologies and Applications & CMP 3731 Software Engineering

Module Description: This module is designed to teach students the basic principles of project management. Topics will include project management function; project management process; project integration; scope and time frames; quality; human resources; communication; procurement; network scheduling; cost and risk management. Students will learn how to identify and schedule project resources, carry out resource allocation, create project flow charts, produce critical path planning and evaluate reports. Emphasis will also be on tools such as Programme Evaluation and Review Technique (PERT) charts and Critical Path Method (CPM) charts. Important issues of staff selection and team management will also be covered. These learning objectives will be reinforced by a team project that allows students to apply the principles and use the tools they learned.

ARTIFICIAL INTELLIGENCE

Module Title **Artificial Intelligence**
Module Code CMP3871
NQF Level 8
Contact Hours 4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits 16
Prerequisite CMP 3711 Computer Theory and CMP 3652 Data Structure and Algorithms

Compulsory/Elective Compulsory

Module Description: The module will cover the following topics: -Introduction to AI; Major components in a typical intelligent system, Flavours of AI; Church-Turing thesis, The Turing test, Searle's Chinese room argument; Introduction to PROLOG, The PROLOG Language, PROLOG in AI; Search: Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimisation and search such as stochastic annealing and genetic algorithm; dynamic programming, A*; Representing Knowledge: Production rules, monotonic and non-monotonic logics, description logics; Reasoning and Control: Data-driven and goal-driven reasoning, AND/OR graphs; Reasoning under Uncertainty: Probabilities, conditional independence, causality, Bayesian networks; Machine Learning: Inductive and deductive learning, unsupervised and supervised learning, reinforcement learning, concept learning from examples, Quinlan's ID3, classification and regression trees, Bayesian methods.

YEAR 4: SEMESTER 2

ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS	
Module Title	**Entrepreneurship And Management Of IT Systems**
Module Code	CMP3832
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite	CMP 3751 Human Computer Interaction

Module Content: Definitions of Entrepreneurship; entrepreneurial mind; starting a new business; home based businesses ;overview of challenges of SME's; Namibian context and entrepreneurial action; legal and accounting concerns; Business plans; economic characteristics; Critical success factors; evaluation processes and feasibility study; entrepreneurial team; Social entrepreneurship, ethics and strategic planning and franchising; management of IT Systems(Making a strategic case for IT systems, historical Development of IT systems, Information Management, Managers views); strategic management of IT system(sector management of IT systems A Framework for Management of IT Systems); Information technology and Strategic advantage(formulating Information Systems Strategy, formulating IT strategy. Formulation Information management Strategy); Organizing IT activities:(controlling IT activities, Financing IT, appraising IT and Responsibility Accounting for IT);evaluation IT; Integrating IT and Organization.

AUTOMATION	
Module Title	**Automation**
Module Code	SCIT3812
NQF Level	8
NQF Credits	16
Assessment	Continuous 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3731 Computer Networks II
Compulsory/Elective	Elective

Module Content: PLC Technology, Programmable Logic Controllers (PLCs), PLC Hardware Components. PLC Wiring Diagrams and Ladder Logic Programs. PLC Programming Timers, Programming Counters. Fundamentals of Logic, Computer-Controlled Machines and Processes. Hierarchical Structure of Automation and Control Systems.COM, DCOM. OPC applications.Key components and features of OPC.Design an application to interface data from the plant floor to SCADA screen using OPC.Troubleshoot OPC.

CLOUD COMPUTING	
Module Title:	**Cloud Computing**
Module Code	**CIT3812**
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous 50%, Examination 50% (1 x 3 hour paper)
Compulsory/Elective	Elective
Pre-requisite	CMP 3612 Databases II & CIT 3771 System Administration and Maintenance

Module Description: Cloud technologies: software as a service, platform as a service, infrastructure as a service, virtualization, computing layers and operating system. Cloud security: threats and potential vulnerabilities. Intelligent web applications: advanced information retrieval, analysis and visualisation and handling data in the cloud, client-server architectures and high-bandwidth, cloud taxonomy, cloud storage, vendors, challenges, ownership, data centres, databases, models

RESEARCH PROJECT	
Module Title	**Research Project**
Module Code	CMP 3810
NQF Level	8
NQF Credits	32
Pre-requisite	Pass All Third Year Modules

Module Description: Identification of research topic; literature review; requirement elicitation and specification; requirement analysis; proposal development and presentation; software design and implementation; testing; deployment and evaluation; report writing; field attachment.

NETWORK SECURITY	
Module Title	**Network Security**
Module Code	CMP 3821
NQF Level	8
Contact Hours	2 lecture periods per week and one practical session every second week for 14 weeks
NQF Credits	8
Pre-requisite	CIT Advanced Computer Networks & CIT 3712 Information Security

Module Description: Security services, digital signature, key management, network security: IPSec, SSL/TLS, PGP, VPN, firewalls and intrusion detection systems. Cryptography: symmetric, asymmetric and digital signature. email security:
Course Title: Numerical Methods and Operations Research
SMIME. Malware: viruses, worms, Trojan horses, spy ware, rootkit and dishonest adware. security in wireless and Ad-hoc networks, Secure remote access, electronic payment, web security

NUMERICAL METHODS AND OPERATIONS RESEARCH

Module Title	**Numerical Methods And Operations Research**
Course Code	**CMP3811**
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP 3651 Mathematics of Computer Science
Compulsory/Elective	Elective

Course Description: Introduction to Model Building; Graphical Solution of Linear Programming Problems; Simplex Algorithm; Goal Programming; Nonlinear Programming; NLPs; Decision Making; Theory and Framing; Game Theory; Probabilistic Inventory Models; Stochastic Processes; Markov Chains; Deterministic Dynamic Programming; Queuing Theory ;Discrete-Event Simulation; Random Numbers and Monte Carlo Simulation; Simulation with Continuous Random Variables; Statistical Analysis in Simulations; Simulation; Time Series Models; exponential Smoothing with Season; Ad Hoc Forecasting; Regression; Operations Research Packages; Simulation with SIMULA; operations research with packages.

ARTIFICIAL INTELLIGENCE

Module Title	**Artificial Intelligence**
Module Code	CMP3821
NQF Level	8
Contact Hours	2 lecture periods per week and one practical session every second week for 14 weeks
NQF Credits	8
Prerequisite	CMP3711 Computer Theory and CMP3652 Data Structure and Algorithms
Compulsory/Elective	Compulsory

Module Description: The module will cover the following topics: -Introduction to AI; Major components in a typical intelligent system, Flavors of AI; Church-Turing thesis, The Turing test, Searle's Chinese room argument; Introduction to PROLOG, The PROLOG Language, PROLOG in AI; Search: Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimisation and search such as stochastic annealing and genetic algorithm; dynamic programming, A*; Representing Knowledge: Production rules, monotonic and non-monotonic logics, description logics; Reasoning and Control: Data-driven and goal-driven reasoning, AND/OR graphs; Reasoning under Uncertainty: Probabilities, conditional independence, causality, Bayesian networks; Machine Learning: Inductive and deductive learning, unsupervised and supervised learning, reinforcement learning, concept learning from examples, Quinlan's ID3, classification and regression trees, Bayesian methods.

DISTRIBUTED SYSTEMS

Module Title	**Distributed Systems**
Module Code	CMP3831
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Compulsory/Elective	Elective
Pre-requisite	CMP3672 Computer Networks II

Module Description: Distributed systems architectures; Inter-process communications; RPC; multithreaded processes; client-server communication; server structures; concurrent and distributed programming; caching; coherence; protocols; name service; reliability and availability; recovery techniques, distribution and duplication; fault management; distributed algorithms; synchronization; distributed coordination; Peer-to-peer; clusters and grid; security; research issues with key application areas will be selected from: enterprise computing systems; GRIDS; Clouds; B2B integration; Infrastructure.

YEAR 4: SEMESTER 2

ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS

Module Title	**Entrepreneurship And Management Of IT systems**
Module Code	CMP3832
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Pre-requisite	CMP3792 Human Computer Interaction

Module Description: Definitions of Entrepreneurship; entrepreneurial mind; starting a new business; home based businesses ;overview of challenges of SME's; Namibian context and entrepreneurial action; legal and accounting concerns; Business plans; economic characteristics; Critical success factors; evaluation processes and feasibility study; entrepreneurial team; Social entrepreneurship, ethics and strategic planning and franchising; management of IT Systems(Making a strategic case for IT systems, historical Development of IT systems, Information Management, Managers views); strategic management of IT system(sector management of IT systems A Framework for Management of IT Systems); Information technology and Strategic advantage(formulating Information Systems Strategy, formulating IT strategy. Formulation Information management Strategy); Organizing IT activities:(controlling IT activities, Financing IT, appraising IT and Responsibility Accounting for IT);evaluation IT; Integrating IT and Organization.

REAL TIME MULTIMEDIA

Module Title	**Real Time Multimedia**
Module Code	CMP3832
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	8
Compulsory/Elective	Elective
Pre-requisite	CMP3752 Computer networks II

Module Description: Session Initiation Protocol (Sip). Streaming multimedia; digital multimedia; interactive multimedia; video/speech/data conferencing; Transmission of Real-Time Multimedia in Packet Networks Using RTP/RTCP; Softswitches; Asterisk; Voice/Video over IP; IPTV; compression techniques; convergence.

DATABASE PROGRAMMING

Course Title	**Database Programming**
Course Code	CMP3812
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP3612 Databases II and CMP 3632 Object Oriented Programming II
Compulsory/Elective	Elective

Course Description: Database concepts; advanced database transaction management/models; database architecture; multilevel transactions; dynamically restructured transactions; workflow models; properties of transaction; sagas; serializability and recovery; serial and nonserial schedules; locking methods; times-tamping methods; thomas's write rule; object data standard; object store; common gateway interface (CGI); web-database platform; web-DBMS integration; web-DBMS approach; scripting languages; hypertext transfer protocol; web server; components; containers; container-Managed persistence; persistent classes; remote data services; common language runtime; open database connectivity; object-relational DBMS; privileges; query processing; relational algebra tree.

DATA WAREHOUSING AND DATA MINING

Course Title:	**Data Warehousing And Data Mining**
Course Code	CMP3872
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Prerequisite	CMP3612 Advanced Databases
Compulsory/Elective	Compulsory

Course Content: Data warehouse; Data models; architecture; relational and multidimensional OLAP; implementing data Warehouses(data extraction, cleansing, transformation and loading, data cube computation, materialized view selection); OLAP query processing; data Mining Fundamentals (data mining process and system architecture, relationship with data warehouse and OLAP systems); mining Techniques and Application(association rules, mining spatial databases, mining multimedia databases, web mining , mining sequence and time-series data and text mining and data pre-processing).

F.5. M.Sc. INFORMATION TECHNOLOGY (IT) PROGRAMME (11MSCI)

F.5.1. ADMISSION REQUIREMENTS

The applicants will be accepted on the basis of their undergraduate records. The Master of Science in Information Technology programme is open to all Bachelor's degree holders with Computer Science major or Computer related field and with a minimum average pass mark of **60%.**

F.5.2. DURATION OF STUDY

The Master of Science in Information Technology is offered through coursework and thesis, extending over two years for full-time students and three years for part-time students. The coursework is conducted during the first academic year of study and is followed by a supervised original research project extending over the second year.

F.5.3. CURRICULUM COMPILATION

The curriculum for the MSc. degree consists of the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of Study in the General Prospectus: Information, Regulations & Fees.

FIRST YEAR MODULES

Compulsory Modules:

ALL modules are compulsory

The following modules are offered in the first semester with a three hours examination paper written in June. The modules are not necessarily offered every academic year.

UAE5819 Academic Writing for Post Graduate Students
CMP5931 Discrete Mathematics
CMP5951 Computer Graphics
CMP5971 Advanced Operating Systems

SECOND SEMESTER
Compulsory module:
ALL modules are compulsory

The following modules are offered in the second semester with a three hours examination paper written in November. The modules are not necessarily offered every academic year.

CMP5912 Cryptography and Network Security
CMP5932 Research Methodology and Research Proposal
CMP5952 Advanced Software Engineering
CMP5972 Data Communication and Computer Networks

SECOND YEAR MODULE CMP5900 MSc Thesis

F.5.4. EXAMINATION REGULATIONS

Formal examination will take place at the end of each semester. Examinations will be subject to external assessment. The candidate should pass the formal examinations in the taught courses before registering for the Thesis Module. A candidate who fails any part of his/her Masters Degree Programme and who is allowed to repeat that part may be exempted by Senate, on the recommendations of the Departmental panel of examiners from those courses or components from that part s/he passed.

F.5.5. FORMAT AND EVALUATION OF THESIS WORK

A candidate shall be required to submit a complete report in loose bound form for verification and approval to the concerned supervisors in the following format: Paper size: A4 (International format, 210 x 297 mm) Line space:1.5 Top and Bottom margins: 20mm Left margin: 30mm Right margin: 10 mm Figures/flowchart/circuits/block diagrams: No restrictions. Font size: 12 After the dissertation has been approved by the panel the candidate shall submit at least four bounded copies with the chairman of the department in accordance with the following specifications: Color of the report: White Type of binding: Artvellum or cloth Front page should include: University Logo Title of the Project Title of the Degree Name of the candidate Month and Year The relevant department will retain one copy and two copies will be deposited in the university Library. Unless senate has agreed to the contrary the Library copies shall be open to public reference. One copy to the supervisor. The candidate should submit the completed project work in all respects before the end of the academic calendar as announced by the respective department. The candidates will be informed in advance the date, time and the venue of the viva-voce examination. Other regulations and guidelines are same shown in the section (9.4.7) page no. 28 of the general prospectus 2002 are holds good. Concept and Evaluation of Mini Project: Concept of mini project is introduced in each course in order to strengthen the programming skills and ideas to develop the real time project as the time goes. It not only gives the skills but also gives the confidence in the candidates to go ahead with the project developments and practical implementations with different types of tools. The evaluation will be done by a group of examiners constituted by the course co-ordinator. The candidate has to submit a complete project report according to the format given by the respective supervisors. Evaluation also involves the demonstration and viva-voce.

F.5.6. PRACTICALS

Attendance of practical classes is compulsory.

NB: STUDENT MUST PASS ALL MODULES/COURSES AND PRE/CO-REQUISITES AS LISTED FOR THE PARTICULAR MODULES. THIS SECTION LISTS ALLTHE COURSE CODES FOR MSC (IT), FOLLOWED THEREAFTER BY THE COURSE CONTENTS IN THE SAME ORDER.

QUALIFICATION: MSc. Information Technology (IT) Programme (11MSCI)

F.5.7. MODULES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Academic Writing for Post Graduate Students	UAE5819	16	Must be a Postgraduate student	None
1	Discrete Mathematics	CMP5931	16	None	None
1	Computer Graphics	CMP5951	16	None	None
1	Advanced Operating Systems	CMP5971	16	None	None
2	Cryptography and Network Security	CMP5912	16	None	None
2	Research Methodology and Research Proposal	CMP5932	16	None	None
2	Advanced Software Engineering	CMP5952	16	None	None
2	Data Communication and Computer Networks	CMP5972	16	None	None
Total Credit			128		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1 & 2	Thesis	CMP5900	120	Passed ALL first year modules	None
Total Credit			120		

FIRST YEAR MODULES

FIRST SEMESTER

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Module title: **ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code: **UAE5819**
NQF level: 9
Contact hours: 56 hours theory (4 hours per week for 14 weeks)
Credits: 16
Module Assessment Continuous Assessment: **50%** (critical reading assignment, annotated bibliography, term paper). Examination: **50%** (1 x 3 hour exam)
Prerequisites: Must be a Masters or PHD student
Module Description: This module is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

CMP5931 DISCRETE MATHEMATICS

Module title: **DISCRETE MATHEMATICS**
Code: **CMP5931**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None
Module Description: To extend student's mathematical ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems. The concepts and notations from discrete mathematics are useful to study or describe objects or problems in computer algorithms and programming languages.
Content: Discrete models, Concepts of sets and functions, foundations, finite series logic, propositional logic, predicate logic, principles of counting, permutations and combinations, induction and recursion, Concepts of AI

CMP5951 COMPUTER GRAPHICS

Module title: **COMPUTER GRAPHICS**
Code: **CMP5951**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None
Module description: Computer graphics have revolutionalized movie and printing techniques, improved human-computer interfaces, and drive new applications such as computerized photography, art, games, simulations, and mechanical design.
Content: Overview of graphics systems, OpenGL, output primitives, attributes of output primitives, two dimensional geometric transformations and viewing, graphical user interfaces and Interactive input methods, three dimensional concepts, three dimensional object representations, computer animation, color models and color applications.

CMP5971 ADVANCED OPERATING SYSTEMS

Module title: **ADVANCED OPERATING SYSTEMS**
Code: **CMP5971**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None
Module description: The module equips students with the knowledge of managing different operating systems
Content: Different types of OS, Operating System Structures, Process Management: Threads, CPU Scheduling, Process Synchronization, Deadlocks, Memory Management: Main Memory, Virtual Memory, Storage Management, Protection and Security, Distributed Systems.

SECOND SEMESTER

CMP5912 CRYPTOGRAPHY AND NETWORK SECURITY

Module title: **CRYPTOGRAPHY AND NETWORK SECURITY**
Code: **CMP5912**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None

Module description: Deals with the main security threats to communications networks such as X-25, Internet, mobile communications, broadband, local area networks and wide area networks. The module establishes certain security mechanisms that avoid or diminish the threats. It introduces students to specific cryptographic techniques that guarantee security in certain applications: e-mail, e-commerce, and web access.

Content: Introduction: OSI security architecture, classical encryption techniques, cipher principles, evaluation criteria foe AES-AES cipher, triple DES. Public key cryptography: key management, Diffie-Hellman key exchange, number theory, confidentiality using symmetric encryption, and RSA. Message authentication and hash function: message authentication codes, security of hash functions and MACs, MD5 message digest algorithm, secure hash algorithm, authentication protocols, and digital signature standards. Network security: Kerberos, X.509 authentication service, electronic mail, security, PGP, S/MIME, IP security, and web security. System level security: intrusion detection, password management, viruses, worms, firewalls.

CMP5932 RESEARCH METHODOLOGY AND RESEARCH PROPOSAL

Module title: **RESEARCH METHODOLOGY AND RESEARCH PROPOSAL**
Code: **CMP5932**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment100% Continuous Assessment
Prerequisites: None

Module description: This module introduces the student to Postgraduate research. It aims to ensure that candidates are able to design and formulate appropriate postgraduate research projects, as well as to present their work, in preparation for the module CMP5900, Thesis. The module focuses on topics that are crucial to writing research proposals, conducting research, and preparation of theses. Candidates will be expected to do a number of presentations, which will enable them to develop confidence in presenting research results and to think carefully about the research approaches and methodologies that they adopted.

Content: Research Skills – search skills, writing skills, presentation skills; Conducting literature review; Research methodology; Research techniques; Developing research instruments; Carrying out research; Analysis of research results; presentation of results; validity of conclusions.

CMP5952 ADVANCED SOFTWARE ENGINEERING

Module title: **ADVANCED SOFTWARE ENGINEERING**
Code: **CMP5952**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None

Module description: The module equips students with the knowledge of designing and building workable software systems

Content: Software – the process and its management, project management: software metrics, estimation, planning, system and software requirement analysis; Computer System analysis, analysis fundamentals, structured analysis, object oriented analysis and data modeling, design and implementation of software, ensuring, verifying and maintaining software integrity; the role of automation.

CMP5972 DATA COMMUNICATION AND COMPUTER NETWORKS

Module title: **DATA COMMUNICATION AND COMPUTER NETWORKS**
Code: **CMP5972**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None

Module description: The module is designed to provide the computer candidates with a working knowledge of data communications, computer networks and open systems. The module includes basic terminology and concepts in data communications, telecommunication protocols, transmission techniques and computer network architecture alternatives.

Content: Introduction to data communications, fundamentals of communications, data transmission coding and framing, data switching, hardware media and network software, reference models, network standardization, complete study of OSI reference models, designing.

SECOND YEAR MODULES

FIRST AND SECOND SEMESTER(S)

CMP5900 THESIS

Module title: **THESIS**
Code: **CMP5900**
NQF level: 9
Contact hours: Weekly meetings, the frequency of which may be agreed with supervisors
Credits: 120

Module Assessment: 100% A comprehensive research proposal is to be submitted to senate through the Faculty. In addition, every candidate shall submit a thesis in accordance with the guidelines stipulated in the Postgraduate Student Guide, to be examined by at least two specialists approved by Senate. At least one of these specialists must be external to UNAM.

Prerequisites: Successful completion of all the Modules in the first year of study

Module description/ Content: Each candidate shall undertake a research project during the year, supervised by an approved supervisor. The research topic may come from the current ICT/Telecommunication technological challenges, in view to provide solutions. Candidates must submit periodic written reports about the research findings to their supervisors, and hold regular discussions with their supervisors. Candidates are also required to participate in research seminars where they present any breakthroughs made in the research for the benefit and input from other scholars.

G. DEPARTMENT OF GEOLOGY

The B.Sc. Geology qualification is an Honours degree that allows graduates to enter a professional career. The programme has been revised in 2012 with effect for the 1st year of the programme in 2013. Geology is a professional career, where graduates become members of the professional organizations in the countries that they will be employed. As such the standard of the graduands are expected to meet the high standards in industry. This requires that students participate in field trips without exception. Practical competences will be learned and sharpened in the field. The practical competences of the graduands are highly valued, and therefore we expect all our students to take a keen interest in the field trip aspect of the course. In their final year, geology students also conduct research as part of the in 2012 revised B.Sc. (honours) geology degree program. This research work develops skills in scientific writing, solving of geological problems and academic communication.

G.1. DEPARTMENTAL REGULATIONS

G.1.1. ADMISSION REQUIREMENTS

To register in the B.Sc. Geology (Honours) Degree, a candidate must hold a valid NSSC-O or NSSC-A certificate or equivalent with passes in at least five subjects which add up to 25 points, calculated using the UNAM specified scale. In addition to the above requirements, the candidate must have at least a 'C' symbol in English, a 'C' symbol in Physical Sciences and a 'C' symbol in Mathematics on NSSC or equivalent qualification. First year students are required to pass a departmental selection test before admission to the B.Sc. Geology (Honours) program. Mature age entrants will gain admission as per UNAM mature age entry regulations contained in the General Prospectus: Information, Regulations and Fees.
Field work to various mines and places of geological interest are an integral part of the geology curriculum. The field work activity varies from 1-3 day trips to 1-4 weeks during semester breaks and at the end of the year. Students should note that field trips are physically strenuous and all students participating in the field trips are therefore required to be medically fit for outdoor activities.

G.1.2. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted to the Faculty of Science for a particular year of registration, a student must have passed the minimum number of modules required as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) be non-core (30%)
- 9 modules (equivalent to 144 credits) by the end of the second year (45%)
- 16 modules (equivalent to 256 credits) by the end of the third year (57%)
- 24 modules (equivalent to 384 credits) by the end of the fourth year (69%)

G.1.3. ADVANCEMENT AND PROGRESSION RULES FOR THE B.SC. GEOLOGY (HONOURS) PROGRAMME:

From Year 1 to Year 2: To progress to the second (2nd) year of study, all first year students registered for the B.Sc. Geology (Honours) program must pass all the first (1st) year level modules. In exceptional cases, students who have failed a single module may be allowed by the Department to progress to second year, depending on their overall performance which should be outstanding.
From Year 2 to Year 3: In order to advance to the third (3rd) year level of study, a student must have passed all first year modules and at least 2/3 of the prescribed second year modules, i.e. 6 modules (equivalent to 96 credits). Furthermore, students may not register for third year level courses without the necessary pre-requisites for such courses.
From Year 3 to Year 4: In order to advance to the fourth (4th) year level of study, a student must have passed all second year modules and at least 2/3 of the prescribed third year modules, i.e. 6 modules (equivalent to 96 credits). Furthermore, students may not register for fourth year level courses without the necessary pre-requisites for such courses.

G.1.4. CHANGE INTO THE B.SC. GEOLOGY (HONOURS) PROGRAMME

Only science students which study towards a BSc Physics (Honours) Degree with Geology Electives or a BSc Chemistry (Honours) Degree with Geology Electives shall be eligible to change to the BSc Geology (Honours) Programme subject to the following conditions:

1. Change is only possible directly after the first year of study in the Science Faculty.
2. The candidate must have successfully completed the first year of study by having cleared all 1st year modules within one academic year.
3. The academic record of the first year of study must be outstanding (65% minimum).
4. The availability of space in the B.Sc. Geology (Honours) program which is limited by the student numbers in the Geology Department (for 2013 no space is available).
5. Final approval of the change will be made by the Geology Department.

In 2013 geology minor students or other students who have already enrolled for a degree in the Science and Engineering Faculty will not be allowed to change to the geology program.

G.1.5. GRADUATION

This qualification will be awarded to candidates who have cleared all prescribed modules. This includes passing the compulsory field geology courses and the research project and relevant elective courses. The Geology Department shall recommend all successful candidates who should graduate with a B.Sc. Geology (Honours) Degree.

G.2. BACHELOR OF SCIENCE IN GEOLOGY (honours) 11BSCG

Students opting for a Bachelor of Science in Geology (Honours) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	NQF-LEVEL	CREDITS	ELECTIVE	PRE-EQUISITES	CO-EQUISITES
1	Computer Literacy	CLC3509	5	8	No		None
1	English Communication & Study skills	LCE3419	4	16	No		None
1	Chemistry 1A	CHM3511	5	16	No		None
1	Physics for Physical Sciences I	PHY3511	5	16	No		None
1	Introduction to Physical Geology & Surface Processes	GLY3521	5	8	No		None
1	Basic Mathematics	MAT3511	5	16	No		None
2	Contemporary Social Issues	CSI3580	5	8	No		None
2	Introduction to Earth Systems	GLY3502	5	8	No		None
2	Chemistry 1B	CHM3512	5	16	No		None
2	Physics for Physical Sciences II	PHY3512	5	16	No		None
2	Pre-Calculus	MAT3512	5	16	No		None
2	English for Academic Purposes	LEA3519	5	16	No		None
2	Introduction to Statistics	STS3522	5	8	No		None
Sub-Total Credits				**88**			
Total Credits				**168**			

YEAR 2

SEMESTER 1						
MODULE NAME	**CODE**	**NQF-LEVEL**	**CREDITS**	**ELECTIVE**	**PRE-REQUISITES**	**CO-REQUISITES**
Calculus I	MAT3611	6	16	No	MAT3512	None
Inorganic Chemistry I	CHM3611	6	16	No	CHM3511 & CHM3512	None
Introduction to Hydrology	GLY3621	6	8	No	MAT3512 & GLY3521	None
Physical Chemistry I	CHM3631	6	16	No	CHM3511 & CHM3512, MAT3511 & MAT3512	None
SUB-TOTAL SEMESTER 1 MODULES			**64**			

SEMESTER 2						
Calculus II	MAT3612	6	16	No	MAT3512	None
Stratigraphy & Geological Mapping	GLY3612	6	16	No	GLY3521	None
Crystallography & Mineral Chemistry	GLY3632	6	16	No	MAT3512 & CHM3512	None
Introduction to Geochemistry	GLY3642	6	8	No	MAT3512 & GLY3521 & CHM3512	None
Introductory Petrology	GLY3662	6	8	No	GLY3521	None
SUB-TOTAL SEMESTER 2 MODULES			**56**			

YEAR 2 – CONTINUED

FULL YEAR MODULES SEMESTER 1 & 2						
MODULE NAME	**CODE**	**NQF-LEVEL**	**CREDITS**	**ELECTIVE**	**PRE – REQUISITES**	**CO - REQUISITES**
Field Geology I	GLY3600	6	8	No	GLY3521	None
SUB-TOTAL FULL YEAR MODULES			**8**			
TOTAL YEAR 2			**128**			

YEAR 3

SEMESTER 1						
MODULE NAME	**CODE**	**NQF-LEVEL**	**CREDITS**	**ELECTIVE**	**PRE–REQUISITES**	**CO-REQUISITES**
GIS	GLY3741	7	8	No	GLY3612	None
Mineralogy	GLY3711	7	16	No	GLY3632 & CHM3512	None
Plate Tectonics	GLY3721	7	8	No	GLY3612	None
Sedimentology	GLY3751	7	16	No	GLY3521 & GLY3662	None
Regional Geology of Namibia	GLY3761	7	8	No	GLY3521	None
Environmental Geology I	GLE3701	7	8	No	GLY3642 & GLY3621	None
SUB-TOTAL SEMESTER 1 MODULES			**64**			

SEMESTER 2						
Hydrogeology I	GLY3702	7	8	No	GLY3621 & GLY3642	None
Structural Geology I	GLY3712	7	16	No	GLY3612 & MAT3612 & GLY3600	None
Igneous & Metamorphic Petrology	GLY3732	7	16	No	GLY3662 & GLY3642 & GLY3600	None
Research Methodology	GLY3762	7	8	No	GLY3600	None
Exploration Geochemistry and Geostatistics	GLE3742	7	8	No	GLY3642	None
SUB-TOTAL SEMESTER 2 MODULES			**56**			

YEAR 3 – CONTINUED

FULL YEAR MODULES SEMESTER 1 & 2						
MODULE NAME	**CODE**	**NQF-EVEL**	**CREDITS**	**ELECTIVE**	**PRE–REQUISITES**	**CO-REQUISITES**
Field Geology II	GLY3700	7	8	No	GLY3600	None
SUB-TOTAL FULL YEAR MODULES			**8**			
TOTAL YEAR 3			**128**			

YEAR 4

SEMESTER 1						
MODULE NAME	**CODE**	**NQF-LEVEL**	**CREDITS**	**ELECTIVE**	**PRE–REQUISITES**	**CO-REQUISITES**
Environmental Geology II	**GLE3821***	8	8	Yes	GLE3701	None
Industrial Minerals and Gemstones	**SGLY3801***	8	8	Yes	GLY3711	None
Economic Geology	GLY3831	8	16	No	GLY3711 & GLY3721	None
Igneous & Metamorphic Petrogenesis	**GLY3871***	8	16	Yes	GLY3732 & GLY3711	None
Coal, Gas & Petroleum	**GLY3811***	8	16	Yes	GLY3751	None
SUB-TOTAL SEMESTER 1 MODULES			**16**			

SEMESTER 2						
Hydrogeology II	**GLY3812***	8	16	Yes	GLY3702	None
Exploration Geology and Geophysics	GLY3832	8	16	No	GLY3712	None
Remote Sensing	GLY3822	8	8	No	GLY3712	None
Structural Geology II	GLY3862	8	8	No	GLY3712 & GLY3700	None
SUB-TOTAL SEMESTER 2 MODULES			**32**			
***Elective module**						

Elective modules in year 4; Students chose one of the following 3 options:

1. GLY3871 Igneous & Metamorphic Petrogenesis plus any other half module of the elective modules

2. GLY3811 Coal, Gas & Petroleum plus any other half module of the elective modules

3. GLY3812 Hydrogeology II plus any other half module of the elective modules. It is recommended to take GLE3821 Environmental Geology II

YEAR 4 – CONTINUED

FULL YEAR MODULES SEMESTER 1 & 2						
Module Name	**CODE**	**NQF-LEVEL**	**CREDITS**	**ELECTIVE**	**PRE–REQUISITES**	**CO-REQUISITES**
Research Project	GLY3810	8	32	No	All third year modules	GLY3820
Field Geology III	GLY3800	8	8	No	GLY3700	None
Field Geology for Research	GLY3820	8	8	No	All third year modules	GLY3810
Sub-Total Full Year Modules			**48**			
Sub-Total Compulsory Modules (48 single semester module credits, 48 full year module credits)			**96**			
Sub-Total Elective Modules (semester 1 and semester 2 elective modules)			**24**			
Total Year 4 (NQF level 8; 96 credits for compulsory modules and 24 credits for elective modules)			**120**			

G.3. MODULE DESCRIPTIONS GEOLOGY (NEW MODULES 2013 – 2016)

FIRST YEAR MODULES

GLY3521: INTRODUCTION TO PHYSICAL GEOLOGY AND SURFACE PROCESSES

Module title:	**Introduction to Physical Geology and Surface Processes**
Code:	**GLY3521**
NQF level:	5
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module assessment:	Continuous 40%: At least 5 practicals; 2 tests, 1 assignment. Examination 60%: One 3 hour exam paper.
Prerequisites:	Faculty entry requirements for geology minor students; departmental entry requirements for B.Sc geology (honours) students

Module description: Introduction to the science of geology: physical geology; the rock cycle and the theory of plate tectonics. Minerals and Rocks: minerals, sedimentary, igneous and metamorphic rocks.
Surficial Earth Processes: Geomorphology and land forms; weathering and soil formation; mass wasting; surface and groundwater; shorelines; glaciers and glaciation; deserts and winds. Natural geological hazards and mitigation measures. Internal Earth processes: the Earth's interior; earthquakes; volcanic activity; plate tectonics: continental drift; palaeomagnetism; seafloor spreading; plate boundaries and plate motions. Geological time: the geological time scale; relative dating; correlation; radioactivity and radiometric dating. The Solar system: origin of the Earth. y.

GLY3502: INTRODUCTION TO EARTH SYSTEMS

Module Title:	**INTRODUCTION TO EARTH SYSTEMS**
Code:	**GLY 3502**
NQF level:	5
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module Assessment:	Continuous 40%: At least 5 practicals; 1-test and at least one assignment. Examination 60%: One 3 hour exam paper.
Pre-requisites:	Faculty entry requirements for geology minor students; departmental entry requirements for B.Sc geology (honours) students

Module Description: The Earth as a planet in space; orbit and rotational parameters; Effects of orbit and rotational parameters on glaciers; sediments; and the magnetic field; paleomagnetism; plate tectonics as a unifying principle in the rock cycle; sources of heat in the earth; evolution of planet earth through time; Energy Resources; coal, petroleum; gas; geothermal and solar energy; nuclear energy and other energy sources

SECOND YEAR MODULES

GLY3600: FIELD GEOLOGY I

Module Title:	**Field Geology I**
Code:	**GLY3600**
NQF level:	6
Contact hours:	2 to 3 weeks of field work during recesses, semester breaks, weekends, and public holidays
Credits:	8
Module Assessment:	Continuous 100%: Field note books, w day reports during field trips, written tests, a final report, field trip participation.
Pre-requisites:	GLY3521 Introduction to Physical Geology & Surface Processes

Module Description: Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive.

GLY3621: INTRODUCTION TO HYDROLOGY

Module title:	**INTRODUCTION TO HYDROLOGY**
Code:	**GLY3621**
NQF level:	6
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module assessment:	Continuous 40%: At least 5 practicals, 2 tests, 1 assignment. Examination 60%: One 3 hour exam paper.
Prerequisites:	GLY3521 Introduction to Physical Geology & Surface Processes, MAT 3512 Precalculus

Module description: The hydrologic cycle: Inventory of water resources on planet earth; elements of the hydrologic cycle; rainfall run-off relationships; stream hydrograph analysis; separation of baseflow and run-off, spring flow analysis. Infiltration & percolation: Infiltration capacity of soil; methods for determining infiltration capacity; soil moisture. Hydraulic properties of geological materials: Porosity; permeability, aquifers & confining units; confined and unconfined aquifers; homogeneity & isotropy in aquifers; geology of groundwater occurrence; primary and secondary permeability in aquifers. Principles of groundwater flow: Darcy's Law, specific discharge, average linear velocity, hydraulic head concept, potentiometric surface; equipotential lines; flow lines & transmissivity. Storage properties of aquifers: Specific storage; storativity and specific yield. Natural chemical evolution of groundwater: Hydrochemical facies; graphical methods of representation of hydrochemical facies (piper diagrams, stiff diagrams & fence diagrams); closed and open system behaviour. Overview of Hydrogeological region in Namibia.

GLY3612: STRATIGRAPHY & GEOLOGICAL MAPPING

Module Title:	**STRATIGRAPHY & GEOLOGICAL MAPPING**
Code:	**GLY3612**
NQF level:	6
Contact hours:	4 lecture hours per week; 3 practical hours per week.
Credits:	16
Module Assessment:	Continuous 40%: At least 6 practicals; 2 tests and 1 assignment. Examination 60%: One 3 hour Exam
Pre-requisites:	GLY3521 Introduction to Physical Geology & Surface Processes

Module Description: Principles of stratigraphy, including Walthers's law; applications of stratigraphic principles and type examples; ; basic palaeontology; biostratigraphy; introduction to the geological time scale; geological history of Namibia; geological maps and structures; geological mapping techniques; structures due to deformation.

GLY3632: CRYSTALLOGRAPHY AND MINERAL CHEMISTRY

Module title:	**CRYSTALLOGRAPHY & MINERAL CHEMISTRY**
Code:	**GLY3632**
NQF level:	6
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous 40%: At least 6 practicals; 2 tests and 2 assignments. Examination 60%: One 3 hour theory paper and one 3 hour practical paper.
Prerequisites:	MAT 3512 Precalculus, CHM3521 Chemistry 1B

Module description: Crystals, lattices and Crystal symmetry; Crystal morphology: and Crystal projections; Space groups, internal order and translational symmetry; Crystal structures and Crystal chemistry. X-ray crystallography and X-ray diffraction. Mineral chemistry – minerals in the Earth's crust; chemical analytical techniques (X-ray diffraction, X-ray fluorescence, electron microprobe analysis); mineral compositions and variations; exsolutions; calculation of mineral analyses; Graphic representation of mineral composition.

GLY3642: INTRODUCTION TO GEOCHEMISTRY

Module Title: **INTRODUCTION TO GEOCHEMISTRY**
Code: **GLY3642**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous 40%: At least 6 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Pre-requisites: GLY3521 Itroduction to Physical Geology & Surface Processes, CHM3521 Chemistry 1B
Module Description: The compositon of the solid earth, its atmosphere, and surrounding universe. The origin and evolution of the earth as a whole, as well as its constituent parts and its structure. Thermodynamics of crystals and minerals, crystal chemistry, magmatism and igneous rocks, sedimentation and sedimentary rocks, isotope geochemistry, Eh-pH diagrams and surface environments, metamorphism as a geochemical process; geochemistry of ore deposits.

GLY3662: INTRODUCTORY PETROLOGY

Module Title: **INTRODUCTION TO PETROLOGY**
Code: **GLY3662**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous 40%: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 2 hour theory exam; One 2 hour theory paper and one 2 hour practical paper.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes
Module Description: Part A: Introduction to Igneous Rocks-their textures, classification of igneous rocks, granites; monzonites; monzodiorites; silicic volcanics; syenites, trachytes; latites; diorites; andesites; gabbros; basalts; ultramafic igneous rocks; nepheline syenites; phonolites; lamprophyres; pyroclastics. Part B: Introduction to sedimentary rocks- sedimentary textures; argillaceous rocks; aranaceous rocks; calcareous rocks; dolomites; siliceous rocks; ferruginous rocks; carbonaceous rocks. Part C: Metamorphic rocks- metamorphism, deformation and recrystallisation; metasomatism and melting; the facies classification; progressive regional metamorphism of pelites and basic rocks.

THIRD YEAR MODULES

GLY3700: FIELD GEOLOGY II

Module Title:	**Field Geology II**
Code:	**GLY3700**
NQF level:	7
Contact hours:	2 to 3 weeks of field work during recesses, semester breaks, weekends, and public holidays; logging.
Credits:	8
Module Assessment:	Continuous 100%: Field note books, day reports during field trips, written tests, field reports and field trip participation.
Pre-requisites:	GLY3600 Field Geology I

Module Description: Introduction to field Mapping Techniques; folded and polyphase deformed strata; igneous bodies, extrusive & intrusive; high grade metamorphic complexes; stratigraphic logging; geochemical sampling; report writing.

GLY3741: GIS

Module title:	**GIS**
Code:	**GLY3741**
NQF level:	7
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module assessment:	Continuous 40%: At least 5 practicals; 2 tests and 1 assignment. Examination 60%: One 3 hour exam paper.
Prerequisites:	GLY3612 Stratigraphy & Geological Mapping

Module description: GIS platforms; digital mapping techniques; gridding; image analysis including digital elevation models using GIS; modeling with GIS.

GLY3711: MINERALOGY

Module title:	**MINERALOGY**
Code:	**GLY3711**
NQF level:	7
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous 40%: At least 6 practicals; 2 tests and 2 assignments. Examination 60%: One 3 hour theory and one 3 hour practical papers.
Prerequisites:	GLY3632 Crystallography and Mineral Chemistry, CHM3521 Chemistry 1B

Module description: Classification of minerals. Physical properties of minerals: colour, streak, lustre, diaphaneity, luminescence, form, cleavage, parting, fracture, hardness, tenacity; magnetism, electricity, radioactivity, specific gravity, thermal properties. Optical mineralogy: optical properties of minerals: isotropic and anisotropic crystals, polarized light, the polarizing microscope. The optical indicatrix: isotropic, uniaxial and biaxial crystals; opaque minerals. Systematic mineralogy: common rock forming minerals, their occurrence and uses (nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicates and tectosilicates); Gemstones - their classification and properties; Nonsilicate minerals.

GLY3721: PLATE TECTONICS

Module Title:	**PLATE TECTONICS**
Code:	**GLY3721**
NQF level:	7
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight
Credits:	8
Module Assessment:	Continuous 40%: At least 4 practicals; 1-test and at least one assignment. Examination 60%: One 3 hour exam paper.
Pre-requisites:	GLY 3612 Stratigraphy & Geological Mapping

Module Description: Concept of sea floor spreading and plate consumption and generation; the Wilson cycle; plate Motions and stress distribution in plates; geomagnetism-reversals in the Earth's magnetic field, process of rock magnetization; hot spots and plumes, Super continents-how they are recognized; SeiMIC crustal structure, Benioff zone and earthquake distribution; Plate tectonic settings and rock associations; Crustal Provinces.

GLY3751: SEDIMENTOLOGY

Module Title: **SEDIMENTOLOGY**
Code: **GLY3751**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Module Assessment: Continuous 40%: At least 6 practicals; 2-tests and 1 assignment.
Examination 60%: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3612 Stratigraphy & Geological Mapping and GLY 3662 Introductory Petrology.
Module Description: Sediments cover 75% of continents and most of the ocean floor. They also host most of the mineral deposits in the world. Main topics include: weathering of rocks; paleoclimates; origin and transport of sedimentary materials; deposition of siliciclastic materials; physical properties of sedimentary rocks; sedimentary textures; sedimentary structures; siliciclastic sedimentary rocks; carbonate sedimentary rocks; biochemical and carbonaceous sedimentary rocks; depositional environments including continental marginal marine, deep marine, carbonate and evaporate environments; sedimentary basins and tectonics, sequence stratigraphy and sea level changes.

GLY3761: REGIONAL GEOLOGY OF NAMIBIA

Module title: **REGIONAL GEOLOGY OF NAMIBIA**
Code: **GLY3761**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous 40%: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3521 Introduction to Physical Geology & Surface Processes
Module description: Regional Geology of Southern Africa. Cratons and cratonic evolution of Southern Africa, mobile belts of Southern Africa. Geology of Namibia: from the Archaean to the Pleistocene. Mineral deposits of Southern Africa according to tectonic settings.

GLE3701: ENVIRONMENTAL I

Module title: **ENVIRONMENTAL GEOLOGY I**
Code: **GLE3701**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight
Credits: 8
Module assessment: Continuous 40%: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 2 hour exam paper.
Prerequisites: GLY3621 Introduction to Hydrology, GLY3642 Introduction to Geochemistry
Module description: Environmental geochemistry; Types of contaminants in natural water resources; anthropogenic sources of Geochemistry of weathering, equilibrium constants and pollution buffering in different rock types. Groundwater pollution. Engineering properties of rocks and rock masses. Geotechnical site investigations in sedimentary, igneous and metamorphic rocks; Soil description for engineering processes; Reservoirs & Dams structures; Slope stability.

GLY3702: HYDROGEOLOGY I

Module title: **HYDROGEOLOGY I**
Code: **GLY3702**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous 40%: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3621 Introduction to Hydrology, GLY3642 Introduction to Geochemistry
Module description: Groundwater flow equations & flow net analysis; Piezometers, piezometer nests and potentiometric surface map; Regional groundwater flow systems; Ground recharge mechanisms and estimation techniques (Chloride Mass Balance Method, stable isotope method, Hydrograph analysis technique); Aquifer Hydraulics: Theis Equation; computing drawdown caused by a pumping well; determining aquifer parameters from Time-Drawdown data; slug tests, intersecting pumping cones and well interference; effect of hydrogeologic boundaries; aquifer test design; well loss; well efficiency; well specific capacity & optimum pumping rates. Hydrochemistry: Thermodynamic principles applied to hydrochemistry. Redox reactions; cation exchange; carbonate dissolution & precipitation reactions, silicate weathering. Open and closed systems.

GLY3712: STRUCTURAL GEOLOGY I

Module Title: **STRUCTURAL GEOLOGY I**
Code: **GLY3712**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week..
Credits: 16
Module Assessment: Continuous 40%: At least 6 practicals; 2-tests and 1 assignment.
Examination 60%: One 3 hour theory exam; one 3 hour practical exam.
Pre-requisites: GLY3612 Stratigraphy & Geological Mapping, MAT3612 Calculus II, GLY3600 Field Geology I
Module Description: The module covers the following topics: Analysis of stress:- its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes. Analysis of Strain:- the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Material response to Stress:- brittle behavior, brittle-ductile behavior, ductile behavior, classes of material response to stress and strain. Microstructures:- crystal defects, microstructural development at various grades, deformation mechanisms and associated textures. Primary Structures:- bedding, unconformities, sedimentary versus tectonic structures. Folds:- their description, fold systems and orientation, classification and development of folds. Foliations:- axial plane foliations, fracture cleavage, crenulation cleavage, slaty cleavage, schistosity, differential layering, orientation of foliation in response to strain, and transposed foliations. Lineations:- slickenside striae, lineations associated with folds, lineations due to intersection of foliations, mineral lineations, pebbles, boulders and ooids and the origin of lineations. Faults and Joints Geometrical analysis: scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas. Structural associations. Tectonics.

GLY3732: IGNEOUS & METAMORPHIC PETROLOGY

Module Title: **IGNEOUS & METAMORPHIC PETROLOGY**
Code: **GLY3732**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Module Assessment: Continuous 40%: At least 7 practicals; 2 tests and 2 assignments.
Examination 60%: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3662 Introductory Petrology, GLY3642 Introduction to Geochemistry, GLY3600 Field Geology I
Module Description: Igneous Petrology: Classification of igneous rocks; The Igneous Rocks: structures and textures; Chemistry, mineralogy and classification. The Phase rule and Phase diagrams. Petrogenesis: movement and modification of magmas. Common igneous rocks: basalts; rhyolites, andesites, granites, granodiorites, alkaline rocks and carbonatites. Metamorphic Petrology: Basics of metamorphism: - grade, metamorphic zones and facies.
Pressure-Temperature depth time paths, types of metamorphism and the geothermal and geobaric gradients.
Progressive metamorphism: Pelites and basic rocks for the greenschist, amphibolite, granulite and eclogite facies.
Fundamental relations of thermodynamics: P-T paths from mineral assemblages. The use of the petrogenetic grid
Calculation of AFM and ACF diagrams and of Mineral formulas. Examination of the Duhem theorem and facies concept, activities and mixing. Gibbs free energy.

GLY3742: EXPLORATION GEOCHEMISTRY AND GEOSTATISTICS

Module title: **Exploration Geochemistry and Geostatistics**
Code: **GLY3742**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous 40%: At least 6 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3642 Introduction to Geochemistry
Module description: Exploration geochemistry: primary and secondary dispersion aureoles and anomalies; geochemical sampling, analysis and interpretation; geochemical patterns of mineral deposits. Geostatistics and geostatistical methods of ore reserve estimation. Laws of distribution for ore deposits; Kriging and error estimation. The module will only cover Linear Geostatistics at this level. Case studies of various deposit types.

GLY3762: RESEARCH METHODOLOGY

Module Title: **RESEARCH METHODOLOGY**
Code: **GLY3762**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous 100%: 5 assignments, 1 tests.
Examination: Not applicable
Pre-requisites: GLY3600 Field Geology I
Module Description: Overview of research. Ethics of research. The scientific method: logic and the scientific, natural observations, formulation of hypothesis, predictions. Types of hypotheses. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance, testing hypotheses. Experimental (research stydy/project) design. Data collection, Documenting research data and other records. Presentation of data in scientific reports/theses/dissertation. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review. Report writing. Giving a good oral presentation (including use of PowerPoint).

FOURTH YEAR MODULES

GLY3800: FIELD GEOLOGY III

Module Title: **Field Geology III**
Code: **GLY3800**
NQF level: 8
Contact hours: 2 to 3 weeks of field work during recesses, semester breaks, weekends, and public holidays.
Credits: 8
Module Assessment: Continuous 100%: Field note books, day reports during field trips, written tests, a final report, field trip participation.
Pre-requisites: GLY3700 Field Geology II
Co-requisite: GLY3810 Research Project
Module Description Advanced Field mapping techniques; complexly folded and polyphase deformed strata; polyphase igneous bodies, extrusive & intrusive; high-grade metamorphic complexes, migmatites; geochemical sampling.

GLY3810: RESEARCH PROJECT

Module Title: **Research Project**
Code: **GLY3810**
NQF level: 8
Contact hours: Independent Research and Mapping Project by the student, under close supervision from the Lecturer. The lecturer will require an average of one hour contact per week and one week supervision in the field.
Credits: 32
Module Assessment: Continuous 100%: The assessment is based on: (i) research report (60%), (ii) presentation (15%) based on the research report, and (iii) an oral examination (25%).
The student will be required to demonstrate competence in research design, conducting research and report writing. The final mark to pass the course is 50% of the combined report, presentation and oral examination results, with a minimum of 50% for each of the three components.
The course can only be passed together with SGLY3820 Field Geology for Research; none of the two modules should be failed.
Pre-requisites: All third and second year modules
Co-requisite: GLY3820 Field Geology for Research
Module Description: The module will be based on a research topic chosen by a student in the previous year. The field work (GLY 3820, Field Geology for Research) will be compulsory, and one of the products in the project will normally be production of a geological map and cross-section.

GLY3820: FIELD GEOLOGY FOR RESEARCH

Module Title:	**Field Geology for Research**
Code:	**GLY3820**
NQF level:	8
Contact hours:	2 to 3 weeks of field work / data collection during recesses, semester breaks, weekends, and public holidays
Credits:	8
Module Assessment:	Continuous 100, which comprises the relevant aspects of the research topic. This is commonly the assessment of the field work planning and design, compilation of geological records (maps, cross-sections, stratigraphic logs), and sample selection and collection.
Pre-requisites:	All third and second year modules
Co-requisite:	GLY3810 Research Project

Module Description Field trip / data collection planning; sample selection; sample collection; sample storage and transport. Depending on the research topic: Geological Mapping, Structural Mapping, Stratigraphic Logging, Hydrological Mapping, Pump Tests, Geophysical Surveys, Rock Sampling, Streambed Sampling, Soil Sampling, Geochemical Sampling, Ground- and Surface Water Sampling, In situ analyses (chemical, magnetic, gravimetric, radiometric, etc.)

GLE3821: ENVIRONMENTAL GEOLOGY II*

Module title:	**ENVIRONMENTAL II**
Code:	**GLE3821**
NQF level:	8
Contact hours:	2 lecture hours per week; 3 hours practical per fortnight
Credits:	8
Module assessment:	Continuous 40%: At least 5 practicals, 2 tests, 1 assignment. Examination 60%: One 2 hour exam paper.
Prerequisites:	GLE 3701 Environmental & Engineering Geology I

Module description: <u>Stress distribution and elastic theory:</u> soil mechanics; analysis of rock slopes; excavation methods and design; control, maintenance and protection of rock slopes; the influence of groundwater and weathering on rock slope stability. <u>Standard practice in Site Investigation and planning:</u> Engineering solutions to construction problems arising from ground conditions (soils and rocks). Earth materials in relation to engineering; ground engineering problems including ground improvement, mining settlement; foundation engineering; retaining structures; groundwater control.

<u>Assessment of contaminated sites:</u> Risk assessment and the legal framework; reclamation and remediation of mining and contaminated sites; the nature of contaminants; ground improvement methods and risk-based strategies for land reclamation and containment of pollutants; potential environmental effects of landfill waste disposal.

<u>Pollution associated with metalliferous deposits:</u> acid mine drainage and its remediation, pollution associated with gold deposits, dangers and its remediation, pollution associated with industrial pollutants of petroleum origin and its remediation.

<u>Environmental Impact Assessment:</u> including the aims and objectives of EIA, design and implementation of EIA, screening and scoping, impact prediction and mitigation.

GLY3801: INDUSTRIAL MINERALS AND GEMSTONES*

Module Title:	**INDUSTRIAL MINERALS AND GEMSTONES**
Code:	**GLY3801**
NQF level:	8
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight
Credits:	8
Module Assessment:	Continuous 40%: At least 5 practicals; 2-tests and 1 assignment. Examination 60%: One 3 hour exam paper.
Pre-requisites:	GLY3711 Mineralogy

Module Description: The module will cover two parts; first industrial minerals, the second gemstones. Under industrial minerals the following topics will be covered: Importance of Industrial Minerals; Standard of living Index as determined by industrial minerals usage; aggregates and construction materials; cement and concrete; glass; gypsum; fluorite; clays in general; kaolinite; smectites and montmorrilonites; evaporates; graphite; sillimanite; kyanite; andalusite; limestone and dolomite; magnesite and magnesia; olivine; perlite; phosphates; asbestos; abrasives; nepheline syenite; slate; wollastonite.
The second part will be gemstones: Introduction to gemstones; host rocks and processes of formation; the economics and valuing of gemstones; gem mining; gem cutting; megagems; precious gemstones: diamonds; sapphires; emerald; aquamarines; Semi-precious stones.

GLY3831: ECONOMIC GEOLOGY

Module title:	**ECONOMIC GEOLOGY**
Code:	**GLY3831**
NQF level:	8
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous 40%: At least 6 practicals; 2 tests and 2 assignments. Examination 60%: One 3 hour theory paper and one 3 hour practical paper.
Prerequisites:	GLY3711 Mineralogy and GLY3721 Plate Tectonics

Module description: Ore-forming processes and theories of ore genesis. Classification of mineral resources. Mineral economics: economic recovery of minerals; environmental impact of mineral exploitation; Ore deposit types: magmatic, volcanogenic, volcano-sedimentary, sedimentary, and metamorphic. Metals - their uses and economics: ferrous and base metals; precious and rare metals. Petroleum: origin, exploration and production. Geopolitical effects of mineral resources and petroleum. Metallogeny: mineral provinces, epochs, and plate tectonic controls.

GLY3871: IGNEOUS & METAMORPHIC PETROGENESIS*

Module title:	**IGNEOUS & METAMORPHIC PETROGENESIS**
Code:	**GLY3871**
NQF level:	8
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous 40%: At least 7 practicals; 2 tests and 2 assignments Examination 60%: 3 hour theory and 3 hour practical papers.
Prerequisites:	GLY3732 Igneous & Metamorphic Petrology, GLY3711 Mineralogy

Module description: <u>Igneous Petrogenesis:</u> Magmatism and global tectonic processes; Igneous rocks as petrogenetic indicators. Partial melting processes: primary magma, fractionation, fractional crystallization, convection and mixing, crustal contamination. Palaeotectonic settings: Magmatism within plates and at plate boundaries. <u>Metamorphic Petrogenesis:</u> Mineral chemistry, mineral sites and geothermobarometry; exchange vectors and P-T-d relationships; thermogeobarometry. Chemical thermodynamics:- equilibrium in metamorphic systems, species, phases, components, kinetics, state variables and their transformation, Fundamental relations of thermodynamics.Examination of the Duhem theorem and facies concept, activities and mixing, Gibbs Free Energy, Enthalpy and Equilibrium constant. Metamorphic reactions:- in basic rocks, pelites and in carbonates. The facies concept, the AFM diagram, ACF diagram, the X-CO2 diagram for carbonates, m-m diagrams for mineral assemblages and the petrogenetic grid. Metamorphic facies: Eclogite facies; Granulite facies; blue schist facies and metamorphism of hydrothermally altered rocks. Metamorphism, tectonics and pressure-temperature-time-depth paths; heat flow in the crust.

GLY3811: COAL, GAS & PETROLEUM*

Module Title:	**COAL, GAS & PETROLEUM**
Code:	**GLY3811**
NQF level:	8
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module Assessment:	Continuous 40%: At least 7 practicals; 2-tests and 1 assignment. Examination: 60%: One 3 hour exam paper.
Pre-requisites:	GLY3751 Sedimentology

Module Description: Sedimentary basins and sequence stratigraphy; development of peat; climates associated with coal development; the preservation of coal; the coalification process; petrology of coal and its origins; types of coal and the environs in which they develop; methods of coal exploration; coal mining; Origin of petroleum and Gas; migration and accumulation of oil and gas; chemical characteristics of oil; source and reservoir rocks; reservoir fluids; reservoir traps; reservoir conditions; introduction to reservoir mechanics; subsurface exploration for oil and gas; exercises in seismic and sequence stratigraphy. Petroleum reservoir modeling using Petrel software.

GLY3812: HYDROGEOLOGY II*

Module title:	**HYDROGEOLOGY II**
Code:	**GLY3812**
NQF level:	8
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous 40% - At least 7 practicals, 2 tests, 1 assignment. Examination 60%: 3 hour theory and 3 hour practical papers.
Prerequisites:	GLY3702 Hydrogeology I

Module description: Groundwater flow modelling: Types of groundwater flow models; governing equations, numerical & analytical techniques, conceptual model design, boundary conditions; initial conditions; steady state & transient simulations; model calibration; sensitivity analysis; predictive modelling; finite difference & finite element models, different types of computer codes; Introduction to modelling with MODFLOW.Groundwater age dating: Carbon-14 method; tritium method; chlonine-36 method; chlorofluorocarbons Stable isotopes: oxygen-18 and deuterium, nitrogen-15 and oxygen-18. Groundwater exploration, development and management: Groundwater resource evaluation, groundwater budgets, conjunctive use groundwater & surface water.

GLY3832: EXPLORATION GEOLOGY AND GEOPHYSICS

Module title: **EXPLORATION GEOLOGY AND GEOPHYSICS**
Code: **GLY3832**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Module assessment: Continuous 40%: At least 7 practicals, 2 tests and 2 assignments.
Examination 60%: One 3 hour theory exam; one 3 hour practical exam.
Prerequisites: GLY3712 Structural Geology I
Module description: Exploration techniques: Geological mapping and prospecting. Application of photogeology and remote sensing in mineral exploration. Deep sampling methods: pitting and trenching, auger drilling, hand-held percussion drills, Wagon and Banka drilling; .Mineral resource evaluation and ore reserve estimation using conventional methods. Exploration geophysics: principles and applications of seismic, magnetic, gravity, resistivity, electromagnetic induced polarization and radiometric techniques.

GLY3822: REMOTE SENSING

Module Title: **REMOTE SENSING**
Code: **GLY 3822**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous Assessment 40%: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 2 hour theory exam; one 2 hour practical Exam.
Pre-requisites: GLY3712 Structural Geology I
Module Description: The Electromagnetic spectrum; remote sensing systems, how they function and life times; data acquisition and storage; image processing and filtering; interpretation of remote sensing images; photogeology-interpretation and analysis; use of GIS platforms for remotely sensed data; applications of remote sensing.

GLY3862: STRUCTURAL GEOLOGY II

Module Title: **STRUCTURAL GEOLOGY II**
Code: **GLY 3862**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous 40%: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 2 hour theory exam; one 2 hour practical Exam.
Pre-requisites: GLY3712 Structural Geology I, GLY3700 Field Geology II
Module Description: The module will cover the following topics: Microstructures and microtectonics: Advanced analysis of stress: its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes. Further topics in Strain analysis: the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Cross-section balancing for regions and smaller areas. Construction of block diagrams; depth to detachment and regional shortening calculations; uplift rates, continents and super continents, cycles of the Earths' magnetic field. Advanced geometrical analysis and stereographic projections for boreholes: scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas. Heat flow in the earths' interior. Geochronology as applied to deformation and crustal evolution.

*** ELECTIVE MODULE**

List of equivalent modules during transition phase

Equivalent modules to the modules offered during the current version of the BSc Geology (Honours) programme are indicated in the following table.

Old BSc Geology (Honours) Modules (2008-2012)		**New BSc Geology (Honours) Modules (2013-2016)**	
Module Name	**Code**	**Module Name**	**Code**
Earth Resources	GLY3642	Introduction to Earth Systems	GLY3502
Introduction to Petrology	GLY3652	Introductory Petrology	GLY3662
Sedimentology & Palaeontology	GLY3731	Sedimentology	GLY3751
Igneous Petrology	GLY3722	Igneous & Metamorphic Petrology	GLY3732
Metamorphic Petrology	GLY3742		
Environmental and Engineering Geology I	GLE3771	Environmental Geology I	GLE3701
Environmental and Engineering Geology II	GLE3801	Environmental Geology II	GLE3821
Remote Sensing & GIS	GLY3852	Remote Sensing GIS	GLY3822 GLY3741
Coal, Petroleum & Gas	GLY3701	Coal, Gas & Petroleum	GLY3811
Igneous Petrogenesis	GLY3821	Igneous & Metamorphic Petrogenesis	GLY3871
Metamorphic Petrogenesis	GLY3841		
		Field Geology for Research	GLY3820

G.4. APPLIED MASTER IN GEOLOGY 11MSGL

G.4.1. REGULATIONS

G.4.1.1. ADMISSION REQUIREMENTS

To register for a MSc postgraduate degree programme a candidate must hold a BSc Honours degree in Geology (NQF level 8) or a recognized equivalent qualification. The applicants will be accepted on the basis of their undergraduate record. An average mark of minimum 60% is required.

G.4.1.2. MODE OF DELIVERY

The programme is offered on a full-time basis on a block module schedule over a period of two years for full time students. The mode of teaching will include lectures, seminars, laboratory practicals, field practicals, site visits, case studies and group projects.
Student intake into the first year will be done every two years so that modules are offered only every second year (first year modules in odd years [i.e. 2013, 2015,…] and second year modules in the even years [i.e. 2014, 2016,…].

G.4.1.3. DURATION OF STUDY

The study duration shall be two years for full time students. The maximum study period shall not exceed three years. An extension of registration beyond the stipulated maximum study period may be granted by relevant committees if valid reasons are advanced.

G.4.1.4. ADVANCEMENT AND PROGRESSION RULES

Students must pass all first year courses (132 credits) in order to advance to the second year of study. A candidate must pass all first year coursework examinations before commencing with the MSc thesis.

G.4.1.5. MAXIMUM NUMBER OF COURSES PER YEAR

The maximum number of courses in year one are eleven (11) with a total of 132 credits, including field work, technical visits and industrial attachments. The maximum number of courses in the second year is six (6) with a total of 72 credits. The MSc thesis (60 credits) is scheduled in the second year.

G.4.1.6. ASSESSMENT CRITERIA

Assessment criteria are based on written examinations (50%) and continuous assessments (50%) based on tests, assignments, field studies, industrial attachment, laboratory practicals and seminar presentations for each module as well as the final master thesis which is based on a research project. A minimum of 50% is required to pass each course and a student is required to attend 80% of all lectures and practicals. The thesis will be supervised by a PhD holder and examined by at least one internal and one external examiner of a recognized institution.

G.4.1.7. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates credited with all 264 credits, and who have met the requirements of the compulsory courses, industrial attachments, field and laboratory practicals as well as the project thesis. **In addition students are required to provide proof of competency of at least one foreign language other than English**. It is recommended that students should learn a language that is relevant in internationally operating companies such as French, Russian, German or Chinese. The language course(s) will be offered in consultation with the UNAM Language Centre (non-degree purposes).
Student will graduate with an MSc in Applied Geology, either majoring in **Exploration & Economic Geology** or majoring in **Environmental Geology & Hydrogeology** depending on the elective courses a student chooses in year two of the programme.

G.4.2. CURRICULUM APPLIED MASTER IN GEOLOGY 11MSGL

Students opting for an Applied Master in Geology must take the following modules:

YEAR 1

Course	Course code	NQF Level	Credits	Pre-/Co-requisite	Compulsory	Elective
Year 1: Common courses (132 credits)						
Academic Writing for Postgraduate Studies	*UAE 5819*	*8*	*(24)*	*none*	*Yes*	
Applied GIS and Remote Sensing	*SGLY 5901*	*9*	*12*	*none*	*Yes*	
Mineral Processing and Metallurgy	*SGLY 5921*	*9*	*12*	*none*	*Yes*	
Applied Geochemistry	*SGLY 5902*	*9*	*12*	*none*	*Yes*	
Applied Geophysics	*SGLY 5922*	*9*	*12*	*none*	*Yes*	
Project Management, Economics and Law	*SGLY 5911*	*9*	*24*	*none*	*Yes*	
Research methodology	*SGLY 5941*	*9*	*12*	*none*	*Yes*	
Field Techniques and Technical Visits	*SGLY 5912*	*9*	*24*	*none*	*Yes*	
Industry Internship	*SGLY 5919*	*9*	*24*	*none*	*Yes*	
	Total Credits Year 1: 132					

YEAR 2

Course	Course code	NQF Level	Credits	Pre-/Co-requisite	Compulsory	Elective
Year 2: Major in Exploration and Economic Geology (132 Credits)						
Ore Forming Processes	*SGLA 5901*	*9*	12	*SGLY5902, SGLY5912*	*Yes*	
Exploration Techniques, Methodology, and Economics	*SGLA 5911*	*9*	24	*SGLY5901, SGLY5912, SGLY5922*	*Yes*	
Ore Body Modelling and Evaluation	*SGLA 5931*	*9*	24	*SGLY5912*		
Underground and Open Pit Mining	*SGLA 5921*	*9*	12	*SGLY5921, SGLY5912*	*Yes*	
Master Thesis (Mini Thesis)	*SGLY 5900*	*9*	60	*All first year modules*	*Yes*	
	Credits		132			
	Total Credits Year 1 (132) + Year 2 (132) 264					
Year 2: Major in Environmental Geology and Hydrogeology(132 Credits)						
Hydro-geochemistry	*SGLE 5911*	*9*	24	SGLY5902	*Yes*	
Protection and Management of Water Resources	*SGLE 5931*	*9*	24	SGLY5902, SGLY5911	*Yes*	
Environmental impact assessment and sustainable development	*SGLE 5941*	*9*	12	SGLY5911, SGLY5912	*Yes*	
Impact of mining activities on aquatic systems	*SGLE 5961*	*9*	12	SGLY5902, SGLY5911	*Yes*	
Master Thesis (Mini Thesis)	*SGLY 5900*	*9*	60	*All first year modules*	*Yes*	
	Credits		132			
	Total Credits Year 1 (132) + Year 2 (132) 264					

G.4.3. MODULE DESCRIPTIONS MSC APPLIED GEOLOGY

FIRST YEAR MODULES

GLY5901: APPLIED GIS AND REMOTE SENSING

Module title: **Applied GIS and Remote Sensing**
Code: **GLY 5901**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Module assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Module description: Basics of remote sensing: systems, scanners, data availability, data formats, data processing software; Applications RS: topographic analysis, relief and landform, hydrological analysis (streams, drainage patterns, flooding and flood control), introduction to hydrotop-concept and application for recharge studies, evapotranspiration determination from RS data, vegetation indices, landuse, erosion, Permeability classification, identification karstic features, geometry of joint systems; Resource satellites; Remote sensing applications for mineral resource exploration; techniques used to diminish vegetation effect; soil-rock ratios; uses of spectral curves and digital data analysis; image interpretation keys; image classification and interpretation; using collateral information; uses of thermal infrared images; radiometric and ratio images; image processing, restoration, enhancement and information extraction; using RS images from ocean surfaces. GIS: data formats, data processing software, data exchange, data sources, digitising, database management, regionalisation of data, data analysis for routes, data merging including RS data, digital elevation models, digital geological maps, engineering maps, hydrogeological maps, vulnerability mapping based on spatial patterns, GIS data as input for various models/modelling software packages.

GLY5921: MINERAL PROCESSING AND METALLURGY

Module Title: **Mineral Processing and Metallurgy**
Code: **GLY 5921**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Module Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Module Description: Comminution: role of comminution. Comminution laws. Basic principles of crushing and crushing equipment; grinding and grinding equipment. Screening and sieve analysis. Concentration: gravity concentration and equipment, magnetic and electrostatic separation and equipment, floatation: principles. Solid and Liquid separation: sedimentation, thickening and filtration. Basic flowsheet design for selected minerals coal preparation, heavy sands processing. Basic Extractive Metallurgy: pyrometallurgy, hydrometallurgy, electrometallurgy.

GLY5902: APPLIED GEOCHEMISTRY

Module Title: **Applied Geochemistry**
Code: **GLY 5902**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Module Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Module Description: Thermodynamic principles and concepts; Activity coefficients and speciation; CO2 Acids and Bases; Speciation modelling using PHREEQC; Oxidation and Reduction; Iron, Sulphur and Nitrogen Geochemistry; Geochemical Reactions in PHREEQC Implicit Equilibrium, Mixing, Dissolution, Precipitation, Co-precipitation and Redox Reactions; Sorption and Ion Exchange (theory and PHREEQC modelling); Carbonates, Silicates, Clay Minerals and Solid Solutions; Reaction Path Modelling; PHREEQC carbonate geochemistry; Reactive Transport – Modelling Mine Waste Seepage; Common Error Modelling; Radionuclides in Dust, Surface Soil, Surface water and Groundwater; Analytic techniques for major, minor and trace element chemistry; Isotope analytic techniques.

GLY5922: APPLIED GEOPHYSICS

Module title: **APPLIED GEOPHYSICS**
Code: **GLY 5922**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Module assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Module description: Theoretical considerations, data acquisition, and data processing and interpretation, of magnetic, gravity, radioactivity, resistivity, Induced Polarization, electromagnetic, seismic and geophysical well logging methods; with the objective of locating concentrations of natural resources and defining their extent; improved techniques for calculating gravity fields, the use of proton-precession and optically-pumped magnetometers, improved quality of seismic data, magnetotelluric as a practical exploration method, new electromagnetic exploration methods, the use of gamma-ray spectrometers in radioactive exploration, and improved well-logging techniques.

GLY5911: PROJECT MANAGEMENT, ECONOMICS AND LAW

Module Title: **Project Management, Economics and Law**
Code: **GLY 5911**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Module Assessment: Continuous 50%: At least 3 seminars; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.
Module Description: Role of a geologist: legislation and codes of a rig geologist; drill rig management - covers program planning and daily rig management; Regolith geochemistry and logging - regolith terminology, architecture of the regolith profile; practical logging workshop; Field sections, reporting and data management - daily data management and reporting, importance of using field sections.
Project management: project initiation, project planning, project implementation and project termination; basic concepts of project and project management, project selection, project definition, project organization structure, team building, communication and conflict management, project planning methods and techniques, resource allocation, project monitoring and control, project termination.
Economics: Microeconomics: elements of economics; demand and supply; elasticity; applied market analysis; utility; competition and monopoly; labour markets. Macroeconomics: inflation and the business cycle; Keynesian aggregate demand; money and interest rates; central banking and monetary policy; world trade and the balance of payments; unemployment. Financial accounting: nature of costs, product costing, cost accounting, profit-volume relationships, financial statements. Introduction to budgeting. Introduction to marketing. Long and short-term decision making.
Law: Environmental law - principles and norms; - Environmental governance; - Environmental planning and assessment; - Administrative Justice; - Enforcement and Compliance; - Pollution law; - Mining and energy law; - Biodiversity law; - Water law; - Compliance and enforcement in environmental law.
Health & Safety in the exploration and mining environment: Dust and associated health risks (calcidosis, silicosis). Radon emissions, toxicity of heavy metals, sulfides and arsenides. Measure to reduce hazardous emissions during exploration and mining, protective measures. Drilling safety: hazard identification and risk reduction around the drill rig; site visits to operating drill rigs.
Environment: best practice environmental procedures and implications for drilling activities; cultural awareness.

GLY5941: RESEARCH METHODOLOGY

Module title: **Research Methodology**
Code: **GLY 5941**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical
Credits: 12
Module assessment: Continuous 100%: At least 5 assignments and one written test.
Module description: Overview of research. Ethics of research. The scientific method: logic and the scientific method, natural observations, formulation of hypothesis/research question, predictions.
Types of hypotheses. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance, Testing hypotheses.
Experimental (research study/project) design. Data collection, documenting research data and other records. Presentation of data in scientific reports/theses/dissertation.
Data processing: Data base management, data format conversions, header information
Scientific writing: Plagiarism, finding and using literature references, citation of references. Writing a literature review. Report writing. Giving a good oral presentation (including use of powerpoint).

GLY5912: FIELD TECHNIQUES AND TECHNICAL VISITS

Module Title: **Field Techniques and Technical Visits**
Code: **GLY 5912**
NQF level: 9
Contact hours: 18 days.
Credits: 24
Module Assessment: Continuous 100%: 50% of the continuous assessment comprises a minimum of 5 practicals, 2 written tests, and 2 assignments, a final report and presentation will contribute to the remaining 50% of the assessment.
Module Description: Geological maps and cross-sections: Introduction to the interpretation of complex geological maps and sections; balanced cross sections; Review of stratigraphic projections, stereographic projection of borehole data; Petro fabrics; deformation in low and high grade rocks; deformation associated with plutons; Domes and basins; Analysis of data from deformation experiments; microfabrics; microtectonics; stress mapping for ore deposit geology; structural geology of ore deposits; fluid-flow mineralization and deformation; finite strain analysis in 2D – 3D; Strain markers in ore deposits.
On site field studies and technical visit: Field work in selected areas of a specific geological/environmental/technical interest for research purposes and technical visits to relevant exploration companies, mines industrial plants and enterprises

GLY5919: INDUSTRY INTERNSHIP

Module Title: **INDUSTRY INTERNSHIP**
Code: **GLY 5919**
NQF level: 9
Contact hours: Face to face consultations with supervising lecturer and/or coordinating lecturer on a regular basis.
Credits: 24
Module Assessment: Continuous 100%: daily field/lab logbook (30%), Company assessment (10%), Lecturer assessment (10%), Final Report (30%), and Seminar Presentation (20%).
Module Description: During Industrial Internship I, students will conduct project work under company supervision in areas of geological/environmental/technical interest for research purposes and industrial internships with relevant exploration companies, mines, industrial plants and enterprises. During attachment, students will be visited at their work place twice by their Lecturers.

SECOND YEAR MODULES

GLY5900: MSC THESIS (MINI THESIS)

Module title: **MSc Thesis (Mini Thesis)**
Code: **GLY 5900**
NQF level: 9
Contact hours: Face to face consultation with supervisor and coordinator on a regular basis.
Credits: 60
Prerequisites: Pass all first year modules
Module assessment: (i) Research report (60%), (ii) presentation (25%) based on the research report, and (iii) an oral examination (15%). The student will be required to demonstrate competence in research design, conducting research and report writing. The final mark to pass the course is 50% of the combined report, presentation and oral examination results, with a minimum of 50% for each of the three components..
Module description: Research proposal: preparation of research proposal according to recommended UNAM guidelines based on a selected research topic in consultation with project supervisors; submission of proposal to relevant postgraduate study committees for approval.
Research project: conducting research, including desk study, field work, sampling and data collection, sample and data analysis, data interpretation.
Research thesis: writing of thesis in accordance with recommended UNAM guidelines.

SECOND YEAR MODULES: MAJOR IN EXPLORATION & ECONOMIC GEOLOGY

GLA5901: ORE FORMING PROCESSES

Module title: **Ore Forming Processes**
Code: **GLA 5901**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5902, GLY5912
Module assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Module description: Igneous ore-forming processes: magmas and metallogeny, partial melting and crystal fractionation, liquid immiscibility, mineralisation in layered mafic intrusions;
Magmatic-hydrothermal ore-forming processes: composition and characteristics of magmatic-hydrothermal solutions, pegmatites and granite-related ore-forming processes, fluid-melt trace element partitioning, formation of porphyry deposits of Cu-Mo-W-Au-Sn, formation of skarn deposits, epithermal Au-Ag-(Cu) deposits.
Hydrothermal ore-forming processes: origin and movement of hydrothermal fluids in the Earth's crust, precipitation mechanisms, fluid/rock interactions, metal zoning and paragenetic sequences, formation of VMS and SEDEX deposits, deposits associated with metamorphic, connate and meteoric fluids.
Surficial and supergene ore-forming processes: principles of chemical weathering, lateritic, clay, and calcrete-hosted deposits; supergene enrichment in near surface deposits.
Sedimentary ore-forming processes: Clastic sedimentation and heavy mineral (placer) concentrations; chemical sedimentation of banded iron-formations, phosphorites and evaporites; fossil fuels.

GLA5911 EXPLORATION TECHNIQUES, METHODOLOGY, AND ECONOMICS

Module Title:	**Exploration Techniques, Methodology, and Economics**
Code:	**GLA 5911**
NQF level:	9
Contact hours:	56 h lectures and 72 h practical.
Credits:	24
Prerequisites:	GLY5901, GLY5912, GLY5922
Module Assessment:	Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.

Module Description: Geological exploration techniques: geological mapping and prospecting; exploration guides for various ore deposit types (magmatic, magmatic-hydrothermal, hydrothermal, metamorphic, sedimentary); application of remote sensing techniques in mineral exploration.
Exploration drilling methods and techniques (percussion and diamond drilling, reverse circulation, rotary drilling for oil and gas).
Geophysical exploration techniques: principles and techniques for mineral resource exploration using magnetic, gravity, induced polarization, electromagnetic, radioactivity and seismic surveys; Interpretation and field examples.
Ore reserve estimations: principles of reserves and resource classifications; orebody evaluation; conventional plan and section methods, grade evaluation, reserve calculation.
Fossil Fuels: Methods of exploration and exploitation; Nuclear Fuels, Carbonaceous Fuels (coal, conventional gas, petroleum, coal-bed methane, shale gas)
Exploration geochemistry: geochemical prospecting, choice of methods, optimizing survey techniques, geochemical survey parameters, survey organization and operation; mechanical and biological dispersion; dispersion patterns; mineral deposit geochemistry.

GLA5931: ORE BODY MODELLING AND EVALUATION

Module Title:	**Ore Body Modelling and Evaluation**
Code:	**GLA 5931**
NQF level:	9
Contact hours:	56 h lectures and 72 h practical.
Credits:	24
Prerequisites:	GLY5912
Module Assessment:	Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.

Module Description: Introduction to geostatistics in geology: examples as used in aquifer analysis and porosity measurement; in structural geology stress mapping; in economic geology resource evaluation.
Overview of resource estimation: decision making and resource estimation; scarcity of data, sample quality and effect and influence of geology; Estimation at different stages of a project: evaluation; systematic sampling; infill sampling; drilling methods and errors associated with them; sampling errors; overcoming errors in sampling.
Overview of resource estimation: polygons, sections, panels from U/ground; inverse distance; Kriging. Systematic Resource Estimation Practice; Statistical Fundamentals and their limitations in geology: statistics and geostatistics; probability; random variables; cumulative distribution functions; moments and expected values; covariance and correlation; linear regression; Gaussian distribution; Lognormal. Regionalised variables and variograms: randomness and ore bodies; probabilistic models; geostatistical approach; random functions; stationarity. The variogram: main features, uses of variograms, what a variogram can do and how it can be used and imporved. Variography: the science and art of variography; the aims of structural analysis; practical aspects; 1-D variograms; 2-D variograms; 3-D variograms; experimental variograms; additivity in variography; estimation of error in variography; models of variograms; models for nugget effect; why we must not fit variograms bt computers; troublesome variograms; combining models; other approaches to calculating variograms; Case studies and effect on ore reserves. Dispersion variance and support effect: dispersion as a function of support; variances of dispersion within a given volume, V; change of support and regularisation. Extension and Estimation Variances: concept of extension variance; formula of extension variance; extension and dispersion variance; factors affecting extension variance; Extension variance and dispersion variance; geometry of mineralisation; sampling patterns. Kriging: estimation; how kriging works; kriging equations; properties of kriging; Kriging practice. Operational Geostatistics: Grade control; why kriging? Variogram as a tool; Block estimation; Kriging technique; Indicator models; Non-linear geostatistics; Multi-variate geostatistics.
Computer techniques for geological characterization; 3D Geological Modelling; how to combine various 3D spatial data sets to solve problems in 3D geological settings; introduction to scripting, gridding algorithms, constructing 3D geological computer models of mineral deposits, gridding of faulted and folded geological data, geostatistical simulation, facies modelling, and calculating the volume of ore. Case studies from mining.
Application of modeling software: assessment of mineralisation to help determine the potential project value; processing of data to identify trends leading to exploration and evaluation targets. Interpretation of structures of high grade zones within the full data set. Combining maps, cross-sections, wireframes, polylines, points, drillholes, and GIS data to create a realistic, consistent and reliable 3D interpretation; slicing options.
Structural data modeling: incorporating measurements of planar features into the model for the development of more geologically realistic models;
Vein modelling: interval selection in modelling laminar structures.
Lithological modelling: how to model complex lithologies.
Grade modelling for enhanced visualization of trends and to produce a range of ore-waste cut-off. Importing geo-reference and display maps and sections to provide geological context. Enhancing visualization and understanding of data based on 3D measurement tools, the transparency function, layering GIS and draping on topography.

GLY5921: UNDERGROUND AND OPEN PIT MINING

Module title: **Underground and Open Pit Mining**
Code: **GLY 5921**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5912, GLY5921
Module assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Module description: Introduction to underground mining: Selection of mining techniques; Shaft sinking and layouts. Major development layout; level, horizon and panels methods of development. Mining systems: mining methods of extracting ore. Mine design parameters and mining processes in underground operations. Mechanization of operations and special technologies. Trackless mining: selection and operation of underground trackless equipment for massive mining.
Introduction to open-pit mining: Selection of open pit mining; Open pit design; slope stability; haul road design; drilling and blasting patterns; economics and stripping ratios; economic cut-offs; pit optimization. Quarry operations; working platforms; bench width; optimum depth; Strip mining of mineral deposits; environmental considerations; dragline operations. Marine mining; dredging; mechanized earth- moving; hydraulic mining; equipment selection and power systems. Formation of soils and rocks: soil and rock types. Properties of soils and rocks: classification; Stresses in soils: effective stresses, failure theories. Shear strength of soils. Settlement; elastic, plastic (consolidation).

SECOND YEAR MODULES: MAJOR IN ENVIRONMENTAL GEOLOGY & HYDROGEOLOGY

GLE5911: HYDRO-GEOCHEMISTRY

Module Title: **Hydro-geochemistry**
Code: **GLE 5911**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Prerequisites: GLY5902
Module Assessment: Continuous 50%: At least 3 seminars; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.
Module Description: Non-reactive tracer transport: advection and dispersion; reactive transport: precipitation and dissolution, sorption, filtration, degradation and persistence; transport equations; introduction to modelling packages; finite differences, finite elements; modelling calibration; inverse problems.
Hydrogeochemistry of geothermal water: origin & occurrence of geothermal water; description and presentation of geothermal waters; classification of geothermal waters; geothermal waters in Namibia; usage of geothermal waters; geothermal water as an alternative energy source

GLE5931: PROTECTION AND MANAGEMENT OF WATER RESOURCES

Module title: **Protection and Management of Water Resources**
Code: **GLE 5931**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Prerequisites: GLY5902, GLY5911
Module assessment: Continuous 50%: At least 3 seminars; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.
Module description: Groundwater recharge: direct, indirect, localized groundwater recharge; interaction surface water – groundwater; groundwater recharge in different climates; soil water balance modelling; precipitation – runoff models; precipitation regionalisation; evapotranspiration quantification; streamflow analysis; hydrograph analysis; separation techniques; tracer studies including isotopic studies; forward and inverse techniques; aquifer response to pumping; artificial (managed) groundwater recharge.
Water Sources and Quality: Different water supply sources; water quality standards; water treatment technology (potable); water supply infrastructure; basic waste water infrastructure and treatment technologies; urban groundwater management; integrated water resource management; exploration, evaluation and exploitation of groundwater resources;
Waste/Risk: land fill disposals; containments of waste disposals; geomembranes, combined liners; monitoring of waste/landfills; monitoring of sewage; contamination sources; saltwater intrusion; vulnerability of aquifers: concept and background.

GLE5941: ENVIRONMENTAL IMPACT ASSESSMENT AND SUSTAINABLE DEVELOPMENT

Module Title:	**Environmental Impact Assessment and Sustainable Development**
Code:	**GLE 5941**
NQF level:	9
Contact hours:	28 h lectures and 36 h practical.
Credits:	12
Prerequisites:	GLY5911, GLY5912
Module Assessment:	Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.

Module Description: Relevant environmental acts and laws in Namibia; international approaches to EIA; assessment techniques for EIA; basic environmental methodologies; monitoring of water, soil & air: relevance of time series, spatial set up and monitoring parameters; tolerable daily intake, - disability-adjusted-life years approach, lowest-observed-adverse effect levels; uncertainty factors; toxicological review of relevant substances mobilized by mining.

GLE5961: IMPACT OF MINING ACTIVITIES ON AQUATIC SYSTEMS

Module Title:	**Impact of mining activities on aquatic systems**
Code:	**GLE 5961**
NQF level:	9
Contact hours:	28 h lectures and 36 h practical.
Credits:	12
Prerequisites:	GLY5911, GLY5902
Module Assessment:	Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.

Module Description: Basic hydrobiology including basic groundwater biology; contaminants derived from mining activities (Focus: gold, uranium, zinc, copper, manganese mining); dewatering of mines; subsidence; aquifer vulnerability: methodology for assessment and presentation of results; remediation: in-situ, on-site, off-site methods; active treatments; monitored/enhanced natural attenuation.

H. DEPARTMENT OF MATHEMATICS

H.1. DEPARTMENTAL REGULATIONS

To register for a B.Sc. in Mathematics (Honours), a candidate needs to have obtained at least a C-symbol in NSSC Mathematics. English is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol. In addition, a minimum C symbol in Physical Science is required for a candidate choosing the Physics Stream.

A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics and English must be included) to be admitted to undergraduate studies (Refer to the **General Admission Criteria for Undergraduate Programmes** in the **General Information and Regulations Yearbook**). Obtaining the minimum number of points, however, **does not necessarily ensure admission. Admission is based on places available in modules, subjects and programmes and is awarded on the basis of merit.**

H.1.1. DURATION OF STUDY

A student should be able to complete this programme in a minimum of four (4) years.

H.1.2. ASSESSMENT CRITERIA

A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical modules in this programme. Continuous assessment will consist of a subset of the following, depending on the module needs: class tests, assignments (in the form of reports), seminar presentations and research projects.

H.1.3. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE DEPARTMENT/FACULTY

To be re-admitted into the faculty for a particular year of registration, a student must have passed the minimum number of modules as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core,
- 8 modules (equivalent to 144 credits) by the end of the second year,
- 15 modules (equivalent to 240 credits by the end of the third year, and
- 23 modules (equivalent to 368 credits) by the end of the fourth year.

H.1.4. ADVANCEMENT AND PROGRESSION RULES

A student advances to when at least 2/3 of the modules of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases, prerequisites for modules have to be passed before a student can proceed to register for such modules.

- From year 1 to 2: At least 7 modules (equivalent to 112 credits) prescribed for year 1.
- From year 2 to 3: All first-year modules plus at least 6 modules (equivalent to 96 credits) prescribed for year 2.
- From year 3 to 4: All second-year modules plus at least 5 modules (equivalent to 80 credits) prescribed for year 3.

H.1.5. MAXIMUM NUMBER OF MODULES THAT MAY BE TAKEN PER YEAR

A student may not take more than the equivalent of 12 full modules per year.

H.1.6. REQUIREMENTS FOR AWARD OF QUALIFICATION

This qualification will be awarded to candidates credited with a minimum of 544 credits - out of which 48 are from UNAM core modules, 368 are from Mathematics modules and 112 from elective modules from Physics, Computer Science or Statistics (the actual numbers depending on the stream chosen).

H.2. BACHELOR OF SCIENCE IN MATHEMATICS (HONOURS)

The Department of Mathematics has now introduced the BSc in Mathematics (Honours) Programme. The design of the programme has changed from the major-minor structure to the system of electives from Physics, or Computer Science or Statistics.

H.2.1. MATHEMATICS (HONOURS), ELECTIVES, CURRICULUM AND PREREQUISITES

H.2.1.1. QUALIFICATION: Bachelor of Science in Mathematics (Honours) : PHYSICS STREAM

Students opting for **Physics stream** must take all of the following modules: **11BSCM**

YEAR 1

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16		None
1	Basic Mathematics	MAT 3511	16		None
1	Computer Literacy	CLC 3509	8		None
1	Analytic Geometry	MAT 3501	8		None
1	Matrices and Complex Numbers	MAT 3521	8		None
1	Physics for Physical Sciences I	PHY 3511	16		None
2	English for Academic Purposes	LEA 3519	16		None
2	Contemporary Social Issues	CSI 3580	8		None
2	Introduction to Probability	STS 3532	16		None
2	Precalculus	MAT 3512	16		None
2	Physics for Physical Sciences II	PHY 3512	16		PHY 3511
Total Credit			**144**		

Year 2:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1`	Sets and Logic	MAT3601	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Optics	PHY3601	8	PHY3511 or PHY3512	None
1	Mechanics and Waves	PHM3611	16	PHY3511 or PHY3512	None
1	Probability Theory	STS3611	16	STS3532 and MAT3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics module at first year and MAT3521	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Electromagnetism	PHY3612	16	PHY3511 or PHY3512	None
2	Electronics	PHY3622	8	PHY3511 or PHY 3512	None
Total Credit			**136**		

YEAR 3:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	(MAT3611 or MAT3612) and MAT3601	None
1	Linear Algebra I	MAT3711	16	(MAT3611 or MAT3612) and MAT3601 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) and MAT3621	None
1	Elements of Set Theory	MAT3721	8	(MAT3611 or MAT3612) and MAT3601	None
1	Research Methodology	MAT3761	8	MAT3601	None
1	Electrodynamics	PHY3711	16	PHY3612	None
2	Real Analysis II	MAT3732	16	(MAT3611 or MAT3612) and MAT3601	None
2	Linear Algebra II	MAT3712	16	(MAT3611 or MAT3612) and MAT3601 and MAT3652	None
2	Vector Analysis	MAT3742	8	MAT3611 and MAT3612	None
2	Number Theory	MAT3722	8	(MAT3611 or MAT 3612) and MAT 3601	None
2	Partial Differential Equations	MAT3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			**136**		

YEAR 4:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Research Project	MAT3810	16	All mathematics modules up to Year 3	None
1	General Topology	MAT3811	16	MAT3731 or MAT3732	None
1	Numerical Analysis II	MAT3871	16	MAT3701 or MAT3732	None
1	Complex Analysis I	MAT3851	16	MAT3731 or MAT3732	None
2	Research Project	MAT3810	16	All mathematics modules up to Year 3	None
2	Normed Vector Spaces	MAT3822	8	MAT3731 or MAT3732) and (MAT3711 or MAT3712)	None
2	Category Theory	MAT3802	8	MAT 3721	None
2	Algebra	MAT3872	16	MAT3711 or MAT3712	None
2	Complex Analysis II	MAT3852	16	MAT3731 or MAT3732	None
Total Credit			**128**		

H.2.1.2. QUALIFICATION: Bachelor of Science in Mathematics (Honours) : COMPUTER SCIENCE STREAM

Students opting for **Computer Science Stream** must take all of the following modules: **11BSMC**

Year 1:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices and Complex Numbers	MAT3521	8		None
1	Programming Fundamentals I	CMP3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Probability	STS3532	16		None
2	Precalculus	MAT3512	16		None
2	Programming Fundamentals II	CMP3512	16		CMP 3511
Total Credit			**144**		

Year 2:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3601	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Databases I	CMP3611	16	CMP3512	None
1	Object Oriented Programming I	CMP3631	16	CMP3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics module at first year and MAT3521	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Databases II	CMP3612	16	CMP3512	CMP3611
2	Object Oriented Programming II	CMP3632	16	CMP3512	CMP3631
Total Credit			**136**		

YEAR 3:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	(MAT3611 or MAT3612) and MAT3601	None
1	Linear Algebra I	MAT3711	16	(MAT 3611 or MAT3612) and MAT3601 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) and SMAT 3621	None
1	Elements of Set Theory	MAT3721	8	(MAT3611 or MAT3612) and MAT3601	None
1	Research Methodology	MAT3761	8	MAT 3601	None
1	Data Structures and Algorithms	CMP3771	16	CMP 3632	None
2	Real Analysis II	MAT3732	16	(MAT 3611 or MAT3612) and MAT3601	None
2	Linear Algebra II	MAT3712	16	(MAT3611 or MAT3612) and MAT3601 and MAT3652	None
2	Vector Analysis	MAT3742	8	MAT3611 and MAT3612	None
2	Number Theory	MAT 3722	8	(MAT3611 or MAT3612) and MAT3601	None
2	Partial Differential Equations	MAT 3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			**136**		

YEAR 4:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Research Project	MAT3810	16	All mathematics modules up to Year 3	None
1	General Topology	MAT3811	16	MAT3731 or MAT3732	None
1	Numerical Analysis II	MAT3871	16	MAT3701 or MAT3732	None
1	Complex Analysis I	MAT3851	16	MAT3731 or MAT3732	None
2	Research Project	MAT3810	16	All mathematics modules up to Year 3	None
2	Normed Vector Spaces	MAT3822	8	(MAT3731 or MAT3732) and (MAT3711 or MAT3712)	None
2	Category Theory	MAT3802	8	MAT3721	None
2	Algebra	MAT3872	16	MAT3711 or MAT3712	None
2	Complex Analysis II	MAT3852	16	MAT3731 or MAT3732	None
Total Credit			**128**		

H.2.1.1. QUALIFICATION: Bachelor of Science in Mathematics (Honours) : STATISTICS STREAM

Students opting for **Statistics Stream** must take all of the following modules: **11BSMS**

YEAR 1:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices and Complex Numbers	MAT3521	8		None
1	Descriptive Statistics	STS3531	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Probability	STS 3532	16		None
2	Precalculus	MAT 3512	16		None
2	Basic Financial Mathematics	MAF 3532	16		None
Total Credit			**144**		

YEAR 2

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3601	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Probability Theory	STS3611	16	STS3532 and MAT3512	None
1	Statistical Estimation	STS3631	16	STS3532	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics module at first year and MAT3521	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Fundamentals of Statistical Computing	STS3652	16	STS3531	None
2	Statistical Inference	STS3632	16	STS3532	None
Total Credit			**136**		

YEAR 3:

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	(MAT3611 or MAT3612) and MAT3601	None
1	Linear Algebra I	MAT3711	16	(MAT3611 or MAT3612) and MAT3601 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) and MAT3621	None
1	Elements of Set Theory	MAT3721	8	(SMAT 3611 or MAT3612) and MAT3601	None
1	Research Methodology	MAT3761	8	MAT3601	None
1	Distribution Theory	STS3751	16	MAT3611 and STS3611	None
2	Real Analysis II	MAT3732	16	(MAT3611 or MAT3612) and MAT3601	None
2	Linear Algebra II	MAT3712	16	(MAT 3611 or MAT3612) and MAT3601 and MAT3652	None
2	Vector Analysis	MAT3742	8	MAT3611 and MAT3612	None
2	Number Theory	MAT3722	8	(MAT3611 or MAT 3612) and MAT3601	None
2	Partial Differential Equations	MAT3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			**136**		

YEAR 4

SEMESTER	MODULE / NAME	MODULE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Research Project	MAT3810	16	All mathematics modules up to Year 3	None
1	General Topology	MAT3811	16	MAT3731 or MAT3732	None
1	Numerical Analysis II	MAT3871	16	MAT3701 or MAT3732	None
1	Complex Analysis I	MAT3851	16	MAT3731 or MAT3732	None
2	Research Project	MAT3810	16	All mathematics modules up to Year 3	None
2	Normed Vector Spaces	MAT3822	8	(MAT3731 or MAT3732) and (MAT3711 or MAT 3712)	None
2	Category Theory	MAT3802	8	MAT 3721	None
2	Algebra	MAT3872	16	MAT 3711 or SMAT 3712	None
2	Complex Analysis II	MAT3852	16	MAT 3731 or SMAT 3732	None
Total Credit			**128**		

H.3. BACHELOR OF SCIENCE IN FINANCIAL MATHEMATICS (HONOURS) 11BFMA

Students opting for B.Sc. in **FINANCIAL MATHEMATICS** (Honours) must take all the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices and Complex Numbers	MAT3521	8		None
1	Basic Microeconomics	EMI3571	16		None
2	English for Academic Purposes	LEA3519	16		Co-requisite: LCE3419
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Basic Financial Mathematics	MAF3532	16		None
2	Mathematical Statistics	MAF3552	16		None
2	Basic Macroenomomics	EMA3572	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDITS	PRE-COREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 and MAT3512] or [MAT3531 and MAT3512]	None
1	Probability theory	STS3611	16	MAF3532	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Financial Mathematics I	MAF3651	16	MAF3532	None
1	Economics I	MAF3671	16	EMA3572, EMI3571	None
2	Calculus II	MAT3612	16	[MAT3511 and MAT3512] or [MAT3531 and MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 and MAT3512] or [MAT3531 and MAT3512]	None
2	Financial Mathematics II	MAF3652	16	MAF3532	None
2	Economics II	MAF3672	16	EMA3572,EMI3571	None
2	Statistical Inference	STS3632	16	MAF3532	None
Total Credits			**144**		

YEAR 3

SEMESTER	MODULE	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	(MAT3611 or MAT3612) and MAT3601	None
1	Assets and Liabilities	MAF3751	16	MAF 3651 and MAF3652	None
1	Numerical Analysis I	MAT3701	8	[MAT3611 or MAT3612] and MAT3621	None
1	Differential Equations and Integral Transforms	MAF3771	16	MAT3611 or MAT3612	None
1	Distribution Theory	STS3721	8	STS3611, STS3632	None
2	Real Analysis II	MAT3732	16	(MAT3611 or MAT3612) and MAT3601	None
2	Mathematical Modeling	MAF3762	8	MAF3771	None
2	Financial Modeling	MAF3782	8	MAF3771	None
2	Risk Theory	MAF3732	16	MAF3651 and MAF3652	None
2	Programming	MAF3742	8	MAT3621	None
2	Research Methodology	MAF3722	16	STS3611, STS3632	None
Total Credits			**136**		

YEAR 4

SEMESTER	MODULE	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Elements of Dynamical Systems	MAF3881	8	MAF3751 and MAF3732	None
1	Risk Management	MAF3831	16	MAF3751 and MAF3732	None
1	Stochastic Processes	STS3831	16	STS3721 and MAF3732	None
1	Mathematical Methods	MAF3821	8	MAF3671 and MAF3672	None
1&2	Research Project	MAF3810	16	All modules up to third year	None
2	Stochastic calculus and Finance	MAF3812	16	MAF3751 and MAF3732	None
2	Operations Research	MAF3842	8	STS3721 and MAF3732	None
2	Numerical Analysis II	MAT3832	16	MAT3732 and MAT3701	None
2	International Business Finance	MAF3862	8	MAF3732 and MAF3751	None
Total Credits			**128**		

H.4 MATHEMATICS (HONOURS) AND FINANCIAL MATHEMATICS (HONOURS) CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES:

MODULE TITLE:	**BASIC MATHEMATICS**
Module Code	MAT 3511
NQF Level	5
Notional Hours	160
NQF Credits	16
Prerequisite	NSSC Mathematics
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content :Sets. What is a set? Set notation, equality of sets, subsets, characterization of equality via the subset relation, empty set, power sets, Venn diagrams, intersection, union, complement, de Morgan's laws, set difference, symmetric difference, proofs of simple results on set equality. Standard examples of sets: natural numbers, integers, rationals, real numbers. Absolute value, intervals in R. A bit about cardinality of sets (examples of finite, infinite, countable, uncountable sets). **Algebraic expressions.** Simplification, expansion, factorization, polynomials, remainder and factor theorem, quadratic polynomial. Binomial expansions, Pascal's triangle and the Binomial Theorem. Rational expressions, partial fractions. **Equations and inequalities.** Linear equations in one-variable, simultaneous linear equations, quadratic equations, simultaneous non-linear equations. Linear inequalities, non-linear inequalities. **Functions.** Definition of a function, domain, codomain, function notation, vertical-line test, image, pre-image, even function, odd function. **Trigonometry.** Trigonometric ratios, angle orientation in the xy-plane, graphs of trigonometric functions (circular functions), trigonometric identities, justifying (proving) equality of relatively simple trigonometric expressions. **Sequences.** Definition, notation, obtaining the general term in sequences, arithmetic sequences, geometric sequences, recursively defined sequences.

MODULE TITLE:	**ANALYTIC GEOMETRY**
Module Code	**MAT 3501**
NQF Level	**5**
Notional Hours	**80**
NQF Credits	**8**
Prerequisite	**NSSC Mathematics**
Compulsory/Elective	**Compulsory**
Contact Hours	**2 lectures plus 1 tutorial per week for 14 weeks**
Module Assessment:	**Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).**

Module Content Lines, Circles and tangent lines. Conic sections: ellipse, parabola, hyperbola. Translation and rotation of the axes. Parametric equations: cycloids. Polar coordinates: definition, polar equations and graphs, relating polar and Cartesian coordinates. Graphic in polar coordinates, Conic section in polar coordinates. Spheres, cylindrical surfaces, quadrics, spherical and cylindrical coordinates.

MODULE TITLE:	COMPLEX NUMBERS AND MATRICES
Module Code	MAT 3521
NQF Level	5
Notional Hours	80
NQF Credits	8
Prerequisite	NSSC Mathematics
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content Vectors in 2-and 3-dimensions: addition of vectors, multiplication by a scalar, norm of a vector, dot product, cross product. Lines and planes in 3D-space. Systems of linear equations: introduction to linear systems, solution by Gaussian elimination and Gauss–Jordan elimination (for up to 3 x 3). Matrices: addition, multiplication, scalar multiplication, transpose (for up to 3 x 3), elementary matrices, diagonal, triangular and symmetric matrices, determinant and inverse (for up to 3 x 3), solutions of systems of linear equations by Cramer's rule (for up to 3 x 3). Complex Numbers: complex planes, operations on complex numbers, modulus, complex conjugate, division, modulus-argument form, de Moivre's formula, Euler's formula, Fundamental Theorem of Algebra.

MODULE TITLE:	PRECALCULUS
Module Code	MAT 3512
NQF Level	5
Notional Hours	160
NQF Credits	16
Prerequisite	IGCSE Mathematics
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Functions: one-to-one, onto and bijective functions, horizontal line test, inverse of a function. Combinations of functions: composition of functions, sum , difference, quotient of functions and their domains. Introduction of exponential and logarithmic functions. Polynomial functions, rational functions and their graphs. Trigonometry: area of a sector and segment of a circle, further trigonometric identities, trigonometric equations. Limit of a function: definition, left and right limits, improper limits, continuity in terms of limits. Differentiation: rate of change, derivative of a function, rules of differentiation, increasing and decreasing functions and graph sketching. Integration: antiderivatives, the definite integral, area under a graph.

MAF 3552: MATHEMATICAL STATISTICS

Module name:	**MATHEMATICAL STATISTICS**
Code:	**MAT3552**
NQF level:	5
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	Faculty Entry Requirements

Module description: Collection and presentation of data , data types, types of measurements – nominal, ordinal, interval, ratio scales – tabular forms, frequency tables, histograms, pie charts, frequency polygons, ogives. Measures of central tendency – mean, median, mode, quartiles, percentiles. Measures of dispersion – range, variance, standard deviation, skewness, kurtosis, Counting techniques – permutation and combination, Probability –axioms, sample space, identification of events, mutually exclusive events, independent events. Conditional probability, Baye's theorem, Probability functions of random variables - Discrete probability distributions – Binomial, Poisson, hyper-geometric distribution, Continuous probability distributions – normal distribution.

MAF 3532: BASIC FINANCIAL MATHEMATICS

Module name:	**BASIC FINANCIAL MATHEMATICS**
Code:	**MAT3532**
NQF level:	5
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	Faculty Entry Requirements

Module description: Forward Contracts: the forward contracts, calculating the delivery price, delivery price and forward price, the value of the forward contract, assets paying dividend, forward contracts on assets that pay discrete dividends, forward contracts on assets paying a continuous dividend value of a forward contract. Future market: futures contracts, closing out position, profit or loss when a position is closed out, use of the future contracts, hedging, hedging ratio, practical hedging: the optimal hedge ratio. Bonds: coupon bearing bond, the value of a bond, how bond prices changes, notation, bond performance, the zero curve. The forward rate, forward rate agreements, swaps, caps, and floors. Options: call options, the put options, put-call parity, strategies involving multiple calls and puts. Option pricing: risk neutral probabilities, multi-stage binomial trees, Black-Scholes formula, further options. Credit derivatives: default risk, credit risk ratings, credit spread, credit spread risk and default probabilities.

SECOND YEAR MODULES:

MODULE TITLE:	SETS AND LOGIC
Module Code	MAT 3602
NQF Level	6
Notional Hours	80
NQF Credits	8
Prerequisite	MAT 3511
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content Basic logic: propositions and predicates. Conjunction, disjunction, negation, implication, contrapositive, equivalence. Elementary methods of proof: direct, contrapositive, contradiction. Sets: symmetric difference of two sets, de Morgan's laws, power set, partition, Cartesian product, definition of a binary relation, functions as binary relations, order relations. Real numbers: natural numbers, integers, positional number systems. The Principle of Mathematical Induction.

MODULE TITLE:	**CALCULUS I**
Module Code	MAT 3611
NQF Level	6
Notional Hours	160
NQF Credits	16
Prerequisite	MAT 3512
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Limits and continuity of functions: limit at a point, improper limits, continuity. Derivatives: definition, rules of differentiation, chain rule, derivatives of higher order, implicit differentiation, logarithmic differentiation, derivative of the inverse function, derivatives of exponential and logarithmic functions. Some applications of the exponential functions: growth and decay. Derivatives of arc functions (inverse trigonometric functions), derivatives of hyperbolic functions, derivatives of area functions (inverse hyperbolic functions). Applications of the derivative: extrema of functions, concavity and curve sketching, applications to optimization problems, related rates. Rolle's Theorem, The Mean Value Theorem, L'Hospital's rule. Integration: antiderivatives, integration by substitution.

MODULE TITLE:	**NUMERICAL METHODS WITH MATLAB**
Module Code	MAT 3621
NQF Level	6
Notional Hours	80
NQF Credits	8
Prerequisite	MAT 3521
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content The MATLAB Environment: arithmetic operations with MATLAB, matrix algebra with MATLAB, MATLAB scripts, matrix operators, graphic output, flow control, MATLAB functions, system of linear equations. Numerical Methods: system of non-linear equations, optimization, interpolation, regression, numerical differentiation, quadrature, differential equations. Application: dynamical systems, stochastic processes (e.g. throwing dice, tossing coins and dealing cards), discrete processes (e.g. population dynamics), continuous processes (e.g. chemical reactions and kinetics).

MODULE TITLE:	CALCULUS II
Module Code	MAT 3612
NQF Level	6
Notional Hours	160
NQF Credits	16
Prerequisite	MAT 3512
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks

Module Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Integration: Riemann sums and the definite integral, the Fundamental Theorem of Calculus, approximations of the Riemann integral using the trapezoidal rule and Simpson's rule, average value of a function on an interval. Integration techniques: integration by parts, reduction formulae, trigonometric substitutions, integration of rational functions. Applications of the Riemann integral: area of a region bounded by graphs, volume of a solid of revolution, arc length, surface of revolution. Partial differentiation, chain rule, directional derivatives. Classification of critical points for two-variable functions. Sequences and series of numbers: the limit of a sequence, absolutely convergent series, tests of convergence. Power series: radius of convergence, interval of convergence, McLaurin and Taylor series, the Binomial Theorem. Double integration, iterated integrals, use of polar coordinates, application of double integration to finding area and volume. Improper integrals.

MODULE TITLE:	ORDINARY DIFFERENTIAL EQUATIONS
Module Code	MAT 3642
NQF Level	6
Notional Hours	80
NQF Credits	8
Prerequisite	MAT 3521 and MAT 3512
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks

Module Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content First order differential equations, linear differential equations of second order, series solutions of second order linear equations, The Laplace transform, systems of first order linear equations.

MODULE TITLE:	ELEMENTARY LINEAR ALGEBRA
Module Code	MAT 3652
NQF Level	6
Notional Hours	160
NQF Credits	16
Prerequisite	Any full module of the first year and MAT 3521
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks

Module Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content Matrices: determinant; cofactor expansion, inverse, adjoint and Cramer's rule. Similar matrices. Eigenvalues and eigenvectors. Diagonalization. Symmetric and skew-symmetric matrices. Orthogonal matrices. Hermitian, skew-Hermitian and unitary matrices. Linear algebra in $\mathbf{R}^2$, $\mathbf{R}^3$ and $\mathbf{R}^n$: Vector spaces, subspaces, linear combination of vectors, linearly independent and linearly dependent vectors, span, basis, dimension, rank and nullity. Points, lines, planes and hyperplanes in $\mathbf{R}^2$, $\mathbf{R}^3$ and $\mathbf{R}^n$. orthogonality, angle.

MAF3651: FINANCIAL MATHEMATICS I

Module name:	**FINANCIAL MATHEMATICS I**
Code:	**MAT3651**
NQF level:	6
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

Prerequisite: MAF3532

Module description: Effective rate of interest and compounding, simple interest, accumulated amount function. Present value and equations of value; nominal rate of interest, effective and nominal rates of discount, the force of interest, inflation and the "real"rate of interest. Valuation of Annuities: level payment annuities, accumulated value of an annuity, present value of an annuity, annuity-immediate and annuity due, some generalizations of annuity, e.g differing interest and payment period, continuous annuity. Loan repayment: the amortization method of loan repayment, amortization of loan with level payment, the sinking – fund method of loan repayment. Bond Valuation: determination of bond price, amortization of a bond, application and illustrations, e.g callable bonds, serial bonds etc.

MAF3671: ECONOMICS I

Module name:	**ECONOMICS I**
Code:	**MAF3671**
NQF level:	6
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	EMA3572, EMI3571

Module description: Consumer theory: The objectivity of the consumer, consumer tastes, preferences, and utility, concept of utility; cardinal and ordinal utility, indifference curves, budget constraint. Consumer behavior and individual demand, Utility maximization, Effects of changes in income and commodity prices, income and substitution effects, consumer surplus. Market demand, from individual to market demand, price and income elasticity of demand, Cross elasticity of demand, Applications. Theory of the firm: Goal of the firm, Production function, Short run, Law of diminishing marginal returns, Factor-product relationship, Long-run (Returns of scale), Factor-factor relationship, Isoquants, Isocosts, Least-cost combination, Elasticity of substitution, Costs and cost functions, types of costs, short run, Long –run. Market structure: perfect competition, price determination in short –run and long –run, welfare effects of perfect competition, Effects of government intervention; price ceiling.

Monopoly, price effects of perfect completion, Effects of government intervention; price ceiling. Monopoly, price determination in the short-run and long run, Comparison with perfect competition, Monopoly power, price discrimination.

MAF 3652: FINANCIAL MATHEMATICS II

Module name:	**FINANCIAL MATHEMATICS II**
Code:	**MAF3652**
NQF level:	6
Contact hours:	2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite:	MAF3532

Module description: This is a continuation of the syllabus of Financial Mathematics I. Measuring the rate of an investment: internal rate of return and net present value, dollar – weighted and time –weighted rate of return, applications and illustration eg the portfolio method and the investment year method. The term structure of interest rate: spot rate of interest, the relationship between spot rates of interest and yield to maturity on coupon bonds, forward rate of interest, applications and illustrations eg arbitrage, the force of interest as a forward rate, at-par Yield, interest rate swaps. Forward and futures contracts: forward contracts, future contracts. Stocks, short sales and options: stock valuation, short sale of stock, options, mutual funds, exchange traded funds, capital asset pricing model.

MAF 3671: ECONOMICS II

Module name:	**ECONOMICS II**
Code:	**MAF3672**
NQF level:	6
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	EMA 3572, EMI 3571

Module description: The scope and methodology of macroeconomics, Goals of macroeconomics policy, School of macroeconomics thought. National Income Accounting-Review, Key concepts in national income accounting, GDP at current prices and GDP at factor cost, GDP and GNP, Gross GDP and net GDP, Nominal GDP and real GDP, Consumer price indices and GDP deflators, GDP at constant prices, Methods of estimating GDP, Product approach, Income approach, Expenditure approach, Problems encountered in estimating GDP, Conceptual problems, Practical problems; Limitations of GDP as an indicator of welfare, The good market, Review of Determination of equilibrium income: The Keynesian Model, aggregate supply – demand approach, investment – saving approach, Keynesian expenditure multipliers, investment expenditure multiplier, government expenditure multiplier, autonomous tax multiplier, balanced budget multiplier, Application of Keynesian Model, Effects of Aggregate demand shocks, changes in investment spending, changes in government spending, other policy changes: taxes; transfers. Micro Foundations of Macroeconomics, Consumer function, Aggregate consumption function; Absolute income hypothesis, relative income hypothesis, permanent income hypothesis, life cycle hypothesis, Investment function, The decision to invest: present value concept, marginal efficiency of investment and the rate of interest; the accelerator theory of investment, the internal funds theory of investment; the neo-classical theory of investment; the q-theory of investment, product market equilibrium and IS curve.

THIRD YEAR MODULES:

MODULE TITLE:	**REAL ANALYSIS I**
Module Code	MAT 3731
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(MAT 3611 or MAT 3612) and MAT 3601
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Real number system: algebraic and order properties, bounded sets, infimum, supremum, Completeness Axiom. Metric spaces: Definition and examples, open balls and open sets. Sequences and series of real numbers, limit theorems, monotone sequences, Cauchy criterion, limsup, liminf, cluster points, Cauchy sequences, dense sets. Continuous functions: equivalent definitions of continuity, uniform continuity, limit of a function, discontinuities of real-valued function, compact spaces and their properties, continuous functions on compact spaces, characterization of compactness.Complete metric spaces: examples, Baire Category Theorem, Banach Contraction Principle.

MODULE TITLE:	**NUMERICAL ANALYSIS I**
Module Code	MAT 3701
NQF Level	7
Notional Hours	80
NQF Credits	8
Prerequisite	(MAT 3611 or MAT 3612) and MAT 3621
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination 50% (1 x 2-hour paper).

Module Content Errors and types of errors: round off error, truncation error, propagation of error.
Root finding methods for non-linear equations: the bisection method, secant method, Regula falsi method, Newton-Raphson method. Zeros of algebraic equations: Muller's method and Newton-Horner method. Systems of linear equations: matrix methods, Gauss elimination method, LU factorization, pivoting, computing the inverse of a matrix. Iterative methods: convergence of iterative methods, Jacobi, Gauss-Seidel and relaxation methods. Interpolation: Lagrange polynomials, divided differences, Newton-Gregory forward and backward polynomials, error terms and error of interpolation, interpolating with splines.

MODULE TITLE:	**ELEMENTS OF SET THEORY**
Module Code	MAT 3721
NQF Level	7
Notional Hours	80
NQF Credits	8
Prerequisite	(MAT 3611 or MAT 3612) and MAT 3601
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination 50% (1 x 2-hour paper).

Module Content Ordered pairs and the product of two sets. Functions: definition of a function as a set of ordered pairs, images and pre-images, injective, surjective and bijective functions, restriction of a function, Cantor's Theorem. Equipotent sets: countable sets, product of two countable sets, countability of Q, uncountability of R. Families of sets, the Axiom of Choice and its applications. Binary relations: equivalence relations, equivalence classes, transversals, order relations, upper and lower bounds, greatest and least elements, maximal and minimal elements, Zorn's Lemma and its applications.

MODULE TITLE:	PARTIAL DIFFERENTIAL EQUATIONS
Module Code	MAT 3751
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(MAT 3611 or SMAT 3612) and MAT 3642
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Definition of a partial differential equation, formation of partial differential equations, linear first order equations, Lagrange's linear equation of first order. Solving non-linear first order equations of the types f(p,q) = 0, f(p,q,z)= 0, f(x,p) = g(y,q), z =px+qy+f(p,q), Charpit's method.Homogeneous linear equations with constant coefficients: complementary function and particular integral, general solution.Non-homogeneous linear equations: non-linear equations of the second order, Monge's method. Fourier series: definition, periodic functions, Dirichlet's conditions, full-range and half-range series, determination of Fourier coefficients, Fourier series of even and odd functions, Fourier series in arbitrary intervals. Classification of linear second order equations: parabolic, hyperbolic, elliptic, method of separation of variables. Applications of partial differential equations: one-dimensional wave equation with boundary conditions in a vibrating string, one-dimensional heat-flow equation, steady state and transient solutions, non-homogeneous boundary conditions.

MODULE TITLE:	LINEAR ALGEBRA I
Module Code	MAT 3711
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(MAT 3611 or MAT 3612) and MAT 3601 and MAT 3652
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Vector spaces: definition and examples. Subspaces, examples of subspaces, operations on subspaces, sum of subspaces, complement of a subspace, Dedekind's law, linear combination of vectors. Linearly independent and dependent set of vectors, span of a set of vectors, definition of a basis, existence of a basis and dimension of a finitely generated vector space, dimension formula for subspaces. Linear mappings: examples, image and preimage of a subspace, kernel, image, rank and defect, isomorphism, automorphism, coset, factor space, dimension of a factor space, coordinates, homomorphism theorem, dimension formula for linear mappings, linear form, hyperplane, dual spaces, dual basis, annihilators.

MODULE TITLE:	REAL ANALYSIS II
Module Code	MAT 3732
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(SMAT 3611 or MAT 3612) and MAT 3601
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Differentiation of single variable functions: derivatives, the chain rule, local extrema, Rolle's Theorem, Mean Value Theorem, Taylor's Theorem.Riemann integral: Definition, linear properties of the integral, necessary and sufficient conditions for the existence, First Fundamental Theorem of Integral Calculus, Mean Value Theorems for integrals, Second Fundamental Theorem of Integral Calculus, change of variable in a Riemann integral, Second Mean Value Inequality for Riemann integrals.Sequence and series of functions: Point-wise convergence, uniform convergence, uniform convergence and integration, uniform convergence and differentiation, sufficient conditions for uniform convergence of a series. Functions of Severable variables: directional derivative, total derivative, Jacobian, chain rule, Mean Value Theorem, Taylor's formula.

MODULE TITLE:	VECTOR ANALYSIS
Module Code	MAT 3742
NQF Level	6
Notional Hours	80
NQF Credits	8
Prerequisite	MAT 3611 and MAT 3612
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content Vector fields: Vector-valued functions and scalar fields, gradient, conservative vector fields, divergence and curl, solenoidal and irrotational fields, Laplace operator, differential vector identities.Line integrals: Definition, line integrals of vector fields, Fundamental theorem for line integrals, path independence, conservation of energy, Green's Theorem.Surface and volume integrals: Parametric surfaces, surface area, oriented surfaces, surface integrals of vector fields, Stokes' Theorem, volume integrals and the Divergence Theorem.

MODULE TITLE:	NUMBER THEORY
Module Code	MAT 3722
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(MAT 3611 or MAT 3612) and MAT 3601
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content Divisibility of integers, congruences, Euclidean Division, greatest common divisor and least common multiple of a set of integers, Euclid's algorithm, prime numbers, Fermat primes and Mersenne primes, the prime number theorem, existence of a prime divisor of an integer, p-exponents, the Fundamental Theorem of Arithmetic, the sigma-function, Euler's formula for the sigma-function, perfect numbers, even perfect numbers, Euler's phi-function, examples of Diophantine equations.

MODULE TITLE:	RESEARCH METHODOLOGY
Module Code	MAT 3761
NQF Level	7
Notional Hours	80
NQF Credits	8
Prerequisite	MAT3601
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 100% (Seminar presentation, proposal writing).

Module Content This module provides the framework for the development of the necessary skills that are essential for conducting and reporting the results of a research in mathematics. The emphasis is on the development of methods for carrying out an investigation on a given problem in mathematics. Due to the theoretical nature of mathematics, certain aspects of conducting research in other fields of knowledge become irrelevant in the preparation of a mathematical report. A typical research article in mathematics is analyzed in terms of its structure, style of writing, and presentation. The writing up of a Research Proposal/ Outline on a given topic in mathematics is taught. Matters of plagiarism, copyrights and intellectual property rights are highlighted.

MODULE TITLE:	LINEAR ALGEBRA II
Module Code	MAT 3712
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(MAT 3611 or MAT 3612) and (MAT 3601 and MAT 3652)
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Endomorphisms: homothety, involution, projection, binomial formula, idempo-tent endomorphism, nilpotent endomorphism, centralizer of a set of endomorphisms, Schur's Lemma. Eigenvalue, eigenvector, eigenspace, the independence of the eigenspaces of an endomorphism. Matrix theory: representation of a linear mapping by a matrix, change of basis, similar matrices. Euclidean vector spaces of arbitrary dimension: scalar product, existence of a scalar product, norm of a vector, Cauchy-Schwarz inequality, orthogonal basis, orthonormal basis, theorem of Riesz, orthogonal mappings. Determinantal forms, determinant of an endomorphism, cross product of a three-dimensional Euclidean vector space, characteristic polynomial.

MAT3741 DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS

Module name:	**DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS**
Code:	**MAF3771**
NQF level:	7
Contact hours:	4 lectures per week for 14 weeks 2 tutorial per week for 14 weeks
Credits:	16

Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).

Prerequisite: [MAT3611 (Calculus I) or MAT3612 (Calculus II)]

Module description: First order equations: initial vale problems, separable, exact, homogeneous linear equations: integrating factor. Second order equations: linear homogeneous with constant coefficients: distinct, complex and repeated roots of the characteristic equation; nonhomogeneous equations; method of underdetermined coefficients and variation of parameters. Series solution of second order linear equations. Bessel's equation. The Laplace transform: solution of initial value problems, inverse Laplace transform. System of first order linear equations, homogenous linear system with constant coefficients. First order equations: basic properties of the linear equations, solutions of linear equations, the general first order nonlinear equation, applications. Fourier series: definition, periodic functions, Dirichlet's conditions, full-range and half-range series, determination of Fourier coefficients, Fourier series of even and odd functions, Fourier series in arbitrary intervals. Linear second order equations in two independent variables: classification of linear second order equations into parabolic, hyperbolic and elliptic equations. Separation of variables. Example: the one –dimensional wave equation, the vibrating string, boundary conditions associated with the wave equation.

MAF 3751: ASSETS AND LIABILITIES

Module name:	**ASSETS AND LIABILITIES**
Code:	**MAT3751**
NQF level:	7
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAF3651, SMAF3652

Module description Managing risk, Marketing, External environment, Investment environment, meeting investor needs, Capital, Interaction with client, Awareness of risk, Management of provision for liabilities, Project planning and management, Input validation. Methodology and techniques, Assumption setting, Design, Expenses, Developing the cost and the price, Provisioning, Relationship between assets and liabilities, Maintaining profitability, Determining the expected results, Reporting actual results, Risk Management, Asset management, Capital management, Surplus management, Mergers and acquisitions, Insolvency and closure, Options and guarantees, Monitoring , Principal terms.

MAF 3752: MATHEMATICAL MODELING

Module name:	**MATHEMATICAL MODELING**
Code:	**MAF3752**
NQF level:	6
Contact hours:	2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite:	MAT3642 and MAT3621

Module description: MATLAB. Data types and control structures. Functions, procedures and subroutines and modules. Inputs and output.Modeling Change: Modeling Change with Difference Equations, Approximating Change with Difference Equations, Solutions to Dynamical Systems, and Systems of Difference Equations. The modeling Process, Proportionality, and Geometric Similarity: Mathematical Models, Modeling using Proportionality, Modeling using Geometric Similarity.Model Fitting:Fitting Models to Data Graphically,Analytic Method of Model Fitting,Applying the Least-Squares Criterion,Choosing a Best Model.Experimental Modeling: Harvesting and other One-Term Models,High-Order Polynomial Models, Smoothing: Low-Order Polynomial Models,Cubic Spline Models.

MAF3782: FINANCIAL MODELING

Module name:	**FINANCIAL MODELING**
Code:	**MAT3782**
NQF level:	7
Contact hours:	2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite:	MAT3642, MAT3621

Module description: The module will examine the tools built in to Excel and VBA and their use in financial modeling. The tools will be introduces using concepts such as the time value of money, bond pricing, risk and return, financial planning and option pricing. Tools will include absolute cell references, names, lookup tables, formatting, spinners and (other controls), if statements, graphs, etc., as well as an introduction to VBA programming. A basic knowledge of Excel is assumed with no prior experience with VBA.

MAF3732: RISK THEORY

Module name:	**RISK THEORY**
Code:	**MAF3732**
NQF level:	7
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAF3651, MAF3652

Module description Loss distribution (Lognormal, Weibul, Gamma, Pareto, Negative Exponential and the like) and MLE's (Maximum Likehood estimates – both one or two parameters); Risk Models: A random sum of a random variable; Experience rating: NCD's (No Claim Discount Systems); Claims Reserving: Chain Ladder Method, Average Cost per Claim Method and BF (Bornhuetter Ferguson) Method – with and without claims inflation; Bayesian Statistics: Bayes theorem,
Loss estimators(quadratic, absolute error, all – or – nothing), and prior, likehood and posterior distribution; Ruin Theory: Poisson process, Lundberg inequality, adjustment coefficient, Reinsurance (Proportional and non-proportional)**;** Credibility Theory: Basic concept and models (Gamma/Poisson, Normal-Normal), Two Empirical Models(both theory and numerical); Decision Theory: very basic introduction, Introduction to statistical games, a decision function, a loss function and decision criteria(Minimax, Byes criteria); Generalized Linear Models.

MAF3742: PROGRAMMING

Module name:	**PROGRAMMING**
Code:	**MAF3742**
NQF level:	7
Contact hours:	2 lectures per week for 14 weeks 1 PRACTICALS per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAT3621

Module description Problem solving strategies: the role of algorithms in the problem solving process, implementation strategies for algorithms, Debugging strategies, the concept and properties of algorithms. Program development steps: planning phase, analysis, design, implementation, testing, and maintenance.Introduction to C – Constants, Variables, Data types – Operator and Expressions. Managing Input and Output operations – Decision Making and Branching – Decision making and Looping. Arrays – Character Arrays and Strings – User defined Functions. Structures and unions – Pointers – File management in C. Dynamic memory allocation – Linked lists- Preprocessors – Programming Guide lines.

MAF3722: RESEARCH METHODOLOGY

Module name:	**RESEARCH METHODOLOGY**
Code:	**MAF3722**
NQF level:	7
Contact hours:	2 lectures per week for 14 weeks 1 PRACTICALS per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	STS3611, STS3632

Module description This module provides students with the methodological foundations of quantitative business research. It introduces a number of financial databases and research methods commonly used in finance and investment and will prepare students to undertake research projects in the area of finance. Topics have included: time value of money, interest rates, the future value of a single cash flow, the frequency of compounding, continuous compounding, stated and effective rates. The future value of a series of cash flows, finding present value of a single cash flow, the frequency of compounding. Present value of a series of cash flows, solving for rates, number of periods, size of annuity payments, cash flow additively principle. Simulation of Bond prices, optimization with conditional, value-at-risk, investment analysis on oil industry, simulation of interest rate models, stochastic numerical CHEmes, game theory and its economic/financial applications, evolutionary game theory.

FOURTH YEAR MODULES:

MODULE TITLE:	GENERAL TOPOLOGY
Module Code	MAT 3811
NQF Level	8
Notional Hours	160
NQF Credits	16
Prerequisite	MAT 3731 or MAT 3732
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content Module description: Topological spaces: topology on a set, topological space, open set, closed set, boundary, base of a topological space, neighbourhood, filter and neighbourhood filter, base of a filter, ultrafilter, accumulation point, derived set, nowhere dense set, meagre set, set of second category, cluster points and limits of a sequence and of a filter, T_0-, T_1- and T_2-spaces, countability axioms, separable topological space, subspace, continuous function, connected subset, connected subsets of the real line, connected component, totally disconnected topological space, locally connected topological space, quasicompact space, compact space, locally quasicompact space, countably quasicompact space, theorem of Heine-Borel. Metric spaces: metric on a set, metric space, topology of a metric space, metrizable topological space, distance between a point and a subset, Cauchy sequence, Cauchy filter, completeness.

MODULE TITLE:	ALGEBRA
Module Code	MAT 3872
NQF Level	8
Notional Hours	160
NQF Credits	16
Prerequisite	MAT 3711 or MAT 3712
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks

Module Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Module Content Binary operations: properties of binary operations, powers of an element, semi-group, monoid. Groups: definition and examples, subgroup, subgroup generated by a subset, cyclic group, subgroups of a cyclic group, finitely generated group, cosets of a subgroup, homomorphism, normal subgroup, factor group, isomorphism, automorphism, homomorphism theorem, conjugacy class of an element, conjugacy class of a subgroup, characteristic subgroup. p-element, p-group. Permutation groups: orbits of a permutation group, stabilizer, length of an orbit, Gleason's Lemma. Cauchy's theorem, Sylow's theorem, applications. Rings: definition and examples, endomorphism ring of an abelian group, units group, characteristic, zero divisor, entire ring, division ring, field, subring, homomorphism, ideal, factor ring, homomorphism theorem, principal ideal domain, polynomial ring in a single indeterminate.

MODULE TITLE:	COMPLEX ANALYSIS I
Module Code	MAT 3851
NQF Level	8
Notional Hours	160
NQF Credits	16
Prerequisite	MAT 3731 or MAT 3732
Compulsory/Elective	Compulsory
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Module Content The field C of the complex numbers: construction of C, absolute value, modulus argument form, roots of unity, non-orderability of C, C as a metric space, convex subsets of C, complex number plane, Riemann sphere. Sequences and series: bounded sequences, convergent sequences, subsequences, theorem of Bolzano-Weierstrass, completeness of C, Cesaro average of a sequence, Cauchy's theorem on the Cesaro average of a convergent sequence, convergent series, absolutely convergent series, re-arrangement of series, product of two series, Cauchy product, Cesaro's theorem on the Cauchy product of two convergent series, Abel's theorem on the Cauchy product.

MODULE TITLE:	NORMED VECTOR SPACES

Module Code MAT 3822
NQF Level 8
Notional Hours 80
NQF Credits 8
Prerequisite (MAT 3731 or MAT 3732) and (MAT 3711 or MAT 3712)
Compulsory/Elective Compulsory
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Module Content Definition of a normed vector space and examples, existence of a norm on a real or complex vector space, closed subspaces, examples of subspaces which are not closed, closedness of subspaces of finite dimension, equivalent norms, equivalence of norms of a vector space of finite dimension, continuity of linear mappings, norm of a continuous linear mapping, Banach spaces, Hilbert spaces, the dual of a normed vector space, continuity of a linear form in terms of the kernel, theorem of Hahn-Banach and the geometric interpretation of this theorem.

MODULE TITLE:	NUMERICAL ANALYSIS II

Module Code MAT 3871
NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite MAT 3701 or MAT 3732
Compulsory/Elective Compulsory
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Module Content Approximation: Least – square approximations, fitting non-linear curves by least squares, Legendre and Chebyshev polynomials, approximation of functions with economized power series, approximations with rational functions , norms and analysis of errorOptimization: First and second order Taylor approximations, the steepest descent method, zeroing the gradient and conjugate gradient method Numerical integration: Newton-Cotes integration formulas, trapezoidal rule, Romberg integration, Simpson's rules, Gaussian quadrature, adaptive integration, convergence criteria Numerical solution to Ordinary differential equations: Taylor series method, Euler and modified Euler methods, Runge-Kutta methods, Milne's method, the shooting method for boundary values problems, finite difference methods.

MODULE TITLE:	COMPLEX ANALYSIS II

Module Code MAT 3852
NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite MAT 3731 or MAT 3732
Compulsory/Elective Compulsory
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Module Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Module Content Differentiation: definition, rules of differentiation, Cauchy-Riemann equations.
Holomorphic functions: definition, mean value inequality. Power series: set of convergence, radius of convergence, Abel's Lemma, differentiability of the sum of a power series, exponential function, circular functions, Euler's formula. Integral of a continuous complex-valued function, rules of integration, standard estimate, fundamental theorem, path, operations on paths, rectifiable path, piecewise C1-path, path integral, Goursat's Lemma, star-shaped region, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, analyticity of holomorphic functions, entire function, Liouville's theorem, fundamental theorem of algebra, isolated singularities, Laurent series, residue, methods to find the residue, residue theorem, applications.

MODULE TITLE:	CATEGORY THEORY
Module Code	MAT 3802
NQF Level	8
Notional Hours	80
NQF Credits	8
Prerequisite	MAT 3721
Compulsory/Elective	Compulsory
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Module Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Module Content Categories: Definition; examples; duality principle; morphism types (mono-, epi-, bi-, isomorphism, sections and retractions); subobjects and quotients; object types (projective, injective, terminal, initial), subcategories; definitions of small, discrete, and concrete categories. Functors: Definition; full, faithful, and representative functors, equivalent and isomorphic categories, CAT (the category of small categories), forgetful functors. Natural transformations: Definition, examples, Godement products, Yoneda Lemma.

MODULE TITLE:	RESEARCH PROJECT
Module Code	MAT 3810
NQF Level	8
Notional Hours	320
NQF Credits	32
Prerequisite	All modules of mathematics up to third year
Compulsory/Elective	Compulsory
Contact Hours	1 contact hour with supervisor per week throughout academic year
Module Assessment:	Continuous Assessment 100% (Seminar Presentation: 30%, Written Project: 70%)

Module Content The student will be required to study and write up a research proposal and a coherent report on a given specific problem in mathematics. The student shall be required to give at least (2) two seminar presentations, one for his or her research proposal and the other for the research project on certain dates as determined by the Department of Mathematics. Although, depending on the magnitude of the problem, the student might not be able to solve the problem, he or she will be expected to find out how much is known about that problem. In the process the student will learn some mathematics required to understand and to solve the problem.

MAF3881: ELEMENTS OF DYNAMICAL SYSTEMS

Module name:	**ELEMENTS OF DYNAMICAL SYSTEMS**
Code:	**MAT3881**
NQF level:	8
Contact hours:	2 lectures per week for 14 weeks 1 tutorials per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAF3751, MAF3732

Module description: Physical aspects of dynamical systems – introduction – existence theorem – a uniqueness theorem – two continuity theorems – some extensions – conservation systems – change of variables in conservative systems – geometrical constraints – internal and external characterization of lagrangian systems . Algebraic variational principle – hamilton's principle – principle of least action – ignorable coordinates – method of multipliers-Hamiltonian equations and transformation of Hamiltonian equations. Formal group and formal solutions – equilibrium problem and generalized equilibrium problem – Hamiltonian multipliers and Hamiltonian equilibrium problem. Pfaffian multipliers – Pfaffian equilibrium problem – generalization of Pfaffian equilibrium problem – stability and instability of Pfaffian systems

MAF3831: RISK MANAGEMENT

Module name:	**RISK MANAGEMENT**
Code:	**MAF3831**
NQF level:	8
Contact hours:	4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

Prerequisite: MAF3751, MAF3732

Module description Market risk: foreign exchange futures, swaps and options. Pricing relationships and contract structures. Measuring risk exposures and using derivatives to manage risks. Interest rate futures, FRAs, swaps and options. Alternative methods for estimating yield curves. Use of the yield curve for pricing cash flows. Using derivatives to manage risk. Financial engineering using derivatives. Liquidity risk. Value at Risk. Estimating Var including extreme value theory and alternative simulation methods. Credit Risk: credit rating, events of default, default probabilities. Structural and Reduced form models of credit risk. Structural models: Merton and KMV models. Bond Models: credit spreads. Transition probabilities. Correlations and default dependencies. Estimating losses given default. Copula approaches to estimating defaults. Portfolio models of credit risk. Creditmetrics, CreditRisk+, KMV. Stress testing. Managing credit risk using credit derivatives. Limitations and risk of credit derivatives. Combining market and credit risks.

MAF3821: MATHEMATICAL METHODS

Module name:	**MATHEMATICAL METHODS**
Code:	**MAF3821**
NQF level:	8
Contact hours:	2 lectures per week for 14 weeks 1 tutorials per week for 14 weeks
Credits:	8
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAT3671 or MAT3672

Module description: Linear regression (univariate, bivariate, mulitivariate), Gauss-Markov theorem, Autocorrelations and heteroskedasticity, Instrumental variables and simultaneous equation models, Time series models, Maximum likelihood moments, Generalized method of moments, Models of conditional heteroskedasticity, Transaction level data analysis, Cointegration and error correction models.

MAF3812: STOCHASTIC CALCULUS AND FINANCE

Module name: **STOCHASTIC CALCULUS AND FINANCE**
Code: **MAF3812**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAF3751, MAF3732
Module description Probability theory, conditional expectation, arbitrage pricing, the Markov property, stopping times and American Options, properties of American Derivatives securities, Jensen's Inequality, Random Walks, The Radon-Nikodym Theorem, Capital Asset pricing, semi-continuous model, Brownian Motion, The Ito integral, Ito's Formula, Markov processes and the Kolmogorov equations, Girsanov's Theorem and the risk-neutral measure, Martingale Representation Theorem, Pricing Exotic options, Asian options, options on divided-paying stocks, bonds, forward contracts and futures, term-structure models, Gaussian procedures, Cox-Ingersoll-Ross models, A two factor model (Duffie & Kan), Change of numeraire, Brace-Gata rek-Musiela model.

MAF3842: OPERATIONS RESEARCH

Module name: **OPERATIONS RESEARCH**
Code: **MAF3842**
NQF level: 8
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: STS3721, MAF3732
Module description: Decision Analysis**:** Types of decision problems.Decision-making under uncertainty: basic concepts**.** Ways of expressing outcomes: Payoffs and opportunity losses; Characterizing the uncertainty in decision problems;Solving decision problems using the expected payoff criterion and the expected utility criterion; Classifying decision makers by their utility functions. Revising state of nature probabilities: Decision trees; Bayes' rule: solving decision problems using posterior probabilities.Deterministic EOQ Inventory models:Introduction: type of inventory models, costs involved, assumptions,Basic Economic Order Quality model: assumptions, derivation, determination of EOQ when holding cost, the effect of a non-zero lead time, power-of-two ordering policies.Probabilistic inventory models:Basic concepts: single-period models, the concept of marginal analysis,Discrete versus continuous demands.Deterministic dynamic programming (Network models):Basic concepts,Network models: minimal-spanning tree technique, maximal-flow technique, shortest-route technique.

MAF3862: INTERNATIONAL BUSINESS FINANCE

Module name: **INTERNATIONAL BUSINESS FINANCE**
Code: **MAF3862**
NQF level: 8
Contact hours: 2 lectures per week for 14 weeks 1 tutorials per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** 30% (Assignments) Examination **50 %** 70% (oral presentation of written project 20%, written project 80%)
Prerequisite: MAF3732, MAF3751.
Module description: Market and Linkage in international Financial Management, Multinational enterprise and international financial management, international flow of funds, international monetary systems, birth of global currency, emerging market crisis, international financial market, multinational financial management, exchange rate systems and policies, determination of exchange rate, equilibrium approach to exchange rate, exchange rate systems, currency risk, currency forecasting, measuring exposure to exchange rate fluctuation, forward exchange market and money market hedging, forward market, international money market, transaction hedging, derivatives, corporate uses and abuses of currency derivatives, swaps and interest rate derivatives, basic currency swaps, foreign exchange risk, international caital budgeting, Eurobond and hybrid instruments.

MAF3810: RESEARCH PROJECT

Module name: **RESEARCH PROJECT**
Code: **MAF3810**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 32
Assessment: Continuous assessment **100%** 30% (Assignments)Examination 70% (oral presentation of written project 20%, written project 80%)
Prerequisite: All modules up to third year level.
Module description: The student will be required to undertake a research project and submit a dissertation. Students will work under the supervision on a research project of their own choice relevant to the industry that they will be attached to work on the project.

H.5. MATHEMATICS: COURSE EQUIVALENTS

OLD MODULES (Started in 2008)	NEW MODULES (Revised in 2012)
MAT3511: Basic Mathematics	MAT3511: Basic Mathematics
MAT3531: Analytic Geometry, Complex Numbers and Matrices	MAT3501: Analytic Geometry and MAT3521: Matrices and Complex Numbers
MAT3512: Precalculus	MAT3512: Precalculus
MAT3601: Sets and Numbers	MAT3601: Sets and Logic
MAT3611: Calculus I	MAT3611: Calculus I
MAT3621: Numerical Methods	MAT3621: Numerical Methods with MATLAB
MAT3612: Calculus II	MAT3612: Calculus II
MAT3642: Ordinary Differential Equations	MAT3642: Ordinary Differential Equations
MAT3652: Elementary Linear Algebra	MAT3652: Elementary Linear Algebra
MAT3701: Numerical Analysis I	MAT3701: Numerical Analysis I
MAT3711: Linear Algebra I	MAT3711: Linear Algebra I
MAT3721: Set Theory	MAT3721: Elements of Set Theory
MAT3731: Real Analysis I	MAT3731: Real Analysis I
MAT3741: Partial Differential Equations	MAT3752: Partial Differential Equations
NONE	MAT3761: Research Methodology
MAT3712: Linear Algebra II	MAT3712: Linear Algebra II
MAT3722: Number Theory	MAT3722: Number Theory
MAT3732: Real Analysis II	MAT3732: Real Analysis II
MAT3622: Vector Analysis	MAT3742: Vector Analysis
MAT3810: Research Project	MAT3810: Research Project
MAT3811: General Topology	MAT3811: General Topology
MAT3831: Algebra	MAT3872: Algebra
MAT3851: Complex Analysis I	MAT3851: Complex Analysis I
MAT3802: Category Theory	MAT3802: Category Theory
MAT3822: Normed Vector Spaces	MAT3822: Normed Vector Spaces
MAT3832: Numerical Analysis II	MAT3871: Numerical Analysis II
MAT3852: Complex Analysis II	MAT3852: Complex Analysis II

H.6. MSC MATHEMATICS (11MSCM)

H.6.1. REGULATIONS

H.6.1.1.ADMISSION REQUIREMENTS

The MSc Programme in the Department of Mathematics will require a minimum of a BSc, with a Mathematics Major, in the lower second class division or an equivalent qualification at NQF Level 8. That means applicants will need to have attained an average mark of at least 60% in their undergraduate programme. Students who have completed the old BSc Programme in Mathematics must do all modules of the current fourth year programme in order to gain admission to the MSc Programme.

H.6.1.2.DURATION OF STUDY

The duration of the MSc in Mathematics is two (2) years for full-time students and three (3) years for part-time students. Relevant committees may grant an extension of registration up to six (6) months beyond the stipulated period if valid reasons are advanced.

H.6.1.3.CURRICULUM COMPILATION

The curriculum for the MSc in Mathematics consists of coursework and the writing of a research thesis.The design of the Programme provides candidates with the opportunity to become pure mathematicians or applied mathematicians due to the introduction of options in the second semester of the first year of study. For general regulations for masters programmes, please refer to the Postgraduate Student Guide from the School of Postgraduate Studies, and the General Prospectus: Information, Regulations & Fees.

H.6.1.4.EXAMINATION REGULATIONS

If a student fails the first semester module he/she may proceed to the next semester. However he/she must repeat the module in the following year. A minimum of 50% is required to pass each module.

H.6.1.5. SEMINARS

Students are expected to give a seminar presentation as part of their continuous assessment in each module.

H.6.2. MODULES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: MSc Mathematics (11MSCM)

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Academic Writing for Post Graduate Students	UAE5819	24		None
1	Mathematical Modeling	MAT5901	12		None
1	Advanced Analysis	MAT5921	12		None
1	Differential Geometry	MAT5951	24		None

OPTION A (PURE MATHEMATICS)

2	Research Methodology	MAT5922	**12**		None
2	Graph Theory	MAT5902	12		None
2	Topics in Topology	MAT5932	24		None
2	Algebraic Topology	MAT5942	12		None
2	Topics in Algebra	MAT5972	24		None
Total Credits			156		

OPTION B (APPLIED MATHEMATICS)

2	Research Methodology	MAT5922	**12**		None
2	Stochastic Differential Equations	MAA5902	12		None
2	Mathematical Biology	MAA5912	24		None
2	Dynamical Systems	MAA5942	12		None
2	Topics in Finance	MAA5972	24		None
Total Credits			156		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Measure Theory and Integration	MAT5931	24		None
1&2	MSc Thesis	MAT5950	96	Passed all first year modules	None
Total Credits			120		

FIRST YEAR MODULES

FIRST SEMESTER

UAE5819 ACADEMIC WRITING FOR POSTGRADUATE STUDENTS

Module Title:	**ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Code:	**UAE5819**
NQF Level:	8
Contact hours:	70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits:	24
Module Assessment:	CA: (1 x 3 hour exam paper)
Prerequisites:	Must be a postgraduate student.

Content: This module is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

MAT5901 MATHEMATICAL MODELING

Module Title:	**MATHEMATICAL MODELING**
Code:	**MAT5901**
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits:	12
Module Assessment:	CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites:	Admission Requirements

Content: The module is taught under the MATLAB environment. Differential equations: simple models, exact differential equations, the first order linear differential equation, growth processes, decay process, mixing processes, miscellaneous modeling problems. Numerical methods: the Euler method, the predicator-corrector method, the MATLAB suite of differential equation integrator, error propagation, stiff differential equations, system of differential equations, higher order equations, event location. Linear transformations: linearity. Matrices: matrix algebra, the matrix of a linear transformation, a fundamental isomorphism, inverses, changes of basis. linear systems: examples, diagonalization, similar matrices, characterization of 2 x 2 matrices, numerical methods, complex eigenvalues, defective eigenvalues. Application of linear systems: mathematical theories of love, population models, mathematical theories of war. Discrete models: recurrence relations, systems of recurrence relations.

MAT5921 ADVANCED ANALYSIS

Module Title:	**ADVANCED ANALYSIS**
Code:	**MAT5921**
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits:	12
Module Assessment:	CA**: 50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites:	Admission Requirements

Content: Metric spaces, normed linear spaces: continous linear mappings between normed linear spaces, product of normed vector spaces, Banach spaces and Hilbert spaces. Differentiation in Banach spaces: integration of regulated functions, the derivative, properties of the derivative, chain rule, mean value inequality, the second derivative, derivative of higher order, Taylor's formula, partial derivatives, differentiation under the integral sign, differentiation of sequences, the inverse function theorem, the implicit function theorem.

MAT5951 DIFFERENTIAL GEOMETRY

Module Title: **DIFFERENTIAL GEOMETRY**
Code: **MAT5951**
NQF Level: 9
Contact Hours: 70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 24
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: Admission Requirements
Content: Curves in R^n: regular curves, parameter transformation, arc length, Frenet frame, Frenet equations, curvature functions. Plane and space curves. Surfaces in R^3: the fundamental forms, curves on surfaces, principle curvature, Gauss curvature and mean curvature, curvature lines, asymptotic directions, developable surfaces, the Gauss equations, the Codazzi-Mainardi equations, Theorema egregium. Vector fields and covariant differentiation, parallel translation, geodesics, surfaces of constant curvature.

SECOND SEMESTER

MAT5922 RESEARCH METHODOLOGY

Module Title: **RESEARCH METHODOLOGY**
Code: **MAT5922**
NQF Level: 9
Contact Hours: 42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 12
Module Assessment: **50%** CA (Supervisor's Evaluation); **50%** Departmental Evaluation
Prerequisites: Departmental Entry Requirements
Content: The module is designed to equip students with the know-how of conducting mathematical research, and the writing up of a mathematical article. Lectures include presentation of a typical research paper in mathematics, and combing through a selection of journal articles for relevant information on a mock topic. Due attention is given to the various forms in which mathematical results are presented namely, propositions, lemmas, corollaries, and theorems – along with the methods of proof. Each student is given a research topic, tasked to write up a mock mathematical paper on that topic, and present the paper in a seminar. Emphasis is not on coming up with new results, but on the ability to conduct independent study and presenting it clearly.

MAT5902 GRAPH THEORY

Module Title: **GRAPH THEORY**
CODE: **MAT5902**
NQF Level: 9
Contact Hours: 42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 12
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50% (**2 hours examination paper)
Prerequisites: Departmental Entry Requirements
Content: Graphs and subgraphs, subgraph spanned by a set of vertices, order and size of a graph, isomorphic graphs, paths, walks, trails, cycles, circuits, connected components, bipartite graphs and their characterization, trees and forests, spanning trees, Hamilton cycles, Euler circuits, existence of Euler circuits, planar graphs, Euler's polyhedron theorem, Kuratowski's theorem, vector spaces and matrices associated with graphs, Menger's theorem, Hall's theorem and applications, factors of a graph. Tutte's 1 –factor theorem.

MAA5902 STOCHASTIC DIFFERENTIAL EQUATIONS

Module Title: **STOCHASTIC DIFFERENTIAL EQUATIONS**
Code: **MAA5902**
NQF Level: 9
Contact Hours: 42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 12
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: Departmental Entry Requirements
Content: Introduction, Ito integrals, The formula and the martingale representation, stochastic differential equations, the filtering problem, diffusions: basic properties, other topics in diffusion theory, applications to boundary value problems, application to optimal stopping, application to stochastic control, application to mathematical finance.

MAT5932 TOPICS IN TOPOLOGY

Module Title: **TOPICS IN TOPOLOGY**
Code: **MAT5932**
NQF Level: 9
Contact Hours: 70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 24
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: Departmental Entry Requirements

Content: Weak Topology, strong topology and the quotient topology. Further separation axioms: regularity, complete regularity, Tychonoff property, Urysohn property, normality, complete normality, perfect normality. Variants of compactness: Lindelof property, pseudocompactness, countable compactness, σ- compactness, paracompactness (needs star-refinements), and the localization of these properties. Product Spaces: The product of the sets, projection maps, product topology, continuous functions, product of the Hausdorff spaces, product of connected spaces, Tychonoff's Theorem, and its equivalence to the Axiom of Choice. Compactifications: Definition, Alexandroff's one–point compactification, Stone-Ćech compactification. Uniform spaces: uniformities, uniform spaces, preuniformities, preuniform spaces (entourage approach and cover approach), metric uniform spaces, uniform topology, uniform continuity, quasi-uniform spaces.

MAA5912 MATHEMATICAL BIOLOGY

Module Title: **MATHEMATICAL BIOLOGY**
Code: **MAA5912**
NQF Level: 9
Contact Hours: 70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 24
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: Departmental Entry Requirements

Content: Mathematical Biology is an interdisciplinary area in which mathematical concepts, techniques, and models are applied to a variety of problems in developmental biology and biomedical sciences. Continuous population models for single species, insect outbreak model (Spruce Budworm), harvesting a single natural population, discrete population models for single species, bifurcation analysis – leading to chaos, plane autonomous systems of ODEs, linear stability theory, non-linear conservative systems, non-linear systems: the use of polar coordinates, continuous population models for interacting species, models for predator – prey, the principle of competitive exclusion, modeling infectious diseases transmission/spreading by ODEs, the S-I-R model, the S-I-R endemic model, the vaccination/control model, enzyme kinetics, other types of complex systems.

MAT5942 ALGEBRAIC TOPOLOGY

Module Title: **ALGEBRAIC TOPOLOGY**
Code: **MAT5942**
NQF Level: 9
Contact Hours: 42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 12
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: Departmental Entry Requirements

Content: Free abelian groups, subgroups of free abelian groups. Singular homology groups: construction, homomorphism induced by a continuous mapping, homotopic mappings, homotopy properties of induced homomorphism, relative homology groups, homology groups of cells and spheres, Brouwer fixed point theorem, continuous nonzero tangent vector fields on a sphere, homology of finite graphs, homology of compact surfaces, the Mayer-Vietoris exact sequence, the Jordan– Brouwer separation theorem, the relation between the fundamental group and the first homology group.

MAA5942 DYNAMICAL SYSTEMS

Module Title: **DYNAMICAL SYSTEMS**
Code: **MAA5942**
NQF Level: 9
Contact Hours: 42 hours (2 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 12
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: Departmental Entry Requirements
Content: Bifurcations: bifurcation from a steady solution, stationery bifurcation, Hopf bifurcation; bifurcation from a periodic solution, saddle-node (or fold) bifurcation, transcritical bifurcation. Dynamical systems classification, orbits and invariant sets, the Poincare map, stability of fixed points, Lyapunov's method, Newton's equation. Planar dynamical systems and examples form ecology and electrical engineering, Poincare-Bendixson Theorem. Attracting sets, Lorenz equation. Discrete dynamical systems and chaos, logistic equation, fixed and periodic points, Sarkovskii's Theorem, Cantor sets and the tent map, strange attractors and fractal sets.

MAT5972 TOPICS IN ALGEBRA

Module Title: **TOPICS IN ALGEBRA**
Code: **MAT5972**
NQF Level: 9
Contact Hours: 70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 24
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: Departmental Entry Requirements
Content: Jordan-Holder theorem, direct product of a family of groups, the basis theorem for finitely generated groups, soluble and nilpotent groups. Commutative rings: prime ideals and maximal ideals, the radicals. Field theory: field extensions, algebraic and transcendental elements, algebraic field extensions, splitting fields, the algebraic closure of a field, normal field extensions, finite fields, automorphism of a field extension, separability, the Galois group of a field extension, Galois theory of equations, solutions of equations by radicals.

MAA5972 TOPICS IN FINANCE

Module Title: **TOPICS IN FINANCE**
Code: **MAA5972**
NQF Level: 9
Contact Hours: 70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits: 24
Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: Departmental Entry Requirements
Content: Econometrics: introduction to financial econometrics, univariate & bivariate statistics, simple regression, multiple regression, relaxing the classical assumption, model selection criteria & diagnostic testing, asymptotic (large sample) theory, stability and time –varying parameters, non –linear regression, qualitative response model, simulation method. fixed income models: continuous time models for arbitrage-free pricing of interest rates derivatives, bonds, yields , the construction of yield curves, short rates models, yield curve models, forward measures, caps, floors, swaps, swaptions, bond options, LIBOR market model. Credit risk modeling and management: credit risk modeling, valuation, and hedging emphasizing underlying economic, probabilistic, statistical concepts. Point processes and their compensators. Structural, incomplete information and reduced form approaches. Single name products: corporate bond, equity options, credit and equity default swaps, forwards and swaptions. multiname modeling: index and tranche swaps and options, collateralized debt obligations. dynamic asset pricing theory: optimal portfolio choice and asset pricing.

SECOND YEAR MODULES

FIRST SEMESTER

MAT5931 MEASURE THEORY AND INTEGRATION	
Module Title:	**MEASURE THEORY AND INTEGRATION**
Code:	**MAT5931**
NQF Level:	9
Contact Hours:	70 hours (4 lecture periods per week and 1 practical session per week for 14 weeks)
Credits:	24

Module Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)

Prerequisites: Departmental Entry Requirements

Content: Measure theory: rings, algebras, sigma–algebras and Dykin systems, contents and premeasures, the Lebesgue premeasured, extension of a premeasured to a measure, the Lebesgue-Borel measure, and the Lebesgue measure. Integration theory: measurable functions, step functions, the integral of nonnegative measurable functions, theorem of B. Levi, integrable functions, null sets, Fatou lemma, dominated convergence theorem, Lebesgue and Riemann integrals, measure with density, Radon-Nikodym theorem.

FIRST AND SECOND SEMESTER

MAT5950 MSc THESIS	
Module Title:	**MSc THESIS**
Code:	**CHM5950**
NQF Level:	9
Contact Hours:	Minimum one year
Credits:	96

Module Assessment: 100% Rules and regulations of UNAM apply. The thesis will be examined by two experts in the area of specialization, at least one of which should be external. The thesis is assessed as a piece of original work and requires an extensive literature survey and synthesis, appropriate theoretical or survey work, and an in-depth analysis and discussion of results therein. Seminar presentation: 10%; Thesis examination: 90%.

Prerequisites: A pass in all modules is required before the students start with the research projects.

Content: The student will be required to undertake research activities in a selected topic of mathematics and to submit a thesis. Students will work under supervision on a research of their own choice which will enable the application of theoretical and analytical knowledge developed in course work to a substantive problem relevant to their area of specialization.

Depending on the research topic the Department will confer the following degrees:

- MSc Mathematics with special research topic in Pure Mathematics
- MSc Mathematics with special research topic in Applied Mathematics

I. DEPARTMENT OF PHYSICS

I.1. DEPARTMENTAL REGULATIONS

To register for a B.Sc. in Physics (Honours), a candidate need to have obtained at least a C-symbol in both NSSC Mathematics and NSSC Physical Science (or equivalent qualifications)

I.1.1. DURATION OF STUDY

A student should be able to complete this programme in a minimum of four (4) years.

I.1.2. ASSESSMENT CRITERIA

A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical modules in this programme. Continuous assessment will consist of a subset of the following, depending on the module needs: class tests, reports (practical-, project-, research-, etc.) and assignments.

I.1.3. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE DEPARTMENT/FACULTY

To be re-admitted into the faculty for a particular year of registration, a student must have passed the minimum number of modules as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core,
- 8 modules (equivalent to 144 credits) by the end of the second year,
- 15 modules (equivalent to 240 credits by the end of the third year, and
- 23 modules (equivalent to 368 credits) by the end of the fourth year.

I.1.4. ADVANCEMENT AND PROGRESSION RULES

A student advances to when at least 2/3 of the modules of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases, prerequisites for modules have to be passed before a student can proceed to register for such modules.

- From year 1 to 2: At least 7 modules (equivalent to 112 credits) prescribed for year 1.
- From year 2 to 3: All first-year modules plus at least 6 modules (equivalent to 96 credits) prescribed for year 2.
- From year 3 to 4: All second-year modules plus at least 5 modules (equivalent to 80 credits) prescribed for year 3.

I.1.5. MAXIMUM NUMBER OF MODULES THAT MAY BE TAKEN PER YEAR

A student may not take more than the equivalent of 12 full modules per year.

I.1.6. REQUIREMENTS FOR AWARD OF QUALIFICATION

This qualification will be awarded to candidates credited with a minimum of 544 credits (out of which 48 are from UNAM core modules, 376—384 are from physics modules and prescribed mathematics modules and 112—120 credits from elective modules from other subjects (the actual numbers depending on the stream chosen).

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I.2. PHYSICS PROGRAMME, CURRICULUM & PREREQUISITES

Four elective “streams” are possible: Stream A1 that combines Mathematics and Computer Science electives with a Mathematics slant, Stream A2 that combines Mathematics and Computer Science electives with a Computer Science slant, Stream B that allows Geology Electives and Stream C that allows Chemistry electives.

I.2.1. PHYSICS PROGRAMME, CURRICULUM & PREREQUISITES – GENERIC STRUCTURE

All Physics students must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	SMAT3501	16		None
1	Analytic Geometry	SMAT3501	8		None
1	Matrices & Complex Numbers	SMAT3521	8		None
1	Physics for Physical Sciences I	SPHY3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	SMAT3512	16		None
2	Physics for Physical Sciences II	SPHY3512	16		SPHY3511
Total Credits			**128**		

ELECTIVE MODULES
32 Credits' worth of Elective(s) must be taken in the first year from the following: CMP3511, CMP3512, SGLY3521, SGLY3502, CHM3511 & CHM3512 in accordance with the appropriate stream and whether pre- and corequistes have been met.

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	SPHY3651	16	SPHY3511, SMAT3512	None
1	Optics	SPHY3601	8	SPHY3512, SMAT3512	None
1	Calculus I	SMAT3611	16	SMAT3512	None
1	Sets & Logic	SMAT3601	8	SMAT3512	None
2	Electromagnetism	SPHY3612	16	SPHY3512, SMAT3512	None
2	Electronics	SPHY3622	8	SPHY3512, SMAT3512	None
2	Calculus II	SMAT3612	16	SMAT3512	None
2	Ordinary Differential Equations	SMAT3642	8	SMAT(3521 **&** 3512)	None
2	Elementary Linear Algebra	SMAT3652	16	SMAT[(3511 **or** 3512) **&** 3521]	None
Total Credits			**112**		

ELECTIVE MODULES
32 Credits' worth of Elective(s) must be taken in the second year from the following: SMAT3621, CMP3631, CMP3632, SGLY3621, SGLY3662, SGLY3612, CHM3611, CHM3631 & CHM3602 in accordance with the appropriate stream and whether pre- and corequistes have been met.

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	SPHY3711	16	SPHY3612, SMAT3612	None
1	Thermodynamics & Kinetic Theory	SPHY3701	8	SPHY3651, SMAT3612	None
SEMESTER	**PHYSICS ELECTIVE MODULE**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Computational Physics	SPHY3741	8	CMP(3511 **or** 3512) **or** SMAT3621	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Analytical Mechanics	SPHY3742	16	SPHY3651, SMAT3612	None
2	Modern Physics	SPHY3752	16	SPHY(3651 **or** 3612)	None
2	Research Methodology	SPHY3722	8	Any **2**: SPHY[3651, 3612 **or** (3601 **&** 3622)]	None
Total Credits			**72**		

ELECTIVE MODULES
48 Credits' worth of Elective(s) must be taken in the third year from the following: SMAT3711, SMAT3731, SMAT3701, SMAT3721, SMAT3712, SMAT3732, SMAT3752, SMAT3742, CMP3731, CMP3732, CMP3772, SGLY3721, SGLY3761, SGLY3712, CHM3701, CHM3721 & CHM3712 in accordance with the appropriate stream and whether pre- and corequistes have been met.

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	SPHY3811	16	SPHY(3742 **&** 3752)	None
1	Statistical Mechanics	SPHY3831	16	SPHY[3701 **&** (3742 **or** 3752)]	None
1	Advanced Electrodynamics	SPHY3809	8	SPHY3711	None
1	Plasma Physics	SPHY3821	8	SPHY3711	None
2	Solid State Physics	SPHY3812	16	SPHY[3701 **&** (3742 **or** 3752)]	None
2	Nuclear Physics	SPHY3802	8	SPHY3752 **or** SPHE3751	None
2	Optics & Laser Physics	SPHY3822	8	SPHY[3601 **&** (3711 **or** 3742)]	None
2	Astrophysics	SPHY3842	8	SPHY3752	None
2	Advanced Potential Field Methods	SPHY3862	8	SPHY3711	None
1&2	Research Project	SPHY3810	**32**	**All** 3rd-year modules	None
Total Credits			**128**		

I.2.2. (new) PHYSICS PROGRAMME, CURRICULUM & PREREQUISITES – STREAMS A1, A2, B & C

I.2.2.1. QUALIFICATION: Bachelor of Science in Physics (Honours) – Stream A1 (Mathematics slant)

Students opting for **Mathematics slant** must take all the following modules **(11BPHY)**

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	SMAT3511	16		None
1	Analytic Geometry	SMAT3501	8		None
1	Matrices & Complex Numbers	SMAT3521	8		None
1	Physics for Physical Sciences I	SPHY3511	16		None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**		**PREREQUISITES**	**COREQUISITES**
1	Programming I	CMP3511	16	Entry test	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	SMAT3512	16		None
2	Physics for Physical Sciences II	SPHY3512	16		SPHY3511
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**		**PREREQUISITES**	**COREQUISITES**
2	Programming II	CMP3512	16		SCMP3511
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	SPHY3651	16	SPHY3511, SMAT3512	None
1	Optics	SPHY3601	8	SPHY3512, SMAT3512	None
1	Calculus I	SMAT3611	16	SMAT3512	None
1	Sets & Logic	SMAT3601	8	SMAT3512	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Numerical Methods with Matlab	SMAT3621	8	SMAT3521	None
1	Object Orientated Programming I	CMP3631	16	CMP3512	None

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
2	Electromagnetism	SPHY3612	16	SPHY3512, SMAT3512	None
2	Electronics	SPHY3622	8	SPHY3512, SMAT3512	None
2	Calculus II	SMAT3612	16	SMAT3512	None
2	Ordinary Differential Equations	SMAT3642	8	SMAT(3521 **&** 3512)	None
2	Elementary Linear Algebra	SMAT3652	16	SMAT[(3511 **or** 3512) **&** 3521]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
	(none)				
Total Credits			**136**		

YEAR 3 (Stream A1)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	None
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3651,MAT3612	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Computational Physics	PHY3741	8	CMP(3511 **or** 3512) **or** MAT3621	None
1	Real Analysis I*	MAT3731	16	MAT[(3611 **or** 3612) **&** 3652]	None
2	Analytical Mechanics	PHY3742	16	PHY3651,SMAT3612	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Modern Physics	PHY3752	16	PHY(3651 **or** 3612)	None
2	Research Methodology	PHY3722	8	Any **2**:SPHY[3651, 3612 **or** (3601 **&** 3622)]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Partial Differential Equations**	MAT3752	16	MAT[(3611 **or** 3612) **&** 3642]	None
Total Credits			**104**		

*** Any one of SMAT3711 or SMAT3731 may be swapped for both the 2 half-modules SMAT3701: Numerical Analysis I and SMAT3721: Elements of Set Theory**
**** SMAT3752 may be replaced by either SMAT3712: Linear Algebra II or SMAT3732: Real Analysis II**

YEAR 4 (Stream A, B & C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	SPHY3811	16	SPHY(3742 **&** 3752)	None
1	Statistical Mechanics	SPHY3831	16	SPHY[3701 **&** (3742 **or** 3752)]	None
1	Advanced Electrodynamics	SPHY3809	8	SPHY3711	None
1	Plasma Physics	SPHY3821	8	SPHY3711	None
2	Solid State Physics	SPHY3812	16	SPHY[3701 **&** (3742 **or** 3752)]	None
2	Nuclear Physics	SPHY3802	8	SPHY3752 **or** SPHE3751	None
2	Optics & Laser Physics	SPHY3822	8	SPHY[3601 **&** (3711 **or** 3742)]	None
2	Astrophysics	SPHY3842	8	SPHY3752	None
2	Advanced Potential Field Methods	SPHY3862	8	SPHY3711	None
1&2	Research Project	SPHY3810	**32**	**All** 3rd-year modules	None
Total Credits			**128**		

I.2.2.2. Bachelor of Science in Physics (Honours) – Stream A2 (Computer Science slant)

Students opting for **Computer Science slant** must take all the following modules **(11BPCO)**

YEAR 1 (Stream A1 & A2)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	SMAT3501	16		None
1	Analytic Geometry	SMAT3501	8		None
1	Matrices & Complex Numbers	SMAT3521	8		None
1	Physics for Physical Sciences I	SPHY3511	16		None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Programming I	CMP3511	16	Entry test	None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	SMAT3512	16		None
2	Physics for Physical Sciences II	SPHY3512	16		SPHY3511
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Programming II	CMP3512	16		CMP3511
Total Credits			**160**		

YEAR 2 (Stream A2)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	SPHY3651	16	SPHY3511, SMAT3512	None
1	Optics	SPHY3601	8	SPHY3512, SMAT3512	None
1	Calculus I	SMAT3611	16	SMAT3512	None
1	Sets & Logic	SMAT3601	8	SMAT3512	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Object Orientated Programming I	CMP3631	16	CMP3512	
2	Electromagnetism	SPHY3612	16	SPHY3512, SMAT3512	None
2	Electronics	SPHY3622	8	SPHY3512, SMAT3512	None
2	Calculus II	SMAT3612	16	SMAT3512	None
2	Ordinary Differential Equations	SMAT3642	8	SMAT(3521 **&** 3512)	None
2	Elementary Linear Algebra	SMAT3652	16	SMAT[(3511 **or** 3512) **&** 3521]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Object Orientated Programming II	CMP3632	16	CMP3512	CMP3631
Total Credits			**128**		

YEAR 3 (Stream A2)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	SPHY3711	16	SPHY3612, SMAT3612	None
1	Thermodynamics & Kinetic Theory	SPHY3701	8	SPHY3651, SMAT3612	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Computational Physics	SPHY3741	8	CMP(3511 **or** 3512) **or** SMAT3621	None
1	Linear Algebra I*	SMAT3711	16	SMAT[(3611 **or** 3612) **&** 3601 **&** 3652]	None
1	Software Engineering	CMP3731	16	CMP3632	None
2	Analytical Mechanics	SPHY3742	16	SPHY3651, SMAT3612	None
2	Modern Physics	SPHY3752	16	SPHY(3651 **or** 3612)	None
2	Research Methodology	SPHY3722	8	Any **2**: SPHY[3651, 3612 **or** (3601 **&** 3622)]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Human Computer Interaction**	CMP3732	16	CMP3632	CMP3731
Total Credits			**120**		

*** SMAT3711 may be replaced by SMAT3731: Real Analysis I**
**** CMP3732 may be replaced by any one of the following: CMP3772: Web Design& Programming, SMAT3712: Linear Algebra II, or SMAT3732: Real Analysis II**

YEAR 4 (Stream A, B & C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	SPHY3811	16	SPHY(3742 **&** 3752)	None
1	Statistical Mechanics	SPHY3831	16	SPHY[3701 **&** (3742 **or** 3752)]	None
1	Advanced Electrodynamics	SPHY3809	8	SPHY3711	None
1	Plasma Physics	SPHY3821	8	SPHY3711	None
2	Solid State Physics	SPHY3812	16	SPHY[3701 **&** (3742 **or** 3752)]	None
2	Nuclear Physics	SPHY3802	8	SPHY3752 **or** SPHE3751	None
2	Optics & Laser Physics	SPHY3822	8	SPHY[3601 **&** (3711 **or** 3742)]	None
2	Astrophysics	SPHY3842	8	SPHY3752	None
2	Advanced Potential Field Methods	SPHY3862	8	SPHY3711	None
1&2	Research Project	SPHY3810	**32**	**All** 3rd-year modules	None
Total Credits			**128**		

I.2.2.3. QUALIFICATION: Bachelor of Science in Physics (Honours) – Stream B (Geology Electives)

Students opting for **Geology Electives** must take all the following modules **(11BPGL)**

YEAR 1 (Stream B)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	SMAT3501	16		None
1	Analytic Geometry	SMAT3501	8		None
1	Matrices & Complex Numbers	SMAT3521	8		None
1	Physics for Physical Sciences I	SPHY3511	16		None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Programming I	CMP3511	16	Entry test	None
1	Introduction to Physical Geology & Surface Processes	SGLY3521	8	C in NSSC Mathematics	None
2	English for Academic Purposes	LEA3519	16	University entry requirements	None
2	Contemporary Social Issues	CSI3580	8	University entry requirements	None
2	Precalculus	SMAT3512	16	C in NSSC Mathematics	None
2	Physics for Physical Sciences II	SPHY3512	16	C in NSSC Mathematics & Physical Science	SPHY3511
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Introduction to Earth Systems	SGLY3502	8	C in NSSC Mathematics	None
Total Credits			**160**		

YEAR 2 (Stream B)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	SPHY3651	16	SPHY3511, SMAT3512	None
1	Optics	SPHY3601	8	SPHY3512, SMAT3512	None
1	Calculus I	SMAT3611	16	SMAT3512	None
1	Sets & Logic	SMAT3601	8	SMAT3512	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Introduction to Hydrology	SGLY3621	8	SMAT3512, SGLY3521	
2	Electromagnetism	SPHY3612	16	SPHY3512, SMAT3512	None
2	Electronics	SPHY3622	8	SPHY3512, SMAT3512	None
2	Calculus II	SMAT3612	16	SMAT3512	None
2	Ordinary Differential Equations	SMAT3642	16	SMAT(3521 **&** 3512)	None
2	Elementary Linear Algebra	SMAT3652	8	SMAT[(3511 **or** 3512) **&** 3521]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Introductory Petrology	SGLY3662	16	SGLY3521	None
2	Geological Mapping & Stratigraphy	SGLY3612	16	SGLY3521	None
Total Credits			**152**		

YEAR 3 (Stream B)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	SPHY3711	16	SPHY3612, SMAT3612	None
1	Thermodynamics & Kinetic Theory	SPHY3701	8	SPHY3651, SMAT3612	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Computational Physics	SPHY3741	8	CMP(3511 **or** 3512) **or** SMAT3621	None
1	Real Analysis I*	SMAT3731	16	SMAT[(3611 **or** 3612) **&** 3652]	None
1	Regional Geology of Namibia	SGLY3761	8	SGLY3521	None
1	Plate Tectonics	SGLY3721	8	SGLY3521	None
2	Analytical Mechanics	SPHY3742	16	SPHY3651, SMAT3612	None
2	Modern Physics	SPHY3752	16	SPHY(3651 **or** 3612)	None
2	Research Methodology	SPHY3722	8	Any **2**: SPHY[3651, 3612 **or** (3601 **&** 3622)]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Structural Geology I	SGLY3712	16	SGLY3612, SMAT3612	None
Total Credits			**128**		

*** SMAT3731 may be replaced by SMAT3711: Linear Algebra I**

YEAR 4 (Stream A, B & C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	SPHY3811	16	SPHY(3742 **&** 3752)	None
1	Statistical Mechanics	SPHY3831	16	SPHY[3701 **&** (3742 **or** 3752)]	None
1	Advanced Electrodynamics**	SPHY3809	8	SPHY3711	None
1	Plasma Physics**	SPHY3821	8	SPHY3711	None
1&2	Research Project	SPHY3810	32	**All** 3rd-year modules	None
2	Solid State Physics	SPHY3812	16	SPHY[3701 **&** (3742 **or** 3752)]	None
2	Nuclear Physics	SPHY3802	8	SPHY3752 **or** SPHE3751	None
2	Optics & Laser Physics**	SPHY3822	8	SPHY[3601 **&** (3711 **or** 3742)]	None
2	Astrophysics**	SPHY3842	8	SPHY3752	None
2	Advanced Potential Field Methods	SPHY3862	8	SPHY3711	None
Total Credits			**128**		

**** Any two of these half modules (SPHY3809, 3821, 3822 or 3842) may be replaced by SGLY3832: Exploration Geology & Geophysics**

I.2.2.4. Bachelor of Science in Physics (Honours) – Stream C (Chemistry Electives)

Students opting for **Chemistry Electives** must take all the following modules **(11BPCH)**

YEAR 1 (Stream C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	SMAT3511	16		None
1	Analytic Geometry	SMAT3501	8		None
1	Matrices & Complex Numbers	SMAT3521	8		None
1	Physics for Physical Sciences I	SPHY3511	16		None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Chemistry 1A	CHM3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	SMAT3512	16		None
2	Physics for Physical Sciences II	SPHY3512	16		SPHY3511
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Chemistry 1B	CHM3512	16	Faculty entry requirements	None
Total Credits			**160**		

YEAR 2 (Stream C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	SPHY3651	16	SPHY3511, SMAT3512	None
1	Optics	SPHY3601	8	SPHY3512, SMAT3512	None
1	Calculus I	SMAT3611	16	SMAT3512	None
1	Sets & Logic	SMAT3601	8	SMAT3512	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Inorganic Chemistry I	CHM3611	16	CHM(3511 **&** 3512)	None
1	Physical Chemistry I	CHM3631	16	CHM(3511 **&** 3512) **&** SMAT(3511 **&** 3512)	None
2	Electromagnetism	SPHY3612	16	SPHY3512, SMAT3512	None
2	Electronics	SPHY3622	8	SPHY3512, SMAT3512	None
2	Calculus II	SMAT3612	16	SMAT3512	None
2	Ordinary Differential Equations	SMAT3642	8	SMAT(3521 **&** 3512)	None
2	Elementary Linear Algebra	SMAT3652	16	SMAT[(3511 **or** 3512) **&** 3521]	None
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Analytical Chemistry I	CHM3602	8	CHM(3511 **&** 3512)	None
Total Credits			**144**		

YEAR 3 (Stream C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	SPHY3711	16	SPHY3612, SMAT3612	
1	Thermodynamics & Kinetic Theory	SPHY3701	8	SPHY3651, SMAT3612	
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
1	Real Analysis I*	SMAT3731	16	SMAT[(3611 **or** 3612) **&** 3652]	
1	Analytical Chemistry II	CHM3721	8	CHM3602	
1	Inorganic Chemistry II	CHM3701	8	CHM3611, SMAT3612	
2	Analytical Mechanics	SPHY3742	16	SPHY3651, SMAT3612	
2	Modern Physics	SPHY3752	16	SPHY(3651 **or** 3612)	
2	Research Methodology	SPHY3722	8	Any **2**: SPHY[3651, 3612 **or** (3601 **&** 3622)]	
SEMESTER	**ELECTIVE MODULE(S)**	**CODE**	**CREDIT**	**PREREQUISITES**	**COREQUISITES**
2	Physical Chemistry II	CHM3712	16	CHM3631	
Total Credits			**112**		

*** SMAT3731 may be replaced by SMAT3711: Linear Algebra I**

YEAR 4 (Stream A, B & C)

SEMESTER	MODULE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	SPHY3811	16	SPHY(3742 **&** 3752)	
1	Statistical Mechanics	SPHY3831	16	SPHY[3701 **&** (3742 **or** 3752)]	
1	Advanced Electrodynamics	SPHY3809	8	SPHY3711	
1	Plasma Physics	SPHY3821	8	SPHY3711	
2	Solid State Physics	SPHY3812	16	SPHY[3701 **&** (3742 **or** 3752)]	
2	Nuclear Physics	SPHY3802	8	SPHY3752 **or** SPHE3751	
2	Optics & Laser Physics	SPHY3822	8	SPHY[3601 **&** (3711 **or** 3742)]	
2	Astrophysics	SPHY3842	8	SPHY3752	
2	Advanced Potential Field Methods	SPHY3862	8	SPHY3711	
1&2	Research Project	SPHY3810	**32**	**All** 3rd-year modules	
Total Credits			**128**		

OLD COURSE	**EQUIVALENT NEW COURSE**
PHY3511	PHY3511
PHY3512	PHY3512
PHY3611	PHY3651
PHY3631	PHY3601 **and** SPHY3651
PHY3612	PHY3612
PHY3602	(to be offered again)
PHY3711	PHY3711
PHY3701	PHY3701
PHY3721	PHY3741
PHY3712	PHYT3742
PHY3732	PHY3752
PHY3702	(to be offered again)
PHY3722	PHY3722
PHY3811	PHY3811
PHY3831	PHY3831
PHY3810	PHY3810
PHY3809	PHY3809
PHY3821	PHY3821
PHY3812	PHY3812
PHY3802	PHY3802
PHY3822	PHY3822
PHY3842	PHY3842
PHY3862	PHY3862
PHY3402	PHY3402
PHY3501	PHY3402
PHY3532	PHY3501
PHE3641	PHY3532
PHE3751	PHE3641

I.3. PHYSICS SERVICE COURSES

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
I	Physics for Life Sciences I	PHY3501	8	NSSC Physical Science	None
I	Modern Physics for Educators	SPHE3751	16	PHY3511, PHY3512, MAT3511, MAT3512	None
II	Physics for Radiographers	PHY3402	8	-	None
II	Physics for Life Sciences II	PHY3532	16	NSSC Physical Science, PHY3501	None
II	Electricity and Magnetism	SPHE3642	8	PHY3512, MAT3511, MAT3512	None
Total Credit			**56**		

I.4. PHYSICS CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

PHY3511: PHYSICS FOR PHYSICAL SCIENCES I

Module title: **PHYSICS FOR PHYSICAL SCIENCES I**
Code: **PHY3511**
NQF level: 5
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of class tests, tutorial tests/assignments and practical reports.
Pre-requisites: NSSC Physical Science and Mathematics (C-symbols)
Module description (content): Units, significant figures & scientific notation; vectors: properties, components, unit vectors, products; average & instantaneous speed, velocity and acceleration; one dimensional motion with constant acceleration; falling bodies; two dimensional motion with constant acceleration; projectile motion; uniform circular motion; circular motion; relative velocity and acceleration; Newton's laws; inertial frames; weight; friction; applications; work and kinetic energy; power; conservative and non-conservative forces; gravitational potential energy; conservation theorem; work-energy theorem; linear momentum & impulse; conservation of linear momentum - 2 particle system; collisions; equilibrium; centre of gravity; applications; Newtonian gravitation; gravitational constant; weight & gravitational force; Kepler's laws; pressure; Archimedes' principle; laminar flow; Bernoulli's equation; temperature & temperature scales; thermal expansion; ideal gas; heat; heat capacity; latent heat; heat transfer.

PHY3501: PHYSICS FOR LIFE SCIENCES I

Module title: **PHYSICS FOR LIFE SCIENCES I**
Code: **PHY3501**
NQF level: 5
Contact hours: 28 Lectures and 14 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of class tests, tutorial tests/assignments and practical reports.
Pre-requisites: IGCSE Physical Science
Module description (content): This module is to introduce Life science students to physics concepts and applications that will be useful to them in their undergraduate studies and carrier. The module is not for physical science students as it is not equivalent to PHY3511.
Units and unit conversion, SI-unit system and non-metric systems, significant figures and scientific notation; Vectors and scalars, operations with vectors in two dimensions, component method of vector operations; Average velocity; acceleration; motion at constant acceleration; freely falling bodies; Projectiles; uniform circular motion; Force and weight, Newton's first, second and third laws, applications of Newton's laws, free-body diagrams, friction, motion on inclined planes; centripetal force, banking of curves; Newton's law of universal gravitation; gravity near the Earth's surface, satellites; Kepler's first, second and third laws; Work done by a constant force, kinetic energy, work-energy theorem, potential energy, conservation of mechanical energy, power; Conservation of momentum; collisions in one dimension; impulse; conservation of energy and momentum in collisions; elastic and inelastic collisions in one dimension.

PHY3512: PHYSICS FOR PHYSICAL SCIENCES II

Module Title: **PHYSICS FOR PHYSICAL SCIENCES II**
Code: **PHY3512**
NQF Level: 5
Contact Hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous assessment (**50%**, Minimum 2 tests, 4 assignments and practical reports) Examination (**50%**, 1 x 3- hour paper)
Pre-requisites: IGCSE Physical Science and Mathematics (C-symbols)
Module description (contents): This module introduces the phenomena associated with electrostatics (charges at rest) and magnetostatics (the magnetic effects associated with steady currents). It also introduces and develops the use of the electric and magnetic field vectors and relates them by considering electromagnetic induction at a classical level. The connection between these fields and conventional circuit parameters R, C and L is developed, together with the techniques to deal with elementary transient phenomena. Sound, basic geometrical optics and radioactivity and its detection are also covered. The contents of this course include: Electric charge; insulators and conductors; Electric force and coulomb's law, Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Basic geometrical optics; Radioactivity and its detection; Sound.

PHY3532: PHYSICS FOR LIFE SCIENCES II

Module Title: **PHYSICS FOR LIFE SCIENCES II**
Code: **PHY3532**
NQF Level: 5
Contact Hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous assessment (**50%**, Minimum 2 tests, 4 assignments and practical reports) and Examination (**50%**,1 x 3-hour paper)
Pre-requisites: IGCSE Physical Science
Co-requisites: Physics for Life Sciences I
Module description (contents): This module introduces life science students to concepts of physics and their application to real life situations, new topics that were not dealt with in PHY 3501 are introduced (i.e., on electricity, magnetism and radioactivity). The module is not for physical science students as it is not equivalent to PHY3512. The content of this course is good enough to help the life science students throughout their undergraduate work and careers. The following topics will also be covered: Electric charge; insulators and conductors; Electric force and coulomb's law , Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Temperature, gas and thermal expansion; Basic geometrical optics; Radioactivity and its detection.

PHY3402: PHYSICS FOR RADIOGRAPHERS

Module Title: **PHYSICS FOR RADIOGRAPHERS**
Code: **PHY3402**
NQF Level: 4
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous assessment **50%**, one 2 hour exam **50%**. Continuous assessment is based on class tests, assignments and minimum 7 practical sessions
Pre-requisites: none
Module Description: Electromagnetic radiation; elementary quantum theory ; atomic structure; atomic nucleus; radioactive decay - half-life, law of radioactive decay, activity of a radioactive sample; detectors of radioactive particles; X- and Gamma-rays and their interactions with matter – photo-absorption, Compton scattering, pair-production; homogeneous and heterogeneous beams, x-ray spectra; intensity of x- and gamma-radiation as a function of distance to the source and as a function of the thickness of the absorber; attenuation coefficients; half-value layer; filters; effects of the different absorption modes on the clarity and quality of a radiographic image; dosimetry - absorbed dose; exposure; dosimetric devices; maximum permissible doses.

SECOND YEAR MODULES

PHY3651: MECHANICS & WAVES

Module title: **MECHANICS & WAVES**
Code: **PHY3651**
NQF level: 6
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous Assessment **(50%)** and one 3-hour Exam Paper (**50%**).Continuous assessment will consist of class tests, assignments and practical reports.
Pre-requisites: PHY3511: Physics for Physical Sciences I, MAT3511: Basic Mathematics and MAT3512: Precalculus
Module description (content): vectors, vector operations and the calculus of vectors. Rectilinear and curvilinear motion; Circular motion; Translational & rotational uniform relative motion; Mass; Linear momentum; Newton's Laws; Friction; The linear and quadratic laws of fluid drag; Variable mass systems; Angular momentum; Central forces; Work energy and power; Conservation laws; Rectilinear motion under conservative forces; Non-conservative forces; Centre of mass; Motion of the centre of mass. Linear and angular momentum of a system; Kinetic energy of a system; Conservation laws of a system; Transforming between Laboratory and Centre-of-mass Frames; Reduced mass; Collision Theory; Rutherford scattering; Angular momentum of a rigid body; Moments and products of inertia; Equation of motion for a rotating body; Kinetic energy of rotation; Body on a spring; Classical SHM; Damped SHM; Forced motion; The different kinds of waves; Standing waves on a string; The one dimensional wave equation; Travelling waves: properties; Plane waves; Scalar & vector waves; Reflection and transmission.

PHY3601: OPTICS

Module Title: **OPTICS**
Code: **PHY3601**
NQF Level: 6
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module Assessment: Continuous [**50%**], Minimum 2 tests and 2 assignments. Exam [**50%**], 1 x 2-hour paper
Pre-requisites: PHY3511: Physics for physical sciences I and PHY3512: Physics for physical sciences II
Module description (contents): Huygens's principle and Fermat's principle; Reflection and refraction of plane waves; Reflection and refraction of waves at plane and spherical surfaces; Lens, prisms, dispersion and chromatic aberrations; Introduction to interference and diffraction and polarization;

PHY3612: ELECTROMAGNETISM

Module Title: **ELECTROMAGNETISM**
Code: **PHY3612**
NQF Level: 6
Credits: 16
Contact Time: 56 Lectures and 14 Practical Sessions/Tutorials
Assessment: Continuous [**50%**] Minimum 2 tests and 2 assignments Exam [**50%**] 1 x 3-hour paper
Pre-requisites: PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus,
Model description (contents): This module will provide students with information on how the charges at rest and those in motion behave. This course will be calculus-based and students will develop the skill to obtain different equations and solve related problems. The contents of the course are: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohm's law; Resistance, Joule effect and emf; Magnetic interaction; Lorentz force; Electromagnetic field of a moving charge; Electric flux of a moving charge; Magnetic field and electric current; Magnetostatics; Ampere's law; Time dependent electric field; Maxwell's equations.

PHY3622: ELECTRONICS

Module Title: **ELECTRONICS**
Code: **PHY3622**
NQF Level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module Assessment: Continuous: **50%**, Examination: **50%** (1 x 2 hour exam)
Pre-requisites: PHY3512: Physics for Physical Sciences II
Module description: This module introduces the basic concepts of analogue electronics and illustrates its applications through examples using such as diodes, BJT's and FET and operational amplifiers. Introduction to semi-conductor theory, intrinsic, p & n type doping, extrinsic semiconductors, conduction processes; Semiconductors diodes and diodes applications, devices transistors, biasing of transistors, load line and the Q-point and its stability; Small signal equivalent circuits and frequency response; p-n-p-n devices, thyristors, diacs and triacs, IC's, logic operation of integrated circuits; Operational amplifier characteristics, Op-amps practical applications, electronic control circuits and feedback concept; Digital circuits, analogy circuits, hybrid (digital plus analogue) circuits; Standard logic functions and gates - AND, OR, NOT, NAND, NOR, XOR, XNOR; truth tables; Boolean theorems; laws and rules; truth table; Boolean algebra and simplification of basic logic networks circuits; Basic combinational logic circuits, flip-flops and their applications.

PHE3642: ELECTRICITY AND MAGNETISM

Module title: **ELECTRICITY AND MAGNETISM**
Code: **PHE3642**
NQF Level: 6
Contact Time: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module Assessment: Continuous assessment (class tests, assignments and practical reports) **50%**, two-hour exam **50%**
Pre-requisites: PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus.
Module description (content): The content of the module will cover the following: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohms law; DC circuits; Magnetic field and flux, Lorentz force; Ampere's law; Electromagnetic induction and ac circuits.

THIRD YEAR MODULES

PHY3711: ELECTRODYNAMICS

Module title: **ELECTRODYNAMICS**
Code: **PHY3711**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16 NQF credits
Module assessment: Continuous assessment (minimum of 4 class tests, 4 assignments and practical reports) **50%**, three hour written exam **50%**
Pre-requisites: PHY3612: Electromagnetism and MAT3612: Calculus II
Module description (content): The following topics are covered in Electrodynamics: Vector analysis, with emphasis on the 'del' operator , integral calculus, curvilinear coordinate systems; The electrostatic field E and its divergence and curl, Gauss's law; The electric potential, Poisson's equation and Laplace's equation; Work and energy in electrostatics, induced charges on conductors and capacitors; Uniqueness theorems and method of images as special techniques for solving some problems; The electric field of a dipole; Electric field in matter – polarization, linear dielectrics, electric displacement; Magnetostatics field B – Lorentz force law, Biot-Savart law, divergence and curl of B, Ampère's law, magnetic vector potential; Magnetic fields in matter – magnetization and the auxiliary field H; Electrodynamics – Ohm's law, Faraday's law, Maxwell's equations in vacuum and in matter, conservation laws, Poynting's theorem.

PHY3701: THERMODYNAMICS AND KINETIC THEORY

Module title: **THERMODYNAMICS AND KINETIC THEORY**
Code: **PHY3701**
NQF Level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous assessment (**50%** weight), one 2 hour exam (**50%** weight) Continuous assessment is based on class tests, assignments and minimum 7 practical sessions
Pre-requisites: PHY3611: Classical Mechanics and MAT3612: Calculus II
Module Description: Fundamental concepts - zeroth law, temperature, equilibrium; equations of state - ideal gas, pressure of an ideal gas, physical basis of temperature; real gases; First Law of Thermodynamics - internal energy, heat, reversible quasi-static processes, work, heat capacity, heat engines; Second Law of Thermodynamics - Caratheodory theorem, absolute temperature, entropy, entropy changes, Clausius inequality, adiabatic equations of ideal gas, Carnot theorem, heat engines; thermodynamic potentials and Maxwell relations - internal energy, enthalpy, Helmholz and Gibbs functions; kinetic theory - mean free path, Maxwell's velocity distribution, Boltzmann distribution; some applications - blackbody radiation, heat capacities of solids.

PHY3741: COMPUTATIONAL PHYSICS

Module title: **COMPUTATIONAL PHYSICS**
Code: **PHY3741**
NQF level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous Assessment (**50%**) and one 2-hour Exam Paper. (**50%**) Continuous assessment will consist of class tests and computational assignments.
Pre-requisites: CMP3511: Programming I **or** CMP3512: Programming II **or** MAT3621: Numerical Methods with Matlab
Module description (content): A First Numerical Problem: Radioactive decay: numerical approach, program design & construction, program testing; Realistic Projectile Motion: The effect of air resistance; Trajectory of a cannon shell;
Oscillatory Motion: Simple Harmonic Motion; The Pendulum: Adding dissipation, non-linearity and driving forces; Chaos in the driven non-linear pendulum. Random Systems: Random processes; Random walks; Self-avoiding walks; Diffusion;

SPHE3751: MODERN PHYSICS FOR EDUCATORS

Module title: **MODERN PHYSICS FOR EDUCATORS**
Code: **PHE3751**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16

Module assessment: Continuous assessment (class tests, assignments and practical reports) **50%**, Three-hour exam **50%**

Pre-requisites:PHY3511: Physics for Physical sciences I, PHY3512: Physics for Physical sciences II, PHY3611: Classical Mechanics, MAT3511: Basic Mathematics and MAT3512: Precalculus.

Module description: Blackbody radiation; Planck's quantization; Photoelectric effect; Compton effect; atomic structure; spectral lines of Hydrogen; the nuclear atom; Bohr's theory; correspondence principle; Franck-Hertz experiment; X-rays; de Broglie wavelengths; particle-wave duality; Heisenberg uncertainty relation; Special relativity; departure from Newtonian dynamics; Einstein and Lorentz transformations; Lorentz contraction and time dilation; wave mechanics, Schrödinger equation for a free particle; the potential step. particles in a box ; particle in a finite potential well; Electrons in metals, Nearly free electron model, energy bands; Semiconductors, band gaps, intrinsic carrier concentration, impurity conductivity, donor and acceptor states.

PHY3742: ANALITICAL MECHANICS

Module title: **ANALITICAL MECHANICS**
Code: **PHY3742**
NQF level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 16

Module assessment: Continuous Assessment (**50%**) and one 3-hour Exam Paper (**50%**). Continuous assessment will consist of class tests, assignments and practical reports.

Pre-requisites:PHY3611: Classical Mechanics, MAT3612 Calculus II: Numerical Methods, MAT3642: Ordinary Differential Equations and MAT3652: Elementary Linear Algebra.

Module description (content): Lagrangian methods; constraints; generalised coordinates; D'Alembert's principle; Lagrange's equations; moving constraints; Lagrangian; generalised momenta; symmetry and conservation principles; The calculus of variations; minimisation problems; Euler-Lagrange equation; variational & Hamilton's principles; Hamilton's equations; phase space; systems of first order ODEs; Legendre transforms; Hamilton's equations; Hamiltonian phase space; Poisson brackets;

PHY3752 MODERN PHYSICS

Module title: **MODERN PHYSICS**
Code: **PHY3752**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16

Module assessment: Continuous assessment (class tests, assignments) **50%**, 3-hour written exam **50%**

Pre-requisites: SMAT3612: Calculus II and **either** PHY3651: Mechanics & Waves **or** PHY3612: Electromagnetism

Module description (content): The Birth of Modern Physics: Classical physics of the 1890s, nature of light, the initial atomic theory of matter, problems in 19th-century physics; Special Theory of Relativity: The need for aether, the Michelson-Morley experiment, Einstein's postulates, Lorentz transformation, time dilation and length contraction, addition of velocities, experimental verifications, the twin paradox, space-time and Minkowski diagrams, doppler effect, relativistic momentum, relativistic energy, electromagnetism and relativity, four vectors; Overview of General Relativity : A brief and qualitative descriptive view of: tenets of: General Relativity, tests of General Relativity, gravitational waves, black holes, and frame dragging; Experimental Basis of Quantum Theory: discovery of the X-ray and the Electron, determination of the electron charge, line spectra, blackbody radiation, photoelectric effect, Compton effect; Structure of the Atom: atomic models of Thomson and Rutherford, Rutherford scattering, the classic atomic model, the Bohr Model of the hydrogen atom, successes and failures of the Bohr model, Mosley's law, Franck-Hertz experiment; Wave Properties of Matter and Quantum Mechanics: X-ray scattering, De Broglie waves, electron scattering, particle-wave duality, Heisenberg uncertainty relation, probability, wave functions, the Schrödinger wave equation, expectation values, infinite square-well potential, finite square-well Potential, barriers and tunneling, quantum numbers, Zeeman effect, Lande g factor, spin-orbit interaction; Lasers: stimulated emission, gain and inversion, rate equations, three- and four-level systems, threshold energy, laser applications.

PHY3722: RESEARCH METHODOLOGY

Module title: **RESEARCH METHODOLOGY**
Code: **PHY3722**
NQF Level: 7
Contact hours: 28 Lectures only
Credits: 8 NQF credits

Module assessment: 100% modulework (assignments & a typed report on literature review on some physic topic)

Pre-requisites: PHY3612: Electromagnetism

Module description (content): Although the actual topics will be adapted to the students research area the following topics will be "generally" covered in this module: various philosophies of Science; Research Proposals (Guidance to writing good project proposals); Basic research skills (e.g. library research, literature review, article analysis etc.); Research Strategy: Planning, Designing and Implementing; Data collection and interpretation methods; Data Reduction, Error analysis (error propagation); Data analysis; Report writing; Communication, skills required to communicate research findings to a broader audience, presentations (oral & written), peer reviewing, refereed journals; Ethics and Legal Issues (e.g. plagiarism); Basics of Quantitative Research (concerned with the tabulation or numeric relevance of various kinds of behaviour (¨measuring¨); Basics of Qualitative Research (concerned with understanding the processes, which underlie various behavioural patterns (Answering the question ¨why? ¨).

FOURTH YEAR MODULES

PHY3811: QUANTUM MECHANICS

Module title: **QUANTUM MECHANICS**
Code: **PHY3811**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous assessment (**50%**) and one 3-hour Examination (**50%**). Continuous assessment consists of a minimum of 4 assignments, 2 tests and practical reports.
Pre-requisites: PHY3712: Thoretical Mechanics and PHY3732: Modern Physics II.
Module description: This course is to have students learn the fundamentals of quantum mechanics. Students will be introduced to many new concepts and techniques in the course. The course will cover the following topics: Mathematical primer; Historical review; The postulates of quantum mechanics, state functions and expectation values, time development of state functions; Dirac notation, eigenvalues and eigenfunctions; Hermitian operators and applications; Commutator relations and compatible observables; Time development of expectation values, Ehrenfest's principle and applications, constants of motion, conservation of energy, momentum and parity; The harmonic oscillator, creation and annihilation operators; Angular momentum, commutation properties of the components of angular momentum, simultaneous eigenfunctions; Total angular momentum, commutation relations for the components of total angular momentum, ladder operators; Elements of matrix mechanics, Pauli spin matrices, spin wave functions; The Slater determinant; Time-independent Perturbation theory, degenerate perturbation theory, the Stark effect; Variational method; Scattering.

PHY3831: STATISTICAL MECHANICS

Module title: **STATISTICAL MECHANICS**
Code: **PHY3831**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous assessment (class tests, assignments) **50%**, three hours written exam **50%**
Pre-requisites: PHY3611: Classical Mechanics and PHY3701: Thermodynamics and Kinetic Theory
Module description (content): Macroscopic and microscopic view point of systems, classical and statistical probability; statistics and distribution function, significance of Lagrangian multipliers; the Bose-Einstein statistics, the Fermi-Dirac statistics, the Maxwell-Boltzmann statistics; the Bose-Einstein distribution function, the Fermi-Dirac distribution function, the Maxwell-Boltzmann distribution function; thermodynamic properties of a system; applications of statistics to gases, monatomic ideal gas; the distribution of molecular velocities, Maxwell-Boltzmann speed distribution, ideal gas in gravitational fields; the principle of equipartition of energy, specific heat capacity of a diatomic gas; applications of quantum statistics to other systems; the Einstein theory of the specific heat capacity of a solid; the Debye theory of the specific heat capacity of a solid; Blackbody radiation, paramagnetism, negative temperatures; the electron gas.

PHY3810: RESEARCH PROJECT

Module title: **RESEARCH PROJECT**
Code: **PHY3810**
NQF Level: 8
Contact hours: Frequent meetings (as determined by the Department) with supervisor(s) amounting to a minimum of 112 hours.
Credits: 32
Module assessment: **100%** A written (typed) report of the research in the form of a dissertation or thesis must be submitted by the student. This will be evaluated by qualified staff within the field. During the course of the project, the student will also be expected to present the progress of his work in the form of two seminars (colloquiums).
Pre-requisites: PHY3711: Electrodynamics and PHY3712: Theoretical Mechanics
Module description (content): This one-year module constitutes the research and report writing for an available project within the various fields of physics. The actual content of the module will depend on the topic of research selected by the student, from the available specialized fields within the department. The student will submit a written dissertation (or thesis) of the project upon completion of the research activities.

PHY3809: ADVANCED ELECTRODYNAMICS

Module title: **ADVANCED ELECTRODYNAMICS**
Code: **PHY3809**
NQF Level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8 NQF credits
Module assessment: Continuous assessment (minimum of 2 tests, 2 assignments and practical reports) **50%**, written examination **50%**
Pre-requisites: PHY3711: Electrodynamics
Module description (content): This module is a follow-up on the module Electrodynamics and constitute the following topics: Conservation laws in electrodynamics; Vector and scalar potential formulation; Coulomb and Lorentz transformations; Retarded potentials and Jefimenko's equations; Liènard-Wiechert potentials; Electric and magnetic dipole radiation, power radiated; Linear Antennas; Electrodynamics and relativity – relativistic magnetism, field transformation, field tensor.

PHY3821: PLASMA PHYSICS

Module title: **PLASMA PHYSICS**
Code: **PHY3821**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous Assessment (**50%**) and 1 2-hour Exam Paper **(50%)** Continuous Assessment will consist of class tests, assignments and practical reports.
Pre-requisites: PHY3711: Electrodynamics
Module description (content): Definition and Temperature; Debye shielding; Plasma parameter; Criteria for plasmas; Applications; Uniform **E-** and **B**-fields; Non-uniform **B**-field; Non-uniform **E**-field; Time-varying **E**-field; Time-varying **B**-field; Guiding-centre drifts; Adiabatic invariants; Relation of Plasma Physics to ordinary Electromagnetics; The fluid equation of motion; Fluid drifts perpendicular to **B**; Fluid drifts parallel to **B**; The plasma approximation; Waves; Group velocity; Plasma oscillations; Electron Plasma waves; Sound waves; Ion waves; Plasma approximation; Comparison of ion and electron waves; Electrostatic electron oscillations perpendicular to **B**; Electrostatic ion waves perpendicular to **B**; Lower hybrid frequency; Electromagnetic waves with $\mathbf{B}_0 = 0$; Experimental applications; Electromagnetic waves perpendicular to $\mathbf{B}_0$; Cut-offs and resonances; Electromagnetic waves parallel to $\mathbf{B}_0$; Experimental consequences; Hydromagnetic waves; Magnetosonic waves; The CMA diagram; Diffusion and mobility in weakly ionised gases; Decay of a plasma by diffusion; Steady state solutions; Recombination; Diffusion across a magnetic field; Collisions in fully ionised plasmas; The single-fluid MHD equations; Diffusion in fully ionised plasmas; Solutions to the diffusion equation; Böhm diffusion and neoclassical diffusion;

PHY3812: SOLID STATE PHYSICS

Module title: **SOLID STATE PHYSICS**
Code: **PHY3812**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous assessment (**50%**) and one 3-hour Examination (**50%**). Continuous assessment consists of a minimum of 4 assignments, 2 tests and practical reports.
Pre-requisites: PHY3701: Thermodynamics and Kinetic Theory and PHY3732: Modern Physics II.
Module description: This course is to have students learn about the properties of solids such as simple crystals, semiconductors and superconductors. The course will cover the following topics: Crystal structure; Fundamental types of lattices, crystal planes; Diffraction of waves by crystals, Bragg law, reciprocal lattice vectors, diffraction conditions, Laue equations, structure factor; Forces between atoms and molecules, forces due to the ionic and covalent bonds, van der Waals forces, dipole-dipole forces; Elastic properties of solids, Young's modulus in terms of inter-atomic force constant, Bulk modulus of an ionic solid, generalized relation between bulk modulus and lattice energy; Lattice dynamics, vibrations of crystals with monatomic basis and with two atoms per primitive basis; Thermal properties, phonon heat capacity, density of states, Einstein model, Debye model, Umklapp processes; Electrons in metals, the free electron Fermi gas, electrical conductivity, Ohm's law, Hall effect; Nearly free electron model, energy bands, Bloch functions, Kronig-penney model; Semiconductors, band gaps, Intrinsic carrier concentration, impurity conductivity, donor and acceptor states; Superconductivity, destruction of superconductivity, Meissner effect, type I and type II superconductors, London equation, the BCS theory.

PHY3802: NUCLEAR PHYSICS

Module title: **NUCLEAR PHYSICS**
Code: **PHY3802**
NQF Level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous assessment (**50%**) and one 2-hour Examination **(50%)**. Continuous assessment consists of a minimum of 3assignments, 2 tests and practical reports.
Pre-requisites: PHY3732: Modern Physics II
Module description : Nuclear Structure, nuclear radius, nomenclature; Decay of the nucleus, alpha decay, beta decay, gamma decay, spontaneous fission; Radioactivity, radioactive growth and decay, transient equilibrium, secular equilibrium, radioactive decay series, carbon dating; Chart of Nuclides; Nuclear reactions, elastic scattering, inelastic scattering, reaction of transmutation, radiative capture, photodisintegration, induced fission; Interaction of radiation with matter, photoelectric effect, pair production, Compton scattering, calculation of energy transferred in Compton scattering using relativistic equations; The liquid drop model, variation of binding energy per nucleon with mass number; Weizsacher's semi-empirical mass formula; The shell model; Nuclear energy, nuclear reactors, introductory reactor physics, nuclear power plants; Nuclear instrumentation, radiation detectors, accelerators; Two body systems and nuclear force: properties of nuclear forces, the deuteron, qualitative treatment of n-p and p-p scattering at low energies; Elementary particle.

PHY3822: OPTICS AND LASER PHYSICS

Module Title: **OPTICS AND LASER PHYSICS**
Code: **PHY3822**
NQF Level: 8
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module Assessment: Continuous [**50%**], Minimum 1 test and 1 assignment Exam [**50%**], 1 x 2-hour paper
Pre-requisites:PHY3631: Waves and Optics and PHY3711: Electrodynamics
Module Description (contents): This module will give opportunity to students to have mastery on various phenomenon based on the wave nature of light and that light is a transverse wave. The main contents of this course will be: Interference: Division of amplitude, Division of wavefronts, Thin films, Interferometers, Multiple reflections and Refractions; Diffraction: Fresnel's diffraction, Fraunhoffer diffraction, Kirchhoff's diffraction theory, Single slit, Double slit and gratings, and Monochromatic aberrations; Polarization: Plane polarized light, Circularly polarized light, Elliptically polarized light, Double refraction, Quarter wave plate, Babinet compensator, Polarimeters, Specific rotation; Introduction to lasers: Basics of lasers, He-Ne laser, N_2 laser and CO_2 laser; Applications.

PHY3842: ASTROPHYSICS

Module title: **ASTROPHYSICS**
Code: **PHY3842**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous Assessment **(50%)** and 1 2-hour Exam Paper **(50%)**
Continuous Assessment will consist of class tests, assignments and practical reports.
Pre-requisites: PHY3732: Modern Physics II
Module description (content): The Origins of Astronomy; Observational Techniques; Introduction to the c-g-s system of Units; Basic Observations: Review of Blackbody Radiation; Measurement of Stellar Parameters; The Hertzsprung-Russel Diagram; Hydrostatic Equilibrium; The Virial Theorem; Mass Continuity; Radiative Energy Transport; Energy Conservation; The Equations of Stellar Structure; The Equation of State; Opacity; Scaling Relations on the Main Sequence; Nuclear Energy Production; Nuclear Reaction Rates; Solution of the Equations of Stellar Structure; Convection; Stellar Evolution; White Dwarfs; Supernovae & Neutron Stars; Pulsars & Supernova Remnants; Black Holes; Interacting Binaries; Star Formation & the Interstellar Medium: Cloud Collapse & Star Formation; H II Regions; Components of the Interstellar Medium; Dynamics of Star-Forming Regions; Practical Astronomy: Time: Calendars; Julian day number; ST, UT, GST, LST, ET, TDT; Conversions; Spherical geometry; Celestial sphere; Coordinates: Horizon, Equatorial, Ecliptic, Galactic; Generalised coordinate transformations; Conversions

PHY3862: ADVANCED POTENTIAL FIELDS

Module Title: **ADVANCED POTENTIAL FIELDS**
Code: **PHY3862**
NQF Level: 8
National Professional: None
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous assessment (**50%**, Minimum 2 tests and 2 or more practical assignments) Examination (**50%**1 x 3-hour paper)
Pre-requisites: PHY3711: Electrodynamics
Module description: The following topics will be covered; Potential field theory: 2D and 3D gravitational and magnetic potentials, equipotential surfaces, forces of attraction–gravity and magnetic, improper integrals, Gauss's (divergence) theorem, Laplace's equation, Poisson's equation, Harmonic functions, Gauss's integral formula, excess mass, transformations of potential fields (derivatives, Poisson's relation, pseudo-gravity, reduction-to-pole, continuation, frequency filtering), ambiguity. Gravity: Measurement of G and gravitational acceleration, units, figure of the earth, rock and mineral densities, reduction to gravity observations, gravity anomalies (Bouguer, Free air, Isostatic), isostasy, interpretation of anomalies (regional/residual separation, forward and inverse modelling). Geomagnetism: Analysis of the earth's internal and external fields, units, basic physics, magnetic properties of rocks and minerals (paramagnetism, diamagnetism, ferromagnetism, anti-ferromagnetism, susceptibility, coercivity, magnetic mineralogy, effect of grain size, curie temperature, induced and remanent magnetization), time variations of the earth's field, palaeomagnetism, magnetometers (Fluxgate, proton precession, optically pumped, Overhauser), interpretation (rules of thumb, forward and inverse modelling, magnetic fields of simple geometry, depth inversion), design of ground and airborne magnetic surveys, image processing (applicable also to gravity data).

I.5. PHYSICS COURSE EQUIVALENTS

OLD COURSE	EQUIVALENT NEW COURSE
PHC3101	*PHY3501 or PHY3511
PHC3112	*PHY3532 or PHY3512
PHC3102	PHY3402
PHC3211	PHY3511
PHC3201	PHY3631
PHC3212	PHY3512
PHC3202	PHY3602
PHC3311	PHY3611
PHC3331	PHY3702
PHC3312	PHY3712
PHC3332	PHY3711
PHC3411	PHY3811
PHC3431	PHY3831
PHC3412	PHY3812
PHC3402	PHY3802 **and** PHY3822
PHC3422	PHY3842 **and** PHY3862
SPHY3401	SPHY3501
SPHY3412	SPHY3532
SPHY3611	SPHY3651
SPHY3631	SPHY3601 **and** SPHY3651
SPHY3602	(to be offered again)
SPHY3721	SPHY3741
SPHY3712	SPHYT3742
SPHY3732	SPHY3752
SPHY3702	(to be offered again)

*** For Life Sciences students only**

I.6. MSC PHYSICS (11MSPH)

I.6.1 DEPARTMENTAL REGULATIONS

I.6.1.1. ADMISSION REQUIREMENTS

The admission requirement for the proposed M.Sc. programme will be a University of Namibia NQF Level 8 degree in Physics or equivalent degree from a recognised university. The applicant will be accepted on the basis of his/her undergraduate academic record with an average mark of at least **60%**. Former UNAM double major Physics graduates may be admitted but will first have to take and pass relevant additional undergraduate modules prescribed by the Department on a case by case basis.

I.6.1.2. DURATION OF STUDY

The duration of this programme will be two (2) years minimum and three (3) years maximum for full-time students. The first year will mostly consist of coursework, while the second year will be dedicated to a supervised research project and the writing of a thesis.

I.6.1.3. CURRICULUM COMPILATION

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PREREQUISITE	Compulsory/Elective	CO-REQUISITES
1	Advanced Quantum Mechanics	PHY5911	24	Admission requirements	Compulsory	None
1	Research Methodology	PHY5931	24	Admission requirements	Compulsory	None
1	Mathematical Methods of Physics	PHY5951	24	Admission requirements	Compulsory	None
1	Advanced Academic Writing for Postgraduate Students	UAE5819	24	Admission requirements	Compulsory	None
2	Lasers and Applications	PHY5912	24	Admission requirements	Elective	None
2	Radiation Physics	PHY5932	24	Admission requirements	Elective	None
2	Computational Physics	PHY5952	24	Admission requirements	Elective	None
2	Advanced Classical Mechanics	PHY5972	24	Admission requirements	Compulsory	None
2	Astro- and Space Physics	PHY 5992	24	Admission requirements	Elective	None
Total credits			216			

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PREREQUISITE	Compulsory/Elective	CO-REQUISITES
1 & 2	M.Sc. Thesis	PHY5900	120	All Year 1 subjects passed	Compulsory	
Total credits			120			

Total credits = 144 (year 1) + 120 (year 2) = 264
*The credit for the module UAE5819 (a level 8 module) is not included in the total credit of 264.

I.6.1.4. EXAMINATION REGULATIONS

Formal examinations, subject to external moderation, will take place at the end of each semester of the first year of the programme. A minimum continuous assessment mark of 40% and a minimum of 80% class attendance is required to be admitted to write the examination in a specific module. Students must pass all modules in order to proceed to the thesis component of the degree. In all cases, a minimum mark of 50% is required to pass.

I.6.1.5. FORMAT AND EVALUATION OF THESIS WORK

During the thesis year, the student shall conduct supervised research in a Senate approved field of study. At the end of this year, the candidate must submit a completed Master Thesis/Dissertation in the English language. This thesis must be in a format prescribed by the Department as per University regulations. The completed thesis will be evaluated by the supervisor(s) and one (or more, if needed) external examiners, normally within a month after submission. The student will be expected to successfully defend his/her thesis in a viva voce examination.

I.6.1.6. PRACTICALS

Attendance of practical classes, experiments, projects, field trips and/or internships as prescribed by the course lecturers and thesis supervisor(s) are compulsory.

I.6.2 COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

FIRST YEAR MODULES

PHY5911: ADVANCED QUANTUM MECHANICS

Module title:	**ADVANCED QUANTUM MECHANICS**
Code:	**PHY5911**
NQF level:	9
Contact hours:	56 L + 35P/T
Credits:	24

Module assessment: Continuous Assessment **(50%)** and 1 x 3-hour Exam Paper **(50%)** Continuous Assessment may consist of a combination of tests, practicals and/or assignments. Subminima of 40% are required in both the continuous assessment and examination.

Pre-requisites: M.Sc. admission requirements

Module description (content): Review of time independent perturbation theory: Non-degenerate case - First order correction to energy and corresponding wave function, second order correction to energy and corresponding wave function, applications; Time independent perturbation theory: Degenerate case - Applications to first order Stark effect and to the normal Zeeman effect; Variational principle: Principle and applications to the ground state of hydrogen and helium atoms; Wentzel-Kramers-Brillouin (WKB) approximation: Development and applications of the WKB approximation: Probability of penetration of a barrier, theory of a- decay, Geiger-Nuttel law, potential-well; Time-dependent perturbation theory (method of variation of constants) : Zero and first order perturbation calculations, adiabatic approximation, Fermi-golden rule, sudden approximation, harmonic perturbation, applications - a charge particle in an electromagnetic field, semi-classical theory of radiation, Einstein's transition probabilities; Scattering theory: Scattering cross-section, Greens function approach, Born approximation, partial wave analysis; Relativistic quantum mechanics: Klein-Gordon equation, Klein-Gordon with external electromagnetic potentials, bilinear covariants, solution of the Dirac equation for free particles, plane waves, projection operators, relativistic hydrogen atom; Elements of second quantization: Introduction, canonical quantization of fields, second quantization of Schrodinger field, systems of bosons, system of fermions, creation and annihilation operators.

PHY5931: RESEARCH METHODOLOGY

Module title:	**RESEARCH METHODOLOGY**
Code:	**PHY5931**
NQF level:	9
Contact hours:	56 L + 35P/T
Credits:	24

Module assessment: Continuous Assessment **(50%)** and an oral presentation **(50%)**
Continuous Assessment may consist of a combination of tests, practicals and/or assignments.Subminima of 40% are required in both the continuous assessment and presentation.

Pre-requisites: M.Sc. admission requirements

Module description (content): Students will be required to conduct independent studies in the field s/he wishes to specialize. The topic will be chosen by the student in consultation with an academic member of staff and should preferably be within the fields of expertise in the department. The topic should support the candidate's broad knowledge in the general area of specialization.

PHY5951: MATHEMATICAL METHODS OF PHYSICS

Module title:	**MATHEMATICAL METHODS OF PHYSICS**
Code:	**PHY5951**
NQF level:	9
Contact hours:	56 L + 35P/T
Credits:	24

Module assessment: Continuous Assessment **(50%)** and 1 x 3-hour Exam Paper **(50%)**
Continuous Assessment may consist of a combination of tests, practicals and/or assignments. Subminima of 40% are required in both the continuous assessment and examination.

Pre-requisites: M.Sc. admission requirements

Module description (content): Tensors - tests for tensor character, types of tensors, operations with tensors, compressed notation. Complex analysis - complex variable functions; continuity and differentiability of complex variable functions; Cauchy-Riemann equations; analytic functions; sequences and series; Boltzano-Weierstrass theorem; differentiability of the sum of a power series; integral of complex variable functions; properties of integrals; paths, piecewise continuous paths; path integral; analytical continuation; elementary functions of complex variables as analytic continuations of functions of real variables; Cauchy integral theorem, Cauchy integral formula; Liouville's theorem; fundamental theorem of algebra; singularities; Lauren series; residue; residue theorem; conformal mappings; applications of conformal mappings; basics of operational calculus. Special functions - Legendre, Laguerre, Hermite, Jacobi, Bernoulli, Chebishev polynomials, Bessel functions, hypergeometric function, degenerate hypergeometric function, Beta function, Riemann zeta function; boundary conditions problems - harmonic functions, harmonic analysis. PDEs - parabolic, hyperbolic, elliptic; boundary conditions problems - Green function, Sturm-Liouville problem, eigenvalues, eigenfunctions.

UAE5819: ACADEMIC WRITING FOR POSTGRADUATE STUDENTS

Module title: **ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Code: **UAE5819**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24
Module assessment: Continuous Assessment 1 x 3-hour Exam PaperContinuous Assessment may consist of a combination of tests, practicals and/or assignments.Subminima of 40% are required in both the continuous assessment and examination.
Pre-requisites: M.Sc. admission requirements
Module description (content): This module is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

PHY5912: LASERS AND APPLICATIONS

Module title: **LASERS AND APPLICATIONS**
Code: **PHY5912**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24
Module assessment: Continuous Assessment **(50%)** and 1 x 3-hour Exam Paper **(50%)** Continuous Assessment may consist of a combination of tests, practicals and/or assignments. Subminima of 40% are required in both the continuous assessment and examination.
Pre-requisites: M.Sc. admission requirements
Module description (content): Review of Atomic Physics: Hydrogen atom, excited states of hydrogen, wave nature of particles, particle nature of light, angular momentum of atoms, one electron atoms, multiple electron atoms, Radiative transitions: Einstein's A and B coefficients, population, inversion, gain, and gain saturation, threshold frequencies, laser oscillation above threshold, laser amplifiers, laser resonators, two level systems, three level systems, and four level laser systems, Characteristics of laser radiations: Coherence, monochromaticity, directionality and brightness, broadening and line width, homogeneous and inhomogeneous broadening, energy levels, radiative properties of materials, solid, liquid and dye molecules, radiation and thermal equilibrium,
Cavity radiations: transverse and longitudinal modes, laser pumping and laser cavities, cavity designs, cavity modes, cavity effects, stable laser resonators, Q switching, mode locking, mode dumping, frequency multiplication, frequency stabilization, Laser systems: atomic gas lasers, molecular gas lasers, solid state lasers, semiconductor lasers, free-electron lasers, chemical lasers, dye lasers, ring lasers. Applications: calibration of meters, distance measurement, entertainment, distortion measurements, guidance, material processing, machining, cutting, welding, cladding, hardening, defence applications, medical applications, applications in agriculture and earth sciences, applications in telecommunications, laser spectroscopy

PHY5932: RADIATION PHYSICS

Module title: **RADIATION PHYSICS**
Code: **PHY5932**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24
Module assessment: Continuous Assessment **(50%)** and 1 x 3-hour Exam Paper **(50%)** Continuous Assessment may consist of a combination of tests, practicals and/or assignments. Subminima of 40% are required in both the continuous assessment and examination.
Pre-requisites: M.Sc. admission requirements
Module description (content): Review of atomic and nuclear structures, atomic and nuclear radiation, classification of radiation, natural and man-made sources of radiation; Interaction of heavy charged particle with matter: Maximum energy transfer, stopping power, range; Interaction of beta particles with matter: Collisional stopping power, radiative stopping power, radiation yield, range; Interaction of photon with matter; Neutron interaction with matter: elastic scattering, capture process, fission; Methods of radiation detection: Ionization in gases, gas-filled detectors, Scintillation and semiconductor detectors, neutron detectors; Radiation dosimetry: exposure, absorbed dose, dose equivalent, measurement of exposure – free air ionization chamber, air-wall chamber – measurements of absorbed dose, X-ray and gamma ray dose, neutron dosimetry, dose calculations; Radiation hazards and effects: direct and indirect radiation, chemical and biological effects, the acute radiation syndrome, somatic effects – stochastic and nonstochastic; External radiation protection: Distance, time and shielding, gamma-ray shielding, protection from beta radiation, neutron shielding; Applications of different types of radiation: Industrial, medical, scientific, environmental pollution, geological.

PHY5952: COMPUTATIONAL PHYSICS

Module title: **COMPUTATIONAL PHYSICS**
Code: **PHY5952**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Module assessment: Continuous Assessment (**50%)** and 1x 3-hour Exam Paper **(50%)** Continuous Assessment may consist of a combination of tests, practicals and/or assignments.Subminima of 40% are required in both the continuous assessment and examination.

Pre-requisites: M.Sc. admission requirements

Module description (content): NUMERICAL SOLUTIONS OF ODES: Generalizations of the Euler method; Runge-Kutta methods; Linear multistep methods; Predictor-Corrector methods; Adams-Moulton method; FINITE DIFFERENCES AND FINITE DIFFERENCE METHODS: Forward, backward and central derivatives; Numerical “stencils”/Computational “molecules”; Grid transformations; MATRIX INVERSION METHODS: Gauss elimination; Techniques for sparse matrices: Iterative methods; the Thomas algorithm; Eigenvalue problem; NUMERICAL SOLUTION OF PDEs: Classification of PDEs (parabolic, elliptical, hyperbolic); Methods for frequently occurring PDEs in Physics: Crank-Nicolson, ADI, LOD; Applications: heat, diffusion, diffusion-convection, wave and poison equations; STOCHASTIC (MONTE CARLO) METHODS: Random number generators; Random walk & random flights; Statistical fundamentals; Sampling from spectra; Successive over-relaxation, Hybrid MC method; Applications.

PHY5972: ADVANCED CLASSICAL MECHANICS

Module title: **ADVANCED CLASSICAL MECHANICS**
Code: **PHY5972**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Module assessment: Continuous Assessment **(50%)** and 1 x 3-hour Exam Paper **(50%)** Continuous Assessment may consist of a combination of tests, practicals and/or assignments. Subminima of 40% are required in both the continuous assessment and examination.

Pre-requisites: M.Sc. admission requirements

Module description (content): SURVEY OF ELEMENTARY PRINCIPLES: Mechanics of a particle and a system of particles; Constraints; D'Alembert's principle and Lagrange's equations; Velocity-dependent potentials and the dissipation function; Simple applications of the Lagrangian formulation; VARIATIONAL PRINCIPLES AND LAGRANGE'S EQUATIONS: Hamilton's principle; Calculus of variations; Derivation of Lagrange's equations from Hamilton's principle; Extension to nonholonomic systems; Conservation theorems; RIGID BODY MOTION: Euler angles; Caley-Klein parameters; Euler theorem on the motion of a rigid body; Finite and infinitesimal rotations; Coriolis force; Tensors and dyadics; Inertia tensor; Applications; SPECIAL RELATIVITY IN CLASSICAL MECHANICS: Lorentz transformations in real 4 dimensional spaces; Covariant 4 dimensional formulations; Force and energy equations in relativistic mechanics; Lagrangian formulation of relativistic mechanics; Covariant Lagrangian formulations; HAMILTON EQUATIONS OF MOTION: Legendre transformations and the Hamilton equations of motion; Cyclic coordinates and conservation theorems; Hamiltonian formulation of relativistic mechanics; Derivation of Hamilton's equations from a variational principle; The principle of least action; CANONICAL TRANSFORMATIONS: Equations of canonical transformations; Sypmplectic approach to canonical transformations; Poisson brackets and Poisson bracket formulation of mechanics; Liouville's theorem; LAGRANGIAN AND HAMILTONIAN FORMULATIONS FOR CONTINUOUS SYSTEMS AND FIELDS: Transition from discrete to continuous systems; Lagrangian formalism for continuous systems; Stress tensor; Hamiltonian formulation, Poisson brackets and momentum representation; Relativistic field theory; Noether's theorem.

PHY5992: ASTRO- AND SPACE PHYSICS

Module title: **ASTRO- AND SPACE PHYSICS**
Code: **PHY5992**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Module assessment: Continuous Assessment **(50%)** and 1 x 3-hour Exam Paper **(50%)** Continuous Assessment may consist of a combination of tests, practicals and/or assignments. Subminima of 40% are required in both the continuous assessment and examination.

Pre-requisites: M.Sc. admission requirements

Module description (content): COSMIC RAYS: Properties of Cosmic Rays; Distribution functions, intensities, energy and mass spectra; Second order Fermi-acceleration; DIFFUSIVE SHOCK ACCELERATION: Astrophysical magnetohydrodynamic shocks; Rankine-Hugoneot relations; Compression ratios and derived properties of astrophysical shocks; First order Fermi-acceleration; Diffusive shock acceleration; DIFFERENTIAL TRANSPORT AND MODULATION THEORY: The Heliosphere; Solar and stellar winds; Termination shock and Heliopause; Interplanetary magnetic field; Parker spiral field and the neutral sheet; Derivation of Parker transport equation from Boltzmann equation; Particle and current sheet drift; The diffusion tensor; Cosmic ray modulation; Anomalous cosmic rays and acceleration at the solar wind termination shock; RADIATIVE PROCESSES: Synchrotron radiation; Compton and inverse Compton effects; Inverse Compton collision cross sections: Thompson and Klein-Nishina; Synchrotron-self-Compton processes; Photon-photon collisions; REVISION OF ASTROPHYSICAL BASICS: Stellar Physics; Stellar Evolution; Star Formation;Stellar Remnants & Degenerate objects: white dwarfs & neutron stars; Pulsars, Plerions and Supernova Remnants; Black Holes; THE MILKY WAY AND OTHER GALAXIES: Structure of the Milky Way; Galaxy Demographics; Active Galactic Nuclei and Quasars; Groups & Clusters of Galaxies. BIG BANG COSMOLOGY: Olbers' Paradox; Extragalactic Distances; Hubble's Law; Cosmic Clocks; Isotropy; The Friedmann-Robertson-Walker Metric; The Friedmann Equations; The Future of the Universe; Light Element Nucleosynthesis; Tests of Big Bang Cosmology: cosmological redshift & Hubble's Law, the cosmic microwave background, quasars as cosmological probes

SECOND YEAR MODULE

PHY5900: THESIS

Module title: **THESIS**
Code: **PHY5900**
NQF level: 9
Contact hours: N/A
Credits: 120
Module assessment: 100% Thesis to be submitted at the end of the year for internal and external examination.
A public viva voce thesis defence by the candidate.
Pre-requisites: All modules of the first year must be completed.
Module description (content): The student will be required to undertake research activities in a selected topic of Physics and to submit a thesis. Students will work under the supervision of a researcher of their own choice which will enable the candidate to gain theoretical and analytical knowledge in course work to a substantive problem relevant to their area of specialization.

J. DEPARTMENT OF STATISTICS AND POPULATION STUDIES

J.1 DIPLOMA PROGRAMMES

J.1.1. REGULATION PERTAINING TO DIPLOMA STUDIES

J.1.1.1. ADMISSION REQUIREMENTS

To qualify for admission to the Diploma in Applied Statistics, an applicant shall satisfy any one of the following minimum requirements:

a) A Namibian Senior Secondary Certificate (NSSC) or equivalent, obtained in not more than two examination sittings with a minimum of 22 points in five subjects on the UNAM Evaluation Scale. English is a compulsory subject and should have been obtained on a First or second Language Ordinary Level with symbol D or higher. A symbol D or higher in Mathematics is also required.

b) Mature age entry (based on the results from the entry test)

J.1.1.2. DURATION OF STUDY

The Diploma in Applied Statistics is to be offered on both full time and part-time basis. It cannot be completed in less than two (2) years for full-time students and cannot be completed in less than 3 years for part-time students. The maximum period of study for full-time and part-time students is 3 and 4 years, respectively.

J.1.1.3. MODE OF DELIVERY

The Diploma in Applied Statistics will be offered in the evening. This is to allow full-time working candidates to attend lectures in the evening. The programme comprises of a total credit of 256 and it is at Namibian Qualification Framework (NQF) level 5. The year 1 modules are at NQF level 4 whereas the year 2 modules are at NQF level 5.

J.1.1.4. EXAMINATION REGULATIONS

For detailed examination and promotion rules see the General Prospectus: Information, Regulations and Fees. A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of **40%**. Examination will be administered at the end of each semester.

J.1.1.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be readmitted to the Diploma programme, a student must have passed the minimum number of modules required as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core.

- 12 modules (equivalent of 192 credits) by the end of the second year

J.1.1.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the second academic year of study when at least 6 modules (96 credits) of the curriculum for a first year have been passed.

J.1.1.7. MAXIMUM NUMBER OF MODULES PER YEAR

A part-time student can only register for 75% of the prescribed modules in any given academic year. Full-time students can register for all first year modules and thereafter, no more than 10 modules in any academic year.

J.1.1.8. ARTICULATION ROUTE

After successful completion of the Diploma in Applied Statistics, students may be exempted from first year Statistics/and or Population Studies modules as follows:

A student joining the Bachelor of Science (Honours) degree in Statistics or Bachelor of Science Population Studies (Honours) after completing the Diploma in Applied Statistics from the University of Namibia or any equivalent qualification may be exempted from certain year 1 modules of the degree program on a case by case basis.

Module passed	Exemption
SSTD2511 Statistical Methods	STS3531 Descriptive Statistics
SSTD2531 Probability	STS3532 Introduction to Probability

QUALIFICATION: DIPLOMA IN APPLIED STATISTICS (11DSST)

YEAR 1

SEMESTER	MODULE TITLE	CODE	CREDIT	PRE-REQUISITE	CO-REQUISITES
1	Computer Literacy	CLC3509	8		None
1	Basics of Statistics	STD2431	16		None
1	The Statistical System	STD2411	16		None
1	Contemporary Social Issues	CSI3580	8		None
1&2	English for General Communication	LEG2410	32		None
2	Index Numbers and Time series	STD2412	16		None
2	Introduction to Mathematics	STD2432	16		None
2	Sampling concepts in Survey work	STD2452	16		None
Total Credits					

YEAR 2

SEMESTER	MODULE TITLE	CODE	CREDIT	PRE-REQUISITE	CO-REQUISITES
1	Basic Data Processing	STD2551	16	STD2452	None
1	Probability	STD2531	16	STD2432	None
1	Statistical Methods and Techniques	STD2511	16	STD2431	None
1	Basic Micro Economics	EMI2571	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Statistical Modeling	STD2532	16	STD2432	None
2	Basic Demography and Epidemiology	STD2512	16	STD2411	None
2	Basic Macro Economics	EMA2572	16		None
Total Credits			128		

J.1.2. DIPLOMA IN APPLIED STATISTICS: MODULES & CURRICULUM DESCRIPTION

FIRST YEAR MODULES

LEG2410 ENGLISH FOR GENERAL COMMUNICATION

Module title: **English for General Communication**
Code: **LEG2410**
NQF Level: 4
Contact hours: 4 hours per week for 28 weeks
Credits: 32
Module Assessment: Continuous assessment (**60%**):4 reading tests, 4 writing tests, 2 oral presentations and 1 literature worksheet. 1x3 hour examination paper (**40%**):
Pre-requisites: None
Module description: This module attempts to assist students to improve their general English proficiency. The main goal of this module is to develop the reading, writing, listening, speaking and study skills of students in order for them to perform tasks in an academic environment and beyond.

CLC3509 COMPUTER LITERACY

Module title: **Computer Literacy**
Code: **CLC 3509**
NQF level: 5
Contact hours: **1 lecture theory and 1 lecture practical per week for 14 weeks**
Credits: 8
Module assessment: Continuous Assessment **100%** 2 Practical Tests 50% and 2 Theory Tests 50%
Prerequisites: None
Module description: The aim of this module is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment. The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

STD241 THE STATISTICAL SYSTEM

Module Title: **The Statistical System**
Code: **STD2411**
NQF Level: **4**
Contact Hours: **4 lectures per week/14 weeks**
Credits: **16**
Module Assessment: Continuous assessment (at least two tests and one assignments**) 40%;** 1 x 3 hours Examination **60%**
Pre- requisite: **None**

Module description: Purpose and scope of official statistics, structure and work of the National Statistical System, Organization, methods and practices of data collection and dissemination. Explain the role of statistics in evidence-based policy-making; The role of statistics in National development policies and frameworks; Assessment of the National statistical system; Components of the National Statistical System and their roles; Characteristics of an effective National statistical system; Types of data and their sources.

STD 2431 BASICS OF STATISTICS

Module Title: **BASICS OF STATISTICS**
Code: **STD 2431**
NQF Level: 4
Contact Hours: 4 Lectures per week for 14 weeks
Number of Credits: **16**
Module Assessment: Continuous assessment (at least two tests and one assignments) **40%;** 1 x 3 hours Examination **60%**
Prerequisites: None

Module Description: Definition: Statistics; descriptive, inferential. Variables: qualitative versus quantitative. Data types: primary versus secondary, categorical versus discrete, continuous. Sources of data: Population versus sample. Reasons for sampling. Sampling techniques: probability versus non- probability sampling- advantages and disadvantages of each. Simple Random Sampling, Stratified Random Sampling, Systematic Sampling, cluster Sampling, Uses of random numbers. Convenience Sampling Purposive Sampling, Judgemental Sampling, Snowball Sampling. Types of measurements: nominal, ordinal, interval, ratio scales. Presentation of data: tabular forms; frequency tables, cross-tabulations (two- variable), graphical methods; histograms, pie charts, bar charts, frequency polygons, stem- and- leaf plots, box- and- whiskers plot, ogives. Measures of Central Tendency: Σ notation, Π notation, mean, median, mode, quartiles, percentiles. Measures of Dispersion: variance, standard deviation, range, inter- quartile range, skewness, Kurtosis. Identifying outliers. Uses of scientific calculators for statistical manipulation limited to calculation of mean, standard deviation, random number generation.

CSI 3429 CONTEMPORARY SOCIAL ISSUES

Module Title: **Contemporary Social Issues**
Code: **CSI 3529**
NQF: 5
Contact Hours: 2 periods per week for 14 weeks
Credits: 8
Module Assessment: Continuous assessment **(50%)**: test or assignment 1x 2 hours examination paper **(50%)**:
Prerequisite: None

Module Description: The module raises awareness on the need for a personal, national and global ethics. The main objectives of the course is to help students reflect on the social moral issues; to discover themselves in a learner-centered, contextual, religious and life related setting. It also stimulates students for critical thinking and help them to appreciate their values, standards and attitudes. Furthermore it orientates students with regards to the epidemiology of HIV/AIDS; the prevalence of the disease on Namibia, Africa and Internationally. It also informs students on the psycho social and environmental factors that contribute to the spread of the disease, the impact of HIV/AIDS on their individual lives, family and communities at large. The unit further seeks to enhance HIV/AIDS preventive skills among students by means of paradigm shift and behavior change and also to impart general introductory knowledge on gender, to make students aware, as well as sensitize them towards gender issues and how they affect our society, Sub-Region and continent at large.

STD2432 INTRODUCTION TO MATHEMATICS

Module Title: **INTRODUCTION TO MATHEMATICS**
Code: **STD2432**
NQF Level: 4
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hours Examination **60%**
Pre- requisite: Grade 12 Mathematics

Module description: Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement; Matrices: addition, multiplication, scalar multiplication and transpose (for up to 3x3 dimension), determinant and inverse (with emphasis on 2x2), Derivatives: definition, rules of differentiation; the definite integral**.** Understand the difference between sequences and series and between finite and infinite series, and appreciate the idea of a limit. Solve basic problems involving Arithmetic and Geometric Progressions. Compute both simple and compound interests, apply the concept to discounting in studying Economics. Use the Binomial Series Expansion to any power. Indices and logarithms.

STD2452 SAMPLING CONCEPTS IN SURVEY WORK

Module Title: **SAMPLING CONCEPTS IN SURVEY WORK**
Code: **STD2452**
NQF Level: 4
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1 x 3 hours Examination **60%**
Pre- requisite: None
Module description: Identifying data needs. Importance of examining the literature to determine existing data sources, their appropriateness and their reliability. Using knowledge concerning the target population. Samples, target population, study population, sampling frames, sampling units. Developing objectives; Designing a sampling CHEme; Designing and testing a questionnaire; Data entry and data cleaning; Producing statistical summaries that relate to the objectives of the study; Presenting results What is meant by "representativeness"? The importance of getting results that are generalisable. What is meant by simple random sampling and stratified random sampling. How to draw such samples. Benefits and limitations. Probability versus non-probability sampling methods. A brief overview of quota sampling, purposive sampling, systematic sampling, cluster sampling and multi-stage sampling. Developing a sampling strategy for a given problem. Identifying information needs. Discussing alternative sampling CHEmes as presented by different groups. Estimating a population mean, a population proportion. Distinguishing between "with" and "without" replacement sampling. Computing measures of precision. How to take a stratified random sample. Advantages of stratification. Sample sizes using proportional allocation or Neyman's allocation. Deriving estimates for a population mean, total and proportion. Formulae for determining the sample size based on simple random sampling for estimating a population mean or population proportion. Difficulties associated with use of formulae. Recognizing broad issues that enter into sample size determinations. Key considerations needed to make decisions about sample sizes. Cluster and multi-stage sampling. Probability proportional to size (PPS) sampling. Self-weighting designs. Brief introduction to the role of design effects. Brief overview of different types of non-sampling errors. Discussion of how non-sampling errors can be minimized. Role of sampling weights in estimation. Calculation of weights for simple scenarios.

STD2412 INDEX NUMBERS AND TIME SERIES

Module Title: **INDEX NUMBERS AND TIME SERIES**
Code: **STD2412**
NQF Level: 4
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: Grade 12 Mathematics
Module description: Introduction to index numbers; Basic theory of index number, consumer price indices, errors in index numbers, rebasing techniques, introduction to National Accounts, GDP statistics by activity, GDP by expenditure, National Income and the balance of payment, measuring GDP. Introduction to time series; Trends in time series; decomposing a time series; forecasting and review.

SECOND YEAR MODULES

STD2531 PROBABILITY

Module Title: **PROBABILITY**
Code: **STD2531**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: SSTD2432
Module description: Introduction to probability and life tables ideas; Laws of probability; Conditional probability and independence; probability distributions: the binomial distribution, the Poisson distribution, the normal distribution; using probability ideas in life tables; basic life table computations.

STD2511 STATISTICAL METHODS AND TECHNIQUES

Module Title: **STATISTICAL METHODS AND TECHNIQUES**
Code: **STD2511**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1X3 hour Examination **60%**
Pre- requisite: SSTD2431
Module description: Analysis of Variance: One way and two-ways; Linear models and estimation by least squares: an introduction; measures of association between variables; Hypothesis testing: Test of significance for means; proportions and variance: in small and large samples (dependent and independent samples); Chi-square tests; Calculating Type II Error probabilities and finding the sample size for the Z test; relationships between hypothesis testing procedure and confidence intervals; Significance levels and p-values as ways of reporting results of a statistical test;

EMI2571 BASIC MICROECONOMICS

Module Title: **BASIC MICROECONOMICS**
Code: **EMI2571**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: None

Module description: This module is aimed at introducing students to key concepts used in microeconomics and facilitates a basic understanding of the economic phenomena. The module is designed to help students understand that society's economic choices often involve tradeoffs between efficiency and equity and serves as preparation for students for further study of the discipline with the economics field. The module content includes: an introduction to microeconomics, demand and supply, market structures, factor markets and introduction to international trade.

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Module title: **ENGLISH FOR ACADEMIC PURPOSES**
Code: **LEA3519**
NQF level: 5
Contact hours: 4 periods per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment (**60%**): 2 tests (reading and writing), 1 academic written essay, 1oralpresentation Examination **(40%)**:1x3 hour examination paper
Prerequisites: LCE3419

Module description: This module develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.

STD2552 BASIC DATA PROCESSING

Module Title: **BASIC DATA PROCESSING**
Code: **STD 2552**
NQF Level: 5
Contact Hours: 2 theoretical lectures and 2 practical lectures per week
Number of Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%.** 1x3 hour practical and theoretical Examination
Prerequisites: STD2452

Module Description: Designing a questionnaire, coding, variable definition; transferring data from paper form to electronic files, uses and limitations of a spreadsheet for data entry; organising data in a spreadsheet; Exploratory data analysis for single variables; analysing numeric variables, producing and presenting good tables and graphs, Analysing categorical variables; managing the dataset; organising multiple response data; international standards and guidelines; efficient storage and management of electronic files; cross tabulation and testing for relationships and associations.

STD2512 BASIC DEMOGRAPHY AND EPIDEMIOLOGY

Module Title: **BASIC DEMOGRAPHY AND EPIDEMIOLOGY**
Code: **STD2512**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1 x 3 hours Examination **60%**
Pre- requisite: STD2411

Module description: Meaning of demography. Data sources: census, vital registration and surveys. Nature of demographic data and usual need for very large samples. Data collection problems: frame, non-response and measurement errors. Uses and importance of demographic data. Difficult concepts for data collection and analysis e.g. household and family. Difficult data to elicit e.g. complete fertility histories. Meaning of epidemiology. Data sources, examples and discussion: routine data, cross-sectional surveys, longitudinal and sentinel site studies, research approaches. Introduction to "demographic shorthand" use of algebraic symbols. Absolute vs. relative numbers. Ratio, proportion and rate. Death rates introduced as being conceptually some of the simplest demographic rates. Age-specific death rates. Data sources. Mortality rates. Mention of some other types of rates. Attribute data & its importance in epidemiology. Point and period prevalence. Incidence and relationship to prevalence. Risk, risk factors, comparison of risks. Brief introduction to cohort and case-control studies and basic perceptions of risk therein. Confounding. Direct and indirect standardisation introduced and discussed in context of death rates. Brief mention of other, more general applications of this idea. Age-grouping conventions. Age-misreporting. Disaggregation and its data demands. Reporting detailed data. Introduction to age-period-cohort issues. Construction of a simple life table

STD2532 STATISTICAL MODELLING

Module Title: **STATISTICAL MODELLING**
Code: **STD2532**
NQF Level: 5
Contact Hours: 2 theoretical lectures and 2 practical lectures per week
Number of Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, 1x3 hour Examination **60%**.
Prerequisites: STD2432
Module Description: Simple Linear Regression; Inferences about the regression line; Correlation and the Coefficient of determination; Assumptions underlying regression analysis; Multiple linear regression; Choosing the best model; Predictions from the regression model; analysis of variance for comparing means; analysis of variance with two categorical factors; comparing regressions

EMA2572 BASIC MACROECONOMICS

Module Title: **BASIC MACROECONOMICS**
Code: **EMA2572**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: None
Module description: This module introduces basic concepts and tools used in macroeconomic analysis: the theory, measurement, and determination of national income; business cycles; the multiplier; fiscal policy; budget deficits; and the national debt; aggregate supply and aggregate demand; money, banking, and monetary policy, exchange rates and balance of payments accounts; and stabilization policy for unemployment and inflation.

J.2 DEGREE PROGRAMMES

J.2.1. REGULATION PERTAINING TO THE DEGREE PROGRAMMES

J.2.1.1. ADMISSION REQUIREMENTS

To register for a Bachelor of Science in Statistics or Population Studies (Honours) degree programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification.

English is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum **C** symbol or English as a First Language at NSSC (O level) with a minimum **D** symbol. In addition to the above, admission to the Bachelor of Science in Statisitics or Population Studies (Honours) programme requires at least a symbol **C** on NSSC or equivalent qualification in Mathematics.

A candidate should obtain a minimum of **25** points on the UNAM Evaluation Point Scale in his/her five **(5)** best subjects (of which Mathematics and English must be included) to be admitted to this degree programme (Refer to the **General Admission Criteria for Undergraduate Programmes** in the **General Information and Regulations Yearbook**). Obtaining the minimum number of points, however, **does not necessarily ensure admission as it is based on places available in the programme and is awarded on the basis of merit.** Nevertheless, exemption rules for students who have completed a Diploma in Applied Statistics should apply.

Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the **General Information and Regulations Prospectus**. A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is granted (See the Faculty of Science Admission Requirements).

Please read this section in conjunction with the academic conditions stipulated in the **General Information and Regulations Prospectus**.

J.1.1.2. DURATION OF STUDY

The Bachelor of Science in Statistics or Population Studies (Honours) degree programme cannot be completed in less than four (4) years. However, it must be completed within a period of six (6) years of full-time study, unless special permission is granted for this period to be exceeded.

J.1.1.3. MODE OF DELIVERY

The programmes are offered during the day on full-time basis. Each programme comprises of a total credit of 544 and it is at Namibian Qualification Authority (NQA) level 8.

a) Class Attendance

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark (Refer to the **General Information and Regulations Prospectus**).

b) Practical and tutorials

Attendance of practical and tutorial classes is compulsory for all modules that have these components.

J.1.1.4. ASSESSMENT CRITERIA

Students will be assessed by writing assignments, tests, practicals, projects and examinations. Examinations in particular will be internally moderated for year 1 and year 3 and externally moderated for year 2 and year 4. To qualify for the Examination a student should obtain a minimum of 40% continuous assessment mark and to qualify for the Supplementary/Special Examination a student should have a minimum final mark of 45% with a minimum of 40% from Examination. Examination will be administered at the end of each semester.

J.1.1.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be re-admitted to the Bachelor of Science in Statistics or Population Studies (Honours) degree programme for a particular year of registration, a student must have passed the minimum number of modules as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core,
- 8 modules (equivalent to 144 credits) by the end of the second year,
- 15 modules (equivalent to 240 credits by the end of the third year, and
- 23 modules (equivalent to 368 credits) by the end of the fourth year.

J.1.1.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the modules of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases, prerequisites for modules have to be passed before a student can proceed to register for modules that require prerequisites.

J.1.1.7. MAXIMUM NUMBER OF MODULES PER YEAR

A part-time student can only register for 75% of the prescribed modules in any given academic year. Full-time students can register for all first year modules and thereafter, no more than 10 modules in any academic year.

J.1.1.8. ARTICULATION ROUTE

These qualifications serve as an entry point to the Master of Science in Applied Statistics and Demography when a student graduates with a minimum of a lower second class (60-69% average). In addition, a student joining the Bachelor of Science in Statistics or Population Studies (Honours) degree after completing the Diploma in Applied Statistics from the University of Namibia or any equivalent qualification may be exempted from certain year 1 modules of the degree program. The modules are as follows:

Module passed	Exemption
STD 2511 Statistical Methods	STS 3531 Descriptive Statistics
STD 2531 Probability	STS 3532 Introduction to Probability
STD 2512 Basic Demography and Epidemiology	POP3512 Fundamentals of Population Theory

J.5. STATISTICS AND POPULATION STUDIES NEW CURRICULUM &PREREQUISITES

QUALIFICATION: **B.Sc. (Honours) Statistics**

Students opting for a Bachelor of Science in Statistics (Honours) degree must take all of the following modules:

YEAR 1

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	4	16		None
1	Descriptive Statistics	STS3531	5	16		None
1	Computer Literacy	CLC3509	5	8		None
1	Basic Mathematics	MAT3511	5	16		None
1	Matrices & Complex Numbers	MAT 3521	5	8		None
1	Analytical Geometry	MAT3501	5	8		None
2	English for academic Purpose	LEA3519	5	16		None
2	Contemporary Social Issues	CSI 3580	5	8		None
2	Precalculus	MAT3512	5	16		None
2	Introduction to Probability	STS3532	5	16		None
2	Basic Financial Mathematics	MAF 3532	5	16		None
Total Credits				**144**		

YEAR 2

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	STS3611	6	16	STS3532, SMAT3512	None
1	Statistical Methods	STS3671	6	16	STS3532	None
1	Calculus I	MAT3611	6	16	MAT3512	None
1	Sets and Logic	MAT3601	6	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3621	6	8	MAT3521	None
1	Financial Mathematics I	MAF 3651	6	16	MAF 3532	None
2	Fundamentals of Statistical Computing	STS3652	6	16	STS3531	None
2	Calculus II	MAT3612	6	16	MAT 3512	None
2	Distribution Theory	STS3672	6	16	Co: STS3611, MAT3611	None
2	Elementary Linear Algebra	MAT3652	6	16	Any full Mathematic module at first year and MAT3521	None
Total Credits				**144**		

YEAR 3

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Non-Parametric & Categorical Statistics	STS3741	7	8	None	None
1	Statistical Inference	STS3771	7	16	STS3671	None
1	Sampling Techniques	STS3731	7	16	STS3531	None
1	Linear Algebra I	MAT3711	7	16	MAT 3611 or MAT3612, MAT3601 and MAT3652	None
2	Data processing	STS3732	7	16	Pre: STS3652, Co: STS3771	None
2	Experimental Design and Analysis of Variance	STS3752	7	16	Pre:STS3672, Co: STS3771	None
2	Linear Algebra II	MAT3712	7	16	MAT3611 or MAT 3612, MAT3601 and MAT3652	None
2	Research and Survey Methods	STS3702	7	8	None	None
2	Linear Models	STS3772	7	16	Pre: STS3671, Co: STS3771	None
Total Credits				**128**		

YEAR 4

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Survival Analysis	STS3871	8	16	STS3671	None
1	Operational research	STS3851	8	16	STS3772	None
1	Research Project	STS3810	8	16	Registered as a fourth year students and STS 3732	None
1	Stochastic Processes	STS3831	8	16	STS3672	None
2	Multivariate Distribution Theory	STS3812	8	16	STS3672, STS3771	None
2	Research Project	STS3810	8	16	Registered as a fourth year students and STS 3732	None
2	Time series and forecasting	STS3872	8	16	STS3772	None
2	Statistical Quality Control	STS3832	8	16	STS3672, STS3771	None
Total Credits				**128**		

QUALIFICATION: B.Sc. (Honours) IN Population Studies

Students opting for a Bachelor of Science (Honours) in Population Studies degree must take all of the following modules:

YEAR 1

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	4	16		None
1	Descriptive Statistics	STS3531	5	16		None
1	Computer Literacy	CLC3509	5	8		None
1	Basic Mathematics	SMAT3511	5	16		None
2	English for academic Purpose	LEA3519	5	16		None
2	Contemporary Social Issues	CSI3580	5	8		None
2	Precalculus	SMAT3512	5	16		None
2	Introduction to Probability	STS3532	5	16		None
2	Fundamentals of Population Theory	POP3512	5	16		None
Total Credits				**128**		

YEAR 2

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Official Statistics and National Statistical Systems	POP3631	6	16	None	None
1	Introduction to Demography	POP3611	6	16	None	None
1	Probability Theory	STS3611	6	16	STS3532, SMAT3512	None
1	Statistical Methods	STS3671	6	16	STS3532	None
1	Social Problems: Learning to Conceptualize and Implement Research	HSOG3671	6	16	None	None
2	Fundamentals of Statistical Computing	STS3652	6	16	STS3531	None
2	Epidemiological Methods	POP3612	6	16	None	None
2	Sociology of Development	HSOG3632	6	16	None	None
2	Fundamentals of Population and Development	POP3632	6	16	POP3512	None
Total Credits				**144**		

YEAR 3

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Fundamentals of Data Processing	POP3731	7	16	STS3652	None
1	Sampling Techniques	STS3731	7	16	STS3531	None
1	Geographical Analysis and Techniques	HGIS3711	7	16	None	None
1	Non-Parametric & Categorical Statistics	STS3741	7	8	None	None
1	Demographic Methods I	POP3711	7	16	POP3611	None
2	Geographical Information System	HGIS3732	7	16	Co: HGIS3711, Placement test	None
2	Social Research Methods	HSOG3732	7	16	None	None
2	Demographic Methods II	POP3732	7	16	Pre: POP3611 Co: POP3711	None
2	Linear Models	STS3772	7	16	STS3671	None
2	Research and Survey Methods	STS3702	7	8	None	None
Total Credits				**144**		

YEAR 4

SEMESTER	MODULE	MODULE CODE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Sociology of Gender and Sexuality	HSOS3860	8	8	Admission to the 4th year level	None
1	Research Project	POP3810	8	16	Registered as a fourth year students and POP3731	None
1	Monitoring & Evaluation Techniques	POP 3831	8	16	None	None
1	Survival Analysis	STS3871	8	16	STS3671	None
2	Population Migration and Urbanization	POP 3872	8	16	POP 3732	None
2	Population Projections	POP 3852	8	16	POP 3732	None
2	Research Project	POP 3810	8	16	Registered as a fourth year students and POP3731	None
2	Indirect Estimation	POP3892	8	16	POP3731, POP 3732	None
2	Sociology of Gender and Sexuality	HSOS3860	8	8	Admission to the 4th year level	None
Total Credits				**128**		

J.3. STATISTICS AND POPULATION STUDIES MODULE AND CURRICULUM DESCRIPTIONS

FIRST YEAR MODULES

STS 3531 DESCRIPTIVE STATISTICS

NQF Level 5
Notional Hours 160
NQF Credits 16
Pre-requisite
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Descriptiont: Data types: Categorical versus discrete and Continuous versus numerical; Data sources: Primary versus secondary; Types of measurements: Nominal, ordinal, interval and ratio Scales; Collection and presentation of data: Tabular forms; frequency tables, cross-tabulations (two variables), Graphical methods; bar charts, histogram, pie charts, frequency polygons, stem-and-leaf plots, box and whiskers plot, ogives; Identifying outliers; Measures of central tendency: Mean, median, mode, quartiles; Measures of dispersion: Skewness and kurtosis; variance, standard deviation, range, inter-quartile range.

STS 3532 INTRODUCTION TO PROBABILITY

NQF Level 5
Notional Hours 160
NQF Credits 16
Pre-requisite
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Basic Set theory: Definitions, Venn diagrams, Distributive Law, De Morgan's Law; Counting techniques: permutation and combination; Probability: definition using relative frequency, properties: axioms of probability, random experiments, sample space and events, addition rule, mutually exclusive events, conditional probability, total probability, Bayes Theorem and independence; Random variables: expectations, random vectors, functions of random variables and probability density in discrete and continuous case; Probability distributions: Bernoulli, Binomial, Poisson, Geometric, Uniform, Normal, Binomial and Normal tables.

POP 3512 FUNDAMENTAL OF POPULATION THEORY

NQF Level 5
Notional Hours 160
NQF Credits 16
Prerequisite
Compulsory/Elective Compulsory
Contact hours: 4 lectures per week/14 weeks
Module Description Concepts of population theories; The need for population studies; Pioneers in the discussion of population issues; Development of Demography as a field of study; Definitions of terminologies used in Demography; The genesis of population studies from the mercantilist theories through the Malthusian, Neo-Malthusian theories and Marxist viewpoints, and present-day perspectives; History of population growth culminating in mid-20th century terminologies like population being a time-bomb; Common population theories that have come into being; Part played by such theories in current world affairs; Use of population pyramids and rates and ratios in understanding population structure

SECOND YEAR MODULES

STS 3611 PROBABILITY THEORY

NQF Level 6
Notional Hours 160
NQF Credits 16
Pre-requisite STS3532 and SMATS3512
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 1 hour tutorial per week/14 weeks
ModuleDescription: Random variables: Distribution functions, probability densities and their relationships, basic properties, quantiles of a distribution; Moments of random variables: Moments of random variables, Expectations and variances of random variables, Expectations of a function of random variables Moment generating functions of random variables; Discrete probability distributions: Binomial, Poisson, Geometric, Hypergeometric, Negative binomial. Expectations and variances of selected discrete probability distributions; Continuous random variables and their probability distributions: Uniform, Exponential, Normal. Expectations and variances of selected continuous probability distributions; Approximation of distributions: Binomial to Poisson, Binomial to Hypergeometric, Binomial to normal, Poisson to normal, Covariance and correlation; Bivariate and multivariate probability distributions: Marginal and Conditional probability distributions, Independent random variables; Convergence in probability and distribution: Law of large number, Central Limit Theorem.

STS 3671 STATISTICAL METHODS
NQF Level 6
Notional Hours 160
NQF Credits 16
Pre-requisite STS3532
Compulsory/Elective Compulsory
Contact hours 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Sample statistics and sampling distributions: Sampling distributions related to the Normal distribution, the Central Limit Theorem; Estimation of parameters: Point estimation; Confidence intervals: for means, proportions, difference in means and proportions; Properties of estimators: unbiased, minimum variance estimators, mean square error, and some common unbiased point estimator; Efficiency: relative efficiency, full efficiency and Cramer-Rao Lower Bound, sufficiency and the Rao-Blackwell theorem; Large sample properties: consistency; Method of Estimation: the Method of Moments, the method of least squares, the Method of maximum Likelihood, Bayesian estimation; Nonparametric methods: Robust estimation, Bootstrap.

MAT 3602 SETS AND LOGIC

NQF Level 6
Notional Hours 80
NQF Credits 8
Pre-requisite SMAT3511
Compulsory/Elective Compulsory
Contact hours 2 lectures plus 1 hour tutorial per week/14 weeks
Module Description Basic logic: propositions and predicates. Conjunction, disjunction, negation, implication, contrapositive, equivalence. Elementary methods of proof: direct, contrapositive, contradiction. Sets: symmetric difference of two sets, de Morgan's laws, power set, partition, Cartesian product, definition of a binary relation, functions as binary relations, order relations. Real numbers: natural numbers, integers, positional number systems. The Principle of Mathematical Induction.

STS 3652 FUNDAMENTAL OF STATISTICAL COMPUTING

NQF Level 6
Notional Hours 160
NQF Credits 16
Pre-requisite STS3531
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 3 hour practical per week/14 weeks
Module Description: Introduction to statistical packages: SPSS, Excel for analysis, Stata; Data acquisition and management: Transferring information from paper form to electronic Form; Create datasets: variable definition, variable labels, data entry, data cleaning, selecting cases, split files. Import/copying files, tables from excel, SPSS to word; Data Analysis: Descriptive statistics; Graphical representation-editing, cross tabulation, estimation and hypothesis testing using a statistical package.

STS 3672 DISTRIBUTION THEORY

NQF Level 6
Notional Hours 160
NQF Credits 16
Co-requisite STS3611 and SMAT3611
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Further probability distribution functions: Bivariate Normal, Gamma, Chi-square, Beta, F and t distributions. Moments of Bivariate Normal, Gamma, Chi-square, Beta, F and t distributions; Functions of random variables: Sum, difference, product and quotient; Methods of Distribution functions: distribution of minimum and maximum, sum and differences, products and quotients; Method of Transformations: probability integral transform, transformation of discrete r.v.s, transformation of continuous r.v.s; Method of Moment-generating functions and related generating functions (characteristic functions, factorial moment generating functions of random variables): sum of independent random variables; Sampling and limiting distributions: Sample mean, sampling from normal distribution: t and F distributions; Mixture and hierarchical distributions; Order statistics and their functions.

POP 3631 OFFICIAL STATISTICS AND NATIONAL STATISTICAL SYSTEM

NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hours: 4 lectures per week/14 weeks
Module Description: Explain the Purpose and scope of official statistics; Explain and discuss structure and work of the National Statistical System, its Organization, methods and practices of data collection and dissemination of Official Statistics; Social Statistics: Define educational levels, purpose, principles and procedures with respect to education statistical data collection, Understand and appreciate data requirement for educational development purposes, Understand and appreciate various rate and ratios required for analysis of statistics on teacher and pupils: Understand definition and scope of health related statistical issues, Understand statistics on medical facilities and uses of hospital records, Comprehend basic ideas of epidemiological issues and indicators of health, Understand and define scope of housing statistics, Understand the importance of statistics related to: definition of a dwelling unit, housing condition, housing needs requirements, Understand labour and employment statistics: Explain how the following statistics are defined and calculated: labour force, economically active and inactive population, employment rates etc, Understand the importance of statistics on wages, labour income, social security, underemployment etc; Understand the importance of: Trade statistics, Migration statistics, Civil registration statistics, Economic statistics; Concept and measure of poverty; Poverty line: Economic growth versus population growth; System of national accounts (SNA): Explain the importance of compiling national accounts; Explain the uses of national accounts in socio-economic planning; Millennium Development Goals (MDGS); National Development Goals (NDP).

POP 3611 INTRODUCTION TO DEMOGRAPHY

NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hours: 4 lectures per week/14 weeks
Module Description: Population trends: Demographic transition theory, Population trends in the world and Namibia in particular, Population size and composition, World population conferences; Population change: Components of population change, the population balancing equation, Decomposition and synthesis of demographic components to explain or to estimate population change; Fertility: Definitions and key concepts in fertility, Sources of data for fertility analysis, Levels, trends and differentials of fertility, Major macro level fertility theories and models, Micro level perspectives of fertility, Economic, psychological; socio-cultural explanations of fertility levels, Recent changes in fertility patterns in developing countries, Fertility policies and programmes; Mortality: Definitions and key concepts in mortality, Sources of data for mortality analysis, Levels and trends of mortality, Differentials and Determinants, Recent changes in mortality levels and patterns in developing countries, Mortality policies and programmes in developing countries, Emerging and re-emerging diseases and their effects on mortality patterns, Impact of HIV; Migration: Definitions and key concepts in migration, Migration theories, Description and explanation to migration patterns, Consequences of migration at place of origin and place of destination.

SOG 3671 SOCIAL PROBLEMS: LEARNING TO CONCEPTUALIZE AND IMPLEMENT RESEARCH

NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hours: 4 lectures per week/14 weeks
Module Description: The course resumes the methodological training introduced into the sociology curriculum with the 1st year course "Basics of Sociology". It familiarizes the student with the use of social science research methods to identify, formulate, and study social problems (class, poverty and inequality; gender inequality; crime and violence; alcohol and substance abuse; HIV/AIDS and other health issues; environmental problems etc). At lower intermediate level, the course is the second in a sequence of three Courses aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation. Practical acquaintance with the field, however, will be reserved for a further course at upper intermediate level, in the following year of studies.

SOG 3632 SOCIOLOGY OF DEVELOPMENT

NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hours: 4 lectures per week/14 weeks
Module Description: Key theories, themes and case studies on social and economic development will be introduced to the student with the intention of explaining the causes of underdevelopment and alternatively, successful development; Classical, modernization, dependency, organisational, regulationist and post-material theories will be critically examined; Historical dimensions of development will be included in relation to: rise of industrial societies, colonial impacts, the emergence of the global economy; Themes will be: measuring development and poverty, international aid, Asian economies including China, population, urbanisation and migration, politics and development, NGO and inter-governmental assistance, sustainable development; These will be: applied to Namibian contexts, including explanations and solutions of restricted development in the African continent. Group work will be undertaken.

POP 3632 FUNDAMENTAL OF POPULATION AND DEVELOPMENT

NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite POP3512
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Examination of the relations between population and development and their potential consequences from a sociological, economic and geographical perspective; Global variation in population size and growth; Various demographic perspectives and their modern implications; Environmental impacts and population policy; Conceptual framework for development planning: Overview of the framework, institutions and principal variables; Economic-demographic interaction, Effects of population change on socio-economic variables (Supply of goods and services; demand for goods and services, distribution of income), Effects of socio-economic change on demographic variables (fertility (marriage), mortality, migration); Gender and Development; Health and Development; Social change and Development; Culture and Development; Measuring Development.

POP 3612 EPIDEMIOLOGICAL METHODS

NQF Level	6
Notional Hours	160
NQF Credits	16
Prerequisite	None
Compulsory/Elective	Compulsory
Contact hours:	4 lectures plus 3 hour practical per week/14 weeks

Module Description: Scope of Epidemiological enquiry: Overview of main problem areas; Measuring occurrence of disease: Incidence, Prevalence, Choice of measure, Comparing rates, Standardization; Studying association between risk factors and disease: Which type of studies Ecological and migrant studies; Clinical trials: Non-randomized design, Randomization, Randomized designs: Parallel and Cross-over designs; Case control design: Advantages and Disadvantages recruitment of cases and controls. One or two control groups, Matched case control design, reasons for matching: advantages and disadvantages relative to unmatched studies; Cohort (prospective) studies: advantages and disadvantages. Selection of subjects for cohort (longitudinal studies); Cross-sectional studies design: Advantages and disadvantages; Identification of the population (Representativeness, Access, Data accuracy, Study size). Use of cross-sectional population surveys to assess incidence; Combination of study designs: Nested cohort design; Which measure of association? Measures of association and impact: risk difference, relative risk and odds ratio, Attributable risks; Bias: Selection and information bias, effects of the various forms of bias on estimation; Confounding and effect modification: its determination and control.

THIRD YEAR MODULES

STS 3741 NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS

NQF Level	7
Notional Hours	80
NQF Credits	8
Pre-requisite	None
Compulsory/Elective	Compulsory
Contact hours:	2 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Goodness of fit tests: Chi- square test, Kolmogorov – Smirnov test; Nonparametric statistics, nonparametric tests: Median tests, Sign test, Wilcoxon Signed Rank test, Mann – Whitney U test, Kruskal – Wallis H test, Friedma's test, Spearman Rank Correlation test; Contingency tables: inferences for two way contingency tables: chi-square tests of independence, comparing proportions: difference in proportions, odds ratio and risk ratio; Trend test, Test for correlated contingency table; Summary measures of association: binary variables: phi and Cramer's V; ordinal measure of association: Kendall's tau, Goodman and Kruskal's gamma, Somer's d; nominal measures of association; Summary measures of agreement: kappa; Models for a binary and count response variable: Logistic regression and log linear models.

STS 3731 SAMPLING TECHNIQUES

NQF Level	7
Notional Hours	160
NQF Credits	16
Pre-requisite	**STS3531**
Compulsory/Elective	Compulsory
Contact hours:	4 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Data collection methods: probability and non-probability methods. Response and non-response errors. Estimation of population mean, population total, population proportion and population variance. Sample size allocation in: simple random sampling (with and without replacement), stratified random sampling, systematic sampling, cluster sampling (two-stage), quota sampling, judgemental sampling, and snowball sampling. Calculation of sampling and Non-sampling errors.Confidenceinterval.Weighting.

STS 3771 STATISTICAL INFERENCE

NQF Level	7
Notional Hours	160
NQF Credits	16
Pre-requisite	STS3671
Compulsory/Elective	Compulsory
Contact hours:	4 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Hypothesis testing: Test of significance for means; proportions and variance: in small and large samples (dependent and independent samples); Chi-square tests; Calculating Type II Error probabilities and finding the sample size for the Z test; relationships between hypothesis testing procedure and confidence intervals; Significance levels and p-values as ways of reporting results of a statistical test; Testing hypotheses concerning variances; power of tests and the Neyman-Pearson Lemma; Likelihood Ratio Tests. Linear models and estimation by least squares: an introduction; measures of association between variables.

STS 3732 DATA PROCESSING

NQF Level 7
Notional Hours 160
NQF Credits 16
Pre/Co-requisite Pre: STS3652 and Co: STS3771
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 3 hour practical per week/14 weeks
Module Description: Applications of inferences concerning means and proportions to data; Parametric tests: t- test, Chi-Square Goodness of Fit and Independence tests, ANOVA tests and Post- hoc tests; Testing for Assumptions: Kolmogorov-Smirnov test for Normality, Levene's tests for Equality and Homogeneity of Variance; Nonparametric tests: Binomial test, Sign Test, Wilcoxon Signed- Ranks test, Mann- Whitney Test, Kruskal – Wallis test, Friedman's test, Spearman Rank Correlation test; Application of Simple Linear Regression (modelling) to Data; Mini project.

STS 3702 RESEARCH AND SURVEY METHODS

NQF Level 7
Notional Hours 80
NQF Credits 8
Pre-requisite None
Compulsory/Elective Compulsory
Contact hours: 2 lectures per week/14 weeks
Module Description: Formulation of: Research problem, Research questions, Research hypotheses, Research questions, research hypotheses; Methods of collecting data: Methods that can be applied in data collection (e.g. primary versus secondary data), The need for sampling versus conducting a census, Sampling techniques and their advantages and disadvantages, Ethical issues in research, Possible sources of errors in survey work, Necessity of pilot surveys prior to actual data collection work, Characteristics of a good questionnaire, Methods of administering a questionnaire, Advantages and disadvantages of various methods of administering a questionnaire; Data processing: Data cleaning, How to deal with non-responses, Coding, Choice of techniques to summarise data, Analytical tools to employ for qualitative and quantitative research; Report writing: Scientific language in report writing, Essential components of a research Report, Citing other works versus plagiarism.

STS 3772 LINEAR MODELS

NQF Level 7
Notional Hours 160
NQF Credits 16
Pre/Co-requisite Pre: STS3671 and Co: STS3771
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 3 hour practical per week/14 weeks
Module Description: Linear models and estimation: fitting a simple linear model, multiple regression; Inference: statistical inference of linear models; Regression analysis: Polynomial and nonlinear regression, Residual analysis, Multicollinearity and its effects; Diagnostics and remedial measures; Model building: Enter method, Stepwise procedure, Backward procedure, Forward method; Model validation.

STS 3752 EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE

NQF Level 7
Notional Hours 160
NQF Credits 16
Co-requisite STS3771
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practical per week/14 weeks
Module Description Experimental designs: Factorial designs, Latin squares design, Graeco-Latin squares design; Analysis of Variance: One-way ANOVA, Two-way ANOVA; Multiple comparisons: Multiple comparison methods; Incomplete designs and missing values: Analysis involving incomplete tables missing observations.

STS3731 SAMPLING TECHNIQUES

NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite STS3531
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Data collection methods: probability and non-probability methods. Response and non-response errors. Estimation of population mean, population total, population proportion and population variance. Sample size allocation in: simple random sampling (with and without replacement), stratified random sampling, systematic sampling, cluster sampling (two-stage), quota sampling, judgemental sampling, and snowball sampling. Calculation of sampling and Non-sampling errors. Confidence interval. Weighting.

POP3731 FUNDAMENTAL OF DATA PROCESSING

NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite STS3652
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practical per week/14 weeks

Module Description: Introduce students to parametric and non-parametric tests; Introduction to regression analysis: Linear regression and Correlation; Explaining the relationship between variables using a Scatter plot; Fitting a simple linear regression model and test of hypothesis for regression coefficient; Testing the association between variables using the correlation analysis; Introducing multiple linear regression analysis: model selection techniques: forward, backward, stepwise; categorical variables in regression; Generalized Linear models: parameter estimation, interpretation; Logistic regression analysis: parameter estimation; interpretation of odds ratio; estimated probabilities.

GIS3711 GEOGRAPHICAL ANALYSIS AND TECHNIQUES

NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hour: 4 lectures per week/14 weeks

Module Description: This course introduce students to concepts, methods and techniques in Geography; methodological paradigms in Geographical Research and problem formation and research design, that seek to provide an understanding about the complexity that implies the generation of scientific knowledge. It also introduces students to the nature of cartography that focuses on the nature of geographical data and, more specifically, the transformation of spatial and non-spatial data into different forms of media such as maps, aerial photographs or satellite images. Other contents includes: map compilation & interpretation, basic Geodesy, map projection and spatial statistics.

STS3741 NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS

NQF Level 7
Notional Hours 80
NQF Credits 8
Pre-requisite None
Compulsory/Elective Compulsory
Contact hour: 2 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Goodness of fit tests: Chi- square test, Kolmogorov – Smirnov test; Nonparametric statistics, nonparametric tests: Median tests, Sign test, Wilcoxon Signed Rank test, Mann – Whitney U test, Kruskal – Wallis H test, Friedma's test, Spearman Rank Correlation test; Contingency tables: inferences for two way contingency tables: chi-square tests of independence, comparing proportions: difference in proportions, odds ratio and risk ratio; Trend test, Test for correlated contingency table; Summary measures of association: binary variables: phi and Cramer's V; ordinal measure of association: Kendall's tau, Goodman and Kruskal's gamma, Somer's d; nominal measures of association; Summary measures of agreement: kappa; Models for a binary and count response variable: Logistic regression and log linear models.

POP3711 DEMOGRAPHIC METHODS I

NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite POP3611
Compulsory/Elective Compulsory
Contact hour: 4 lectures per week/14 weeks

Module Description: Sources and types of demographic data: Population census, sample surveys, vital registration, population register, non-traditional sources (parish register, administrative records), international sources; Uses and limitations of demographic data; Availability of population data in sub-Saharan Africa; Evaluation of demographic data: Errors in demographic data and techniques of detecting these errors, Data adjustment techniques, Techniques of estimating population size and composition; Understanding the concepts of the Basic demographic methods: the balancing equation; Demographic measures: Dependency ratio, Age and economic dependency ratios and their implications, Estimation and measurements of basic Demographic parameters: fertility, mortality and migration

GIS3732 GEOGRAPHICAL INFORMATION SYSTEMS

NQF Level 7
Notional Hours 160
NQF Credits 16
Co-requisite HGIS3711, Placement test
Compulsory/Elective Compulsory
Conatct hour: 4 lectures per week/14 weeks

Module Description: This course introduces students to various basic concepts of geographical information systems, examining both local and global GIS trends. Topics includes: introduction to GPS, projection and distortions, basic and practical understanding of GIS concepts, techniques and real world applications; utilization of GIS in the larger context of geography and other applications; basic concepts of geography necessary to efficiently and accurately use GIS technology; GIS data models and concepts.

POP3732 DEMOGRAPHIC METHODS II

NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite Pre: POP3611, C0: POP3711
Compulsory/Elective Compulsory
Contact hour: 4 lectures per week/14 weeks

Module Description: Measurements of Mortality: CDR, ASDR, (q-type and m-type mortality rates); Standardization: standardized death rate, standardized mortality ratio, standardized fertility ratio, standardized birth rate; Understanding the Lexis chart; Frameworks and models for mortality analysis; Measurements of fertility: CBR, ASFR, TFR, Period and Cohort analysis of fertility Parity progression; Explaining the determinants of fertility; Frameworks and models for fertility analysis; Understanding the Life table: the theory of the life table, abridged life tables, multiple decrement life tables; Mortality Models - UN model Life Tables, Coale and Demeny regional model life tables, Ledermann's and Brass logit life tables etc.

SOG3732 SOCIAL RESEARCH METHODS

NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hour: 4 lectures per week/14 weeks

Module Description: This module is designed to introduce students to the application of social research. The students will acquire fundamental knowledge and understanding of the concepts and techniques of social research and will develop the ability to apply their acquired skills to practical social research. The course covers basic research concepts and theoretical debates that underlie different research approaches. The topics include among others; basic concepts and philosophical models of research, the role of theory in research, types of research, research model, reliability and validity, measurements, index scale and construction, sampling and methods of data collection and data analyses.

FOURTH YEAR MODULES

STS3851 OPERATIONAL RESEARCH

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite **STS3772**
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Decision Analysis: Types of decision problems; Decision-making under uncertainty: basic concepts; Ways of expressing outcomes: Payoffs and opportunity losses, Characterizing the uncertainty in decision problems, Solving decision problems using the expected payoff criterion and the expected utility criterion, Classifying decision makers by their utility functions; Revising state of nature probabilities: Decision trees; Bayes' rule: solving decision problems using posterior probabilities; Deterministic EOQ Inventory models; Introduction: type of inventory models, costs involved, Assumptions, Basic Economic Order Quality model: assumptions, derivation, determination of EOQ when holding cost, the effect of a non-zero lead time, power-of-two ordering policies; Probabilistic inventory models: Basic concepts: single-period models, the concept of marginal analysis, Discrete versus continuous demands; Deterministic dynamic programming (Network models): Basic concepts; Network models: minimal-spanning tree technique, maximal-flow technique, shortest-route technique.

STS3831 STOCHASTIC PROCESSES

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite SSTS3672
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Conditional Probability and conditional expectations; Elements of Stochastic Processes: Definition, Stationarity, finite –dimensional distributions, versions and modification; Markov Chains in discrete time and Markov Chains in continuous time: The basic limit theorem of Markov chains and applications, Classification of states, Limiting probabilities, Branching processes; The Poisson Processes: Counting process, Compounding stochastic processes Queuing processes; Gaussian distribution: for variables, vectors and processes; Brownian motion and Branching Processes: Definition, Gaussian construction, independence of increments Geometric Brownian motion, Brownian Bridge and Ornstein-Uhlenbeck process.

STS 3810 RESEARCH PROJECT

NQF Level 8
Notional Hours 320
NQF Credits 32
Pre-requisite Registered as a fourth year students and STS 3732
Compulsory/Elective Compulsory
Contact hour: 2 lectures per week/28 weeks
Module Description:: A final year project on a selected topic demonstrating the applications of relevant statistical methods culminating in a project report. The module runs throughout the two semesters. Students work under supervision of a member of the academic staff of the department. When possible students may be attached to relevant industries/institutions and so on.

STS 3871 SURVIVAL ANALYSIS

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite STS3671
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 1 hour tutorial per week/14 weeks
Module Description: Concepts in Survival Analysis; Nature of survival data: common assumptions, censoring and truncation, Calendar time and study time; Functions that describe survival: some commonly used survival functions, fully parametric and nonparametric methods; Introduction to standard statistical software for analysing time-to-event data; Survival curves: Lifetables, Kaplain-Meier curves, Why linear or logistic curves won't work; Comparison of survival curves: Log-rank test-Use and assumptions; Design issues in time-to-event data: Designing time to event studies, Choice of end-point; Sample size calculation; Parametric survival modelling; Types of models: Exponential, Weibull, Lognormal and loglogistic models; Testing parameters: likelihood ratio test, Wald test and Akaike Information criteria; Cox's Regression models; Proportional hazard models, Hazard ratios, risk and survival times, Hypothesis test and confidence intervals, Binary and Continuous predictors, Interaction/confounding/Mediation, Adjusting survival curves for comparison.

STS 3812 MULTIVARIATE DISTRIBUTION THEORY

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite **STS3672 and STS3771**
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Basic matrix theory: Basic concepts of matrix theory such as their operations, rank and inverse, special matrices and their properties; Multivariate Normal Distribution: Definition and properties of multivariate normal Distribution, Moment-generating function of multivariate normal variate; Moments: population mean vector and covariance matrix; Marginal and conditional distribution in multivariate context, Quadratic forms in relation to chi-square distribution; Transformations: Random VectorsEstimation of the population and covariance matrix; Inference about the mean vectors: one or two samples cases: Hotelling's T^2 - statistic and tests on the mean vector if the covariance matrix is unknown, Test on the mean difference between two means from independent multivariate normal distributions when the covariance matrix is known (i.e. Chi-square statistic) and it is unknown (i.e. F -statistic); Correlation: Estimation of population mean vector and correlation matrix, Distribution andtests associated with the Pearson correlation coefficient.

STS 3872 TIME SERIES ANALYSIS AND FORECASTING

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite STS3772
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practical per week/14 weeks

Module Description: Components of time series: Long-term trend, Seasonal variations, Cyclical variations, Irregular variations; Time series Models: Multiplicative models, Additive models; Trend Analysis: Method of least squares, Method of moving average; Measuring seasonal effect: Specific seasonal indices, Typical seasonal indices; Measuring cyclical effects: Residual method; Smoothing techniques; The Forecasting Context: Basic Forecasting Tools, Time Series Decomposition, Exponential Smoothing Methods, Simple Regression, Multiple Regression, The Box-Jenkins Methodology for ARIMA Models; Advanced Forecasting Models: Regression with ARIMA Errors, Dynamic Regression Models, Intervention Analysis, State Space Models, Neural Networks, Forecasting the Long-term, Mega trends, Analogies, Scenarios, Judgmental Forecasting and Adjustments, Accuracy of Judgmental Forecasts; Judgmental Biases and their Limitations; Combining Statistical and Judgmental Forecasts; Using Forecasting Methods in Practice; Implementing Forecasting: uses, advantages, and Limitations.

STS 3832 STATISTICAL QUALITY CONTROL

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite STS3672 and STS3771
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practicall per week/14 weeks

Module Description: Quality improvement in modern Business: Dimensions of quality, Quality philosophy and management strategies: Total quality, Quality standards and Registrations, Six sigma; Statistical Methods used in Quality improvements: Describing variation, Important distribution of note, Inference about Process Quality; Methods and philosophy of Statistical Process Control: Chance and assignable cause of Quality variation, statistical basis of control charts: sample size and sampling, rational subgroups, analysis and patterns on control charts, rules for control charts; Control charts for variables: Simple control charts for variables, charts for individual measurements, Operating characteristic functions, application; Control charts for attributes: Properties of charts, charts for fraction nonconforming, charts for nonconformities (defects), choice between attributes and variable control charts; Process and measurement system capability analysis: Process capability ratios, Process capability using a control chart, Gage and measurement system capability studies, setting specification limits, estimating natural tolerance limits of a process; Cumulative sum and exponentially weighted moving average control charts: Principle of Cusum charts, EWMA charts.

SOS 3860 SOCIOLOGY OF GENDER AND SEXUALITY

NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite Admission to the fourth year level
Compulsory/Elective Compulsory
Contact hour: 4 lectures per week/14 weeks
Module Description: Testing sociological theories of structuralist orientation and of agency, the module will exemplify both approaches: the ways in which societies socialize individuals into gendered identities and roles and the ways in which individuals appropriate and re-construct them; Sociological schools in the conceptualization of gender, i.e. origins of biological sex, origins and strands of feminism; Feminist analysis of Namibian society, women's movement in Namibia; Sexuality i.e. sexual identities, sexual cultures, sexual rights, friendship and intimate relationship; Reproductive health and HIV/AIDS, safe motherhood, contraception, abortion; Concepts of masculinity, construction of masculinities in Namibian society, masculinity and gender-based violence; Gender policies and developmental organizations in Namibia, i.e. Women in Development (WID), Women and development (WAD), Gender and Development (GAD), policy approaches of state and civil society; Gender and economy, i.e. poverty, empowerment, labour market and work place, gender division of labour, job and salary discrimination; Gender and culture, i.e. education, media, cultural traditions and commodified culture; Gender and social culture, i.e. gender stratification, gender and class; Gender and politics, i.e. women and power, women in politics, the legal framework for the promotion of gender equality.

POP 3831 MONITORING AND EVALUATION TECHNIQUES

NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite None
Compulsory/Elective Compulsory
Contact hour: 4 lectures per week/14 weeks
Module Description: Definitions and Concepts: Monitoring, evaluation; Types and Methods; Familiarizes students in different types of program evaluation, including needs assessment, formative research, process evaluation, monitoring of outputs and outcomes, impact assessment, and cost analysis; Students gain practical experience through a series of exercises involving the design of a conceptual framework, development of indicators, analysis of computerized service statistics, and development of an evaluation plan to measure impact; Covers experimental, quasi-experimental, and non-experimental study designs, including the strengths and limitations of each.

POP 3892 INDERECT ESTIMATION

NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite POP3732 and POP3731
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practical per week/14 weeks
Module Description: Definition of indirect techniques in demographic estimation, Need for indirect estimation; Demographic Models: Estimation of fertility based on information on children ever born; Estimation of adult survivorship probabilities from information on orphanhood and widowhood; Estimation of child mortality from information on children ever born and children surviving.

POP 3852 POPULATION PROJECTIONS

NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite POP3732
Compulsory/Elective Compulsory
Contact hour: 4 lecture per week/14 weeks
Module Description: Introducing population projection, the need for population forecast, Basic methods of population projection and applications, the mathematical method, the limitations of the mathematical method; The component method of population projection: the principles of the method, the details of the method, the use of broader age groups, data requirements; Population projections in the Namibian context.

POP 3872 POPULATION MIGRATION AND URBANIZATION

NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite POP3732
Compulsory/Elective Compulsory
Contact Hours 4 lectures per week/14 weeks

Module Description: Definition and terminologies in migration studies; International migration: Sources of data, quality of statistics; Evaluation and estimation of international migration; Intercensal component method; Intercensal cohort – component method; Net migration, gross migration (migration turnover) and migration ratios; Migration rates: crude immigration rate, Crude emigration rate, Crude net migration rate, Crude gross migration rate; Contribution of migration to population change; Graphic techniques of analysis (population turnover); Life-time migration; Migration streams and counter streams; Return migration; Longitudinal migration; Bases of migration rates; Sources of migration statistics; Measurement of mobility; National growth rate method; Residual methods; vital statistics method; Residual method: survival rate method, Place of birth vs place of enumeration statistics, Residence at a fixed past date; Migration selectivity: by sex, by age, by educational level etc. Causes of migration, Ravenstein'spush and pull theory; Lee's Intervening Obstacles theory; Other theories; Other consequences of migration at the place of origin and at the place of destination. Internal migration (Namibian context); Urbanization – Trend: levels and patterns, Modernization theory and urbanization, Linkages between migration and urbanization, Manifestation of urbanization and challenges faced by urban centres due to rapid urbanization.

POP 3810 RESEARCH PROJECT

NQF Level 8
Notional Hours 320
NQF Credits 32
Prerequisite Registered as a fourth year students and POP3731
Compulsory/Elective Compulsory
Contact hour: 2 lectures per week/28 weeks

Module Description: A final year project on a selected topic demonstrating the applications of relevant demographic and statistical methods culminating in a project report. The module runs throughout the two semesters. Students work under supervision of a member of the academic staff of the department. When possible students may be attached to relevant industries/institutions etc.

J.5. SERVICE MODULES

STS 3522 INTRODUCTION TO STATISTICS

NQF Level 5
Notional Hours 80
NQF Credits 8
Pre-requisite Faculty entry requirements
Compulsory/Elective Compulsory
Contact hour: 2 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Terminologies used in statistics; Populations and samples as sources of data; The need for sampling; Probability and non-probability sampling techniques; Summarising data using frequency distributions and graphs; Computation of descriptive statistics for ungrouped and grouped data; Use of the scientific calculator.

STS 3621 STATISTICS FOR LIFE SCIENCE I

NQF Level 6
Notional Hours 80
NQF Credits 8
Pre-requisite STS 3522
Compulsory/Elective Compulsory
Contact hour: 2 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Tests of Hypotheses: one sample and two sample cases for dependent and independent samples; Confidence Intervals. Linear regression and correlation. Test of Significance of regression and Correlation coefficients; Predictions using regression models.

STS 3622 STATISTICS FOR LIFE SCIENCE II

NQF Level 6
Notional Hours 80
NQF Credits 8
Pre-requisite STS 3522
Compulsory/Elective Compulsory

Contact hour: 2 lectures plus 1 hour tutorial per week/14 weeks

Module Description: Design of Biological Experiments: Choice of factors, sampling units, Analysis of variance: One- and two-way. Selecting samples, replications. Nonparametric tests: Sign test, Mann- Whitney U- test, Wilcoxon- Signed Ranks test, Spearman rank correlation test, Kruskal – Wallis H – test, Friedman's test; Use of Chi- square test for independence and goodness of fit. Tests for normality should be included Shannon-Wiener index.

J.6. MSC APPLIED STATISTICS AND DEMOGRAPHY (11MSST)

J.6.1. DEPARTMENTAL REGULATIONS

J.6.1.1. ADMISSION REQUIREMENTS

The MSc Programme in the Department of Statistics will require a minimum of a BSc, with a Statistics or Population studies Major, in the lower second class division (60-69%) or an equivalent qualification.

J.6.1.2. DURATION OF STUDY

The Master of Science in Applied Statistics and Demography cannot be completed in less than two (2) years. The programme must be completed within three (3) years of full-time study.

J.6.1.3. CURRICULUM COMPILATION

The curriculum for the MSc Applied Statistics and Demography consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

FIRST YEAR MODULES

First Semester
UAE5819 Advanced Academic Writing for Post Graduate Studies
STM5911 Research Design and Methodology
STM5921 Population and Development
STM5951 Statistical Computing

Second Semester
STM5912 Generalized Linear models
STM5932 Multivariate Data Analysis
STM5922 Monitoring and Evaluation
STM5952 Demographic Analysis

SECOND YEAR MODULES
STM5900 MSc Thesis

J.6.1.4. EXAMINATION REGULATIONS

If a student fails the first semester module he/she may proceed to the next semester. However he/she must repeat the module in the following year. A minimum of 50% is required to pass each module.

J.6.1.5. PRACTICALS

All practicals are compulsory.

J.6.2. MODULES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: MSc Applied Statistics and Demography (11MSST)

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Research Design and Methodology	STM5911	24		None
1	Population and Development	STM5921	12		None
1	Statistical Computing	STM5951	24		None
1	Advanced Academic Writing for Postgraduate Studies	UAE5819	24		None
2	Generalized Linear models	STM5912	24		None
2	Multivariate Data Analysis	STM5932	24		None
2	Monitoring and Evaluation	STM5922	24		None
2	Demographic Analysis	STM5952	24		None
Total Credits			**180**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1 & 2	MSc Thesis	STM5900	120	Passed all first year modules	None
Total Credits			**120**		

FIRST YEAR MODULES

FIRST SEMESTER

UAE5819 ADVANCED ACADEMIC WRITING FOR POST GRADUATE STUDIES

Module Title: **ADVANCED ACADEMIC WRITING FOR POST GRADUATE STUDIES**
Code: **UAE5819**
NQF Level: 9
Contact hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 24
Module Assessment: CA: (1 x 3 hour exam paper)
Prerequisites: Must be a postgraduate student.
Content: This module is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

STM5911 RESEARCH DESIGN AND METHODOLOGY

Course title: **RESEARCH DESIGN AND METHODOLOGY**
Course Code: **STM5911**
NQF Level: 9
Contact hours: 4 lectures per week for 14 weeks
NQF Credits: 24
Module Assessment: Continuous assessment **(50%);** 1x3 hour examination paper **(50%)**
Pre-requisites: Admission Requirements
Content: Types of research; Formulation of a research problem: identification of researchable topics, formulation of objectives, problem statement, research questions, hypotheses etc; Literature review: citation and referencing, plagiarism, Research designs: Sample Surveys, Censuses, Experiments, desk review, etc Research methodology: target population, units of enquiry, sampling designs, data source and collection methods, measurement instruments, questionnaire design principles, piloting research tool, field administration, Data management (Understanding and measuring survey quality (process quality and outcome quality; data quality; total survey error and classification of sources of errors; reliability and validity); Data analysis methods; Ethical considerations; Developing a research proposal; Report writing: structure, language, presentation of figures and tables, interpretation of results; Writing modules: Microsoft Word, Latex, etc; Appropriate communication skills: design of presentation materials, presentation skills.

STM 5921 POPULATION AND DEVELOPMENT

Course title: **POPULATION AND DEVELOPMENT**
Course Code: **STM592**1
NQF Level: 9
Contact hours: 2 lectures per week for 14 weeks
NQF Credits: 12
Module Assessment: Continuous assessment **(50%);** 1x2 hour examination paper **(50%)**
Prerequisites: Admission Requirements
Content: Population trends: world trend, levels and differentials; implication of fertility and mortality; the role of migrationin world population trends; demographic-economic interrelationship; the world population "explosion" "momentum"; marriage trends and the birth rate contemporary marriage trends in the West. Determinants and consequences of population trends; Causes and consequences of world demographic change. Population Policies and Development: development theory and policy, relationships between economic and demographic growth, effectiveness of population policies; Sexual and reproductive health programmes and policies; the 1965, 1969, 1974, 1984, and 1994 World Population Conferences. HIV epidemic in Africa and its impact on populations. , the socio-economic consequences of HIV/AIDS; migration and urbanization; Demographic inputs for development: Integration of demographic variables into sectoral and regional/local planning, Design and evaluation of population projects and programs with emphasis on decentralization

STM5951 STATISTICAL COMPUTING

Course title: **STATISTICAL COMPUTING**
Course Code: **STM5951**
NQF Level: 9
Contact hours: 4 lab based lectures per week for 14 weeks
NQF Credits: 24
Module Assessment: Continuous assessment **(50%);** 1x3 hour examination paper **(50%)**
Pre-requisites: None
Content: Introduction to statistical and demographic software; Data entry (Database creation, variable definition, etc); Manipulation and management of data; Summarizing data numerically and graphically; Statistical procedures including formal tests of hypotheses of interest

SECOND SEMESTER

STM5952 DEMOGRAPHIC ANALYSIS

Course title: **DEMOGRAPHIC ANALYSIS**
Course Code: **STM5952**
NQF Level: 9
Contact hours: 4 lectures per week for 14 weeks
NQF Credits: 24
Module Assessment: Continuous assessment **(50%);** 1x3 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: Demographic Analysis: Fertility analysis, Nuptiality, Morbidity, Mortality analysis, Internal and international migration analysis, Geographical distribution of population, urbanization, Evaluation of demographic data, Population structure and dynamics and its economic and social determinants and consequences. The Life table; Population estimates and projections Approaches to measuring maternal mortality: Civil registration systems; Sisterhood methods, Orphanhood method

STM 5912 GENERALISED LINEAR MODELS

Course title: **GENERALIZED LINEAR MODELS**
Course Code: **STM5912**
NQF Level: 9
Contact hours: 4 lectures per week for 14 weeks
NQF Credits: 24
Module Assessment: Continuous assessment **(50%)**; 1x3 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: Principles of model fitting; Exponential family of distributions; Generalized Linear Models: Estimation and inference with Normal, Binomial and Poisson error distributions; Binary responses and Logistic regression (odds ratios); Contingency tables (Relative risk, Goodness of fit) and Log-linear models; Residual analysis and diagnostic measures. Multilevel models

STM5932 MULTIVARIATE DATA ANALYSIS

Course title: **MULTIVARIATE DATA ANALYSIS**
Course Code: **STM5932**
NQF Level: 9
Contact hours: 4 lectures per week for 14 weeks
NQF Credits: 24
Module Assessment: Continuous assessment **(50%)**; 1x3 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: Applications of Discriminant analysis, Principal Component analysis, Factor analysis
Cluster Analysis; MANOVA, Canonical Correlation; Interpretation of results from statistical analyses; Imputation of missing data.

STM5922 MONITORING AND EVALUATION

Course title: **MONITORING AND EVALUATION**
Course Code: **STM5922**
NQF Level: 9
NQF Credits: 12
Contact hours: 2 lectures per week for 14 weeks
Module Assessment: Continuous assessment **(50%);** 1x2 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: The importance of monitoring as a management tool; Comparison between Monitoring and Evaluation; key uses of M&E information; The role of government departments in promoting useful M&E systems; Steps to Developing an M&E System; Integration of population variables in development planning; Evaluation methods of programmes; Monitoring techniques of programmes; Operational research; Assessing Data Quality: Primary and Secondary Statistical Data; Defining evaluation questions; Data collection; indicator development.

STM5900 THESIS

Course title: **THESIS**
Course Code: **STM5900**
NQF Level: 9
NQF Credits: 120
Pre-requisites: All first year modules
Module Assessment: 100% Thesis
Content: A student will be expected to choose a topic under the guidance of a supervisor and undertake research. Students will be expected to demonstrate key research steps including information gathering, analysis and interpretation. They will be expected to demonstrate statistical and demographic techniques to a real research problem.

K. DEAN'S OFFICE: MILITARY SCIENCE

K.1. MILITARY SCIENCE REGULATIONS

COMPULSORY REQUIREMENTS

- Candidates must be approved by the Ministry of Defence.
- All BSc Military Science (Aeronautical, Army and Nautical) candidates must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognized equivalent qualification.
- English is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O-level) with a C-symbol as minimum requirement, or English as a First Language at NSSC (O-level) with a D-symbol as a minimum.
- Students require at least a symbol C on NSSC or equivalent qualification in Mathematics.
- The admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the *General Information and Regulations* of the University of Namibia.
- A candidate should obtain a minimum of 25 points on the University of Namibia's Evaluation Point Scale in his/her five (5) best subject (of which Mathematics and English must be included) to be admitted to undergraduate studies. Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook.
- All fourth years are required to do research projects: AER3810, ARM3810 and NAV3810 (prerequisite for this course the student should have passed all third year modules).

COMPILATION OF THE CA MARK

- Details on how the CA for each module is compiled are given under the respective modules.

WEIGHTING OF CA AND EXAM MARKS

- Unless otherwise indicated, the relationship between the CA mark and the Examination mark is 50:50.

K.2. MILITARY SCIENCE

J.2.1. BACHELOR OF SCIENCE IN MILITARY SCIENCE (AERONAUTICAL, army and nautical) (HONOURS)

Students opting for a Military Science (Aeronautical, Army and Nautical) must take all of the following modules:

Qualification: BSc (Honours) Military Science **Army**

Students opting for a Military Science (**Army**) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	English Communication & Study Skills	LCE 3419	16	None
1	Basic Mathematics	MAT3511	16	None
1	Computer Literacy	CLC3509	8	None
1	Analytic Geometry	MAT3501	8	None
1	Matrices and Complex Numbers	MAT3521	8	None
1	Physics for Physical Sciences I	PHY3511	16	None
1	Fundamentals of Information Technology I	CIT3521	8	None
2	English for Academic Purposes	LEA3519	16	None
2	Contemporary Social Issues	CSI3529	8	None
2	Fundamentals of Information Technology II	CIT3512	16	None
2	Precalculus	MAT3512	16	None
2	Introduction to Statistics	STS3522	8	None
2	Physics for Physical Sciences II	PHY3512	16	None
Total Credits			**160**	

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Calculus I	MAT3611	16	MAT3512
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511
1	Human Resource Management I	ARM3641	8	None
1	Concepts and Techniques in Military Geography	ARM3611	16	None
1	Physical Environment I	ARM3601	8	None
2	Calculus II	MAT3612	16	MAT3512
2	Ordinary Differential Equations	MAT3642	8	MAT3521
2	Electromagnetism	PHY3612	16	PHY3512 & MAT3512
2	Human Resource Management II	ARM3642	8	Co-requisite: ARM3641
2	Physical Environment II	ARM3612	16	Co-Requisites: ARM3611 & ARM3601
Total Credits			**136**	

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612 & MAT3612
1	Military Psychology	ARM3721	8	None
1	Military Management	ARM3741	8	None
1	Military History	ARM3761	8	None
1	Military Conduct and Environment	ARM3711	16	ARM3612
2	Research Methodology	AER3732	16	STS3522
2	Research Methodology Modern Physics	PHY3752	16	PHY3651 or PHY3612
2	Africa and International Political Economy	ARM3732	16	None
2	Geography of Sub-Saharan Africa	ARM3712	16	ARM3612
2	Contemporary Political Relations	ARM3772	16	None
Total Credits			**136**	

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Advanced Electrodynamics	PHY3809	8	PHY3711
1	Military Leadership	ARM3831	16	ARM3741
1	Economics I	ARM3851	16	ARM3732
1	Geographical Information Systems	ARM3811	16	ARM3711 & ARM3712
1&2	Research Project	ARM3810	32	AER3732
2	Nuclear Physics	PHY3802	8	PHY3752
2	Economics II	ARM3872	16	ARM3732
2	Remote Sensing	ARM3852	16	ARM3711 & ARM3712
Total Credits			**128**	

Qualification: BSc (Honours) Military Science **Aeronautical**

Students opting for a Military Science (**Aeronautical**) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	English Communication & Study Skills	LCE 3419	16	None
1	Basic Mathematics	MAT3511	16	None
1	Computer Literacy	CLC3509	8	None
1	Analytic Geometry	MAT3501	8	None
1	Matrices and Complex Numbers	MAT3521	8	None
1	Physics for Physical Sciences I	PHY3511	16	None
1	Fundamentals of Information Technology I	CIT3521	8	None
2	English for Academic Purposes	LEA3519	16	None
2	Contemporary Social Issues	CSI3529	8	None
2	Fundamentals of Information Technology II	CIT3512	16	None
2	Precalculus	MAT3512	16	None
2	Introduction to Statistics	STS3522	8	None
2	Physics for Physical Sciences II	PHY3512	16	None
Total Credits			**160**	

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Calculus I	MAT3611	16	MAT3512
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511
1	Fundamentals of Physical Geography	AER3631	16	None
1	Theory of Flight I	AER3621	8	None
2	Calculus II	MAT3612	16	MAT3512
2	Ordinary Differential Equations	MAT3642	8	MAT3521
2	Electromagnetism	PHY3612	16	PHY3512 & MAT3512
2	Theory of Flight II	AER3612	16	Co-requisite: AER3621
2	Flight Physiology	AER3642	8	Co-requisite: AER3621
Total Credits			**128**	

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612 & MAT3612
1	History of Aviation	AER3721	8	None
1	Military Management	ARM3741	8	None
1	Military Psychology	ARM3721	8	None
1	Airport Planning and Management	AER3751	16	None
1	Theory of Flight III	AER3711	16	AER3612 & AER3621
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612
2	Research Methodology	AER3732	16	STS3522
2	Aviation Management Principles	AER3702	8	Co-requisite: ARM3741
2	Aviation Ethics	AER3722	8	Co-requisite: ARM3721
2	Aviation Laws and Regulations	AER3742	8	Co-requisite: AER3751
2	Aircraft Turbine Engine Operation	AER3762	8	Co-requisite: AER3711
Total Credits			**136**	

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Advanced Electrodynamics	PHY3809	8	PHY3711
1	Aviation Safety	AER3811	16	AER3702
1	Advanced Aircraft Performance	AER3831	16	AER3762
1	Crew Resource Management in Aviation	AER3821	8	AER3742
1&2	Research Project	AER3810	32	AER3732
2	Nuclear Physics	PHY3802	8	PHY3752
2	Aviation Navigation GPS	AER3812	16	AER3742
2	Aviation Leadership	AER3822	8	AER3722
2	Aviation-Aerospace Security Issues	AER3842	8	AER3722
2	Aviation Terrorism and Asymmetrical Warfare	AER3862	8	Co-requisite:AER3811
Total Credits			**128**	

Qualification: BSc (Honours) Military Science **Nautical.**

Students opting for a Military Science **Mechanics** (**Nautical**) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	English Communication & Study Skills	LCE 3419	16	None
1	Basic Mathematics	MAT3511	16	None
1	Computer Literacy	CLC3509	8	None
1	Analytic Geometry	MAT3501	8	None
1	Matrices and Complex Numbers	MAT3521	8	None
1	Physics for Physical Sciences I	PHY3511	16	None
1	Fundamentals of Information Technology I	CIT3521	8	None
2	English for Academic Purposes	LEA3519	16	None
2	Contemporary Social Issues	CSI3529	8	None
2	Fundamentals of Information Technology II	CIT3512	16	None
2	Precalculus	MAT3512	16	None
2	Introduction to Statistics	STS3522	8	None
2	Physics for Physical Sciences II	PHY3512	16	None
Total Credits			**160**	

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Calculus I	MAT3611	16	MAT3512
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511
1	Propulsion	NAV3661	8	PHY3511
1	Seamanship	NAV3601	8	None
2	Calculus II	MAT3612	16	MAT3512
2	Ordinary Differential Equations	MAT3642	8	MAT3521
2	Electromagnetism	PHY3612	16	PHY3512 & MAT3512
2	Ship Stability and Controls	NAV3642	8	Co-requisite: NAV3601
2	Maritime History	NAV3622	8	None
2	Telecommunications	CMP3652	16	MAT3512
Total Credits			**128**	

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Military Psychology	ARM3721	8	None
1	Military Management	ARM3741	8	None
1	Navigation and Naval Operations	NAV3711	16	NAV3661 & NAV3642
1	***Electives*: *Mechanics***			
1	Applied Thermodynamics	NAV3711	16	PHY3512
1	Auxiliaries Naval Engines	NAV3731	16	NAV3661
2	Research Methodology	AER3732	16	STS3522
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612
2	Advanced Navigation	NAV3742	8	NAV3661
2	Vector Analysis	MAT3742	8	MAT3612
2	***Electives*: *Mechanics***			
2	Naval Weapon Systems	NAV3712	16	PHY3612
2	Ship Design	NAV3762	8	NAV3642
Total Credits			**136**	

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Research Project	NAV3810	32	AER3732
1	Astro-Navigation	NAV3801	8	NAV3742
1	Military Leadership	ARM3831	16	ARM3741
1	***Electives Mechanics***			
1	Material Resistance	NAV3841	8	PHY3711
1	Process and Material Technologies	NAV3861	8	PHY3651
1	Ship Hydro-Statics and Stability	NAV3871	16	NAV3762
2	Nuclear Physics	PHY3802	8	PHY3752
2	Naval Warfare	NAV3822	8	NAV3742
2	***Electives Mechanics***			
2	Engine Automation and Controls	NAV3862	8	NAV3731
2	Applied Electronics	NAV3882	8	PHY3612
2	Corrosion and Controls	NAV3809	8	NAV3762
Total Credits			**128**	

Qualification: BSc (Honours) Military Science **Nautical.**

Students opting for a Military Science **Electronics** (**Nautical**) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	English Communication & Study Skills	LCE 3419	16	None
1	Basic Mathematics	MAT3511	16	None
1	Computer Literacy	CLC3509	8	None
1	Analytic Geometry	MAT3501	8	None
1	Matrices and Complex Numbers	MAT3521	8	None
1	Physics for Physical Sciences I	PHY3511	16	None
1	Fundamentals of Information Technology I	CIT3521	8	None
2	English for Academic Purposes	LEA3519	16	None
2	Contemporary Social Issues	CSI3529	8	None
2	Fundamentals of Information Technology II	CIT3512	16	None
2	Precalculus	MAT3512	16	None
2	Introduction to Statistics	STS3522	8	None
2	Physics for Physical Sciences II	PHY3512	16	None
Total Credits			**160**	

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Calculus I	MAT3611	16	MAT3512
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511
1	Propulsion	NAV3661	8	PHY3511
1	Seamanship	NAV3601	8	None
2	Calculus II	MAT3612	16	MAT3512
2	Ordinary Differential Equations	MAT3642	8	MAT3521
2	Electromagnetism	PHY3612	16	PHY3512 & MAT3512
2	Ship Stability and Controls	NAV3642	8	Co-requisite: NAV3601
2	Maritime History	NAV3622	8	None
2	Telecommunications	CMP3652	16	MAT3512
Total Credits			**128**	

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Military Psychology	ARM3721	8	None
1	Military Management	ARM3741	8	None
1	Navigation and Naval Operations	NAV3711	16	NAV3661 & NAV3642
1	***Electives***: ***Electronics***			
1	Electronics I	NAV3741	8	PHY3612
1	Electro-Techniques	NAV3761	8	PHY3612
1	Electrodynamics	PHY3711	16	PHY3612 & MAT3612
2	Research Methodology	AER3732	16	STS3522
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612
2	Advanced Navigation	NAV3742	8	NAV3661
2	Vector Analysis	MAT3742	8	MAT3612
2	***Electives***: ***Electronics***			
2	Electronics II	NAV3752	16	PHY3612
Total Credits			**128**	

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Research Project	NAV3810	32	AER3732
1	Astro-Navigation	NAV3801	8	NAV3742
1	Military Leadership	ARM3831	16	ARM3741
1	***Electives Electronics***			
1	Advanced Electrodynamics	PHY3809	8	PHY3711
1	Digital Electronics	NAV3861	8	NAV3741 or NAV3752
1	Digital Techniques	NAV3881	8	NAV3741 or NAV3752
1	Signals and Systems	NAV3809	8	NAV3741 or NAV3752
2	Nuclear Physics	PHY3802	8	PHY3752
2	Naval Warfare	NAV3822	8	NAV3742
2	***Electives Electronics***			
2	Electric-Machines and Drives	NAV3812	16	NAV3752
2	Theory and Applications of Lasers	NAV3882	8	PHY3612
Total Credits			**128**	

Qualification: BSc (Honours) Military Science **Nautical.**

Students opting for a Military Science **Weapon Systems** (**Nautical**) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	English Communication & Study Skills	LCE 3419	16	None
1	Basic Mathematics	MAT3511	16	None
1	Computer Literacy	CLC3509	8	None
1	Analytic Geometry	MAT3501	8	None
1	Matrices and Complex Numbers	MAT3521	8	None
1	Physics for Physical Sciences I	PHY3511	16	None
1	Fundamentals of Information Technology I	CIT3521	8	None
2	English for Academic Purposes	LEA3519	16	None
2	Contemporary Social Issues	CSI3529	8	None
2	Fundamentals of Information Technology II	CIT3512	16	None
2	Precalculus	MAT3512	16	None
2	Introduction to Statistics	STS3522	8	None
2	Physics for Physical Sciences II	PHY3512	16	None
Total Credits			**160**	

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Calculus I	MAT3611	16	MAT3512
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511
1	Propulsion	NAV3661	8	PHY3511
1	Seamanship	NAV3601	8	None
2	Calculus II	MAT3612	16	MAT3512
2	Ordinary Differential Equations	MAT3642	8	MAT3521
2	Electromagnetism	PHY3612	16	PHY3512 & MAT3512
2	Ship Stability and Controls	NAV3642	8	Co-requisite: NAV3601
2	Maritime History	NAV3622	8	None
2	Telecommunications	CMP3652	16	MAT3512
Total Credits			**128**	

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Military Psychology	ARM3721	8	None
1	Military Management	ARM3741	8	None
1	Navigation and Naval Operations	NAV3711	16	NAV3661 & NAV3642
1	***Electives***: **Weapons Systems**			
1	Electronics I	NAV3741	8	PHY3612
1	Electro-Techniques	NAV3761	8	PHY3612
1	Naval Automation Systems	NAV3791	16	NAV3661
2	Research Methodology	AER3732	16	STS3522
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612
2	Advanced Navigation	NAV3742	8	NAV3661
2	Vector Analysis	MAT3742	8	MAT3612
2	***Electives***: **Weapons Systems**			
2	Electronics II	NAV3752	16	PHY3612
Total Credits			**128**	

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-/COREQUISITES
1	Research Project	NAV3810	32	AER3732
1	Astro-Navigation	NAV3801	8	NAV3742
1	Military Leadership	ARM3831	16	ARM3741
1	***Electives* Weapon Systems**			
1	Signals and Systems	NAV3809	8	NAV3741 or NAV3752
1	Electronic Control Systems	NAV3851	16	NAV3741 or NAV3752
1	Applied Sensors and Actuators	NAV3881	8	NAV3741 or NAV3752
2	Nuclear Physics	PHY3802	8	PHY3752
2	Naval Warfare	NAV3822	8	NAV3742
2	***Electives* Weapon Systems**			
2	Ballistics	NAV3872	16	NAV3752
2	Advanced Electro-Techniques	NAV3842	8	NAV3761
Total Credits			**128**	

OLD CURRICULUM

L. QUALIFICATIONS OFFERED BY THE FACULTY

The Faculty may award the following Undergraduate degrees:

L.1. UNDERGRADUATE PROGRAMMES

IN 2013 THE SENIOR STUDENTS WILL REGISTER FOR THIS QUALIFICATIONS

CODE	MAJOR/MINOR	DEGREE	MINIMUM DURATION
11BEGL	Environmental Biology / Geology	Bachelor of Science (Honours)	4 years full-time
11BEGH	Environmental Biology Geography	Bachelor of Science (Honours)	4 years full-time
11BMIC	Micro Biology/ Chemistry	Bachelor of Science (Honours)	4 years full-time
11BMIB	Micro Biology/ Biochemistry	Bachelor of Science (Honours)	4yearsfull-time
11BMOC	Molecular Biology/ Chemistry	Bachelor of Science (Honours)	4 years full-time
11BMOB	Molecular Biology/ Biochemistry	Bachelor of Science (Honours)	4 years full-time
11BCHP	Chemistry/Physics	Bachelor of Science (Honours)	4 years full-time
11BCHB	Chemistry/Biology	Bachelor of Science (Honours)	4 years full-time
11BCHG	Chemistry/Geology	Bachelor of Science (Honours)	4 years full-time
11BCBB	Biochemistry/ Biology	Bachelor of Science (Honours)	4 years full-time
11BCBC	Biochemisty/ Chemistry	Bachelor of Science (Honours)	4 years full-time
11BCMI	Computer Science/Information Technology	Bachelor of Science (Honours)	4 years full-time
11BCMM	Computer Science/Mathematics	Bachelor of Science (Honours)	4 years full-time
11BCMS	Computer Science/Statistics	Bachelor of Science (Honours)	4 years full-time
11BGLY	Geology	Bachelor of Science (Honours)	4 years full-time
11BMAS	Mathematics/Statistics	Bachelor of Science (Honours)	4 years full-time
11BMAC	Mathematics/Computer Science	Bachelor of Science (Honours)	4 years full-time
11BMAP	Mathematics/Physics	Bachelor of Science (Honours)	4 years full-time
11BPHM	Physics/Mathematics	Bachelor of Science (Honours)	4 years full-time
11BPHG	Physics/ Geology	Bachelor of Science (Honours)	4 years full-time
11BPHC	Physics/ Computer Science	Bachelor of Science (Honours)	4 years full-time
11BPHH	Physics/ Chemistry	Bachelor of Science (Honours)	4 years full-time
11BSTC	Statistics/Computer Science	Bachelor of Science (Honours)	4 years full-time
11BSTP	Statistics/ Population Studies	Bachelor of Science (Honours)	4 years full-time
11BSTM	Statistics/Mathematics	Bachelor of Science (Honours)	4 years full-time
11BSTE	Statistics/ Economics	Bachelor of Science (Honours)	4 years full-time
11BPGE	Population Studies/ Geography	Bachelor of Science (Honours)	4 years full-time
11BPST	Population Studies/ Statistics	Bachelor of Science (Honours)	4 years full-time
11BPSO	Population Studies/ Sociology	Bachelor of Science (Honours)	4 years full-time

OLD CURRICULUM

CODE	DIPLOMA/DEGREE	MINIMUM DURATION
11BSCI	Bachelor of Science	4 years full-time

M. REGULATIONS PERTAINING TO UNDERGRADUATE STUDIES IN THE FACULTY (2nd, 3rd and 4th year students only)

M.1. ADMISSION REQUIREMENTS

To register for a B.Sc. undergraduate degree programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification.

English is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol.

In addition to the above, admission to the B.Sc. course of study requires at least a symbol C on NSSC or equivalent qualification in Mathematics.

A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics and English must be included) to be admitted to undergraduate studies (Refer to the **General Admission Criteria for Undergraduate Programmes** in the **General Information and Regulations Yearbook**). Obtaining the minimum number of points, however, **does not necessarily ensure admission. Admission is based on places available in modules, subjects and programmes and is awarded on the basis of merit.**

The Faculty reserves the right to interview students before admission.

Certain modules, subjects or programmes may require special written entry tests for screening candidates before admission is considered. Candidates who do not meet the requirements for admission to such modules, subjects or programmes may, however, register for any other modules, subjects or programmes to which they are admitted subject to relevant University and Faculty of Science regulations.

Admission can also be considered for persons who qualify through the Mature Age Entry CHEme upon successful completion of the relevant examinations as set out in the (**General Information and Regulations Prospectus**). A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is considered.

Please read this section in conjunction with the academic conditions stipulated in the **General Information and Regulations Prospectus**.

M.2. DURATION OF STUDY

All Bachelor of Science degree programmes cannot be completed in less than four (4) years. All B.Sc. degrees must be completed within six (6) years of full-time study, unless special permission is granted for this period to be exceeded.

M.2.1. TWO MODES OF STUDY FOR FIRST YEAR MATHEMATICS

All new students enrolling into the Faculty of Science are required to register for Basic Mathematics (MAT 3511) and Precalculus (MAT 3512) and all students which programme requires Analytic Geometry (MAT3501) and Matrices & Complex Numbers (MAT3521). In order to assist students with a weaker background in mathematics, the Department of Mathematics has introduced two modes of teaching for its first year courses. The decision as to which mode a student shall take is reached upon sitting for the first class test in Basic Mathematics (MAT3511) after the first four weeks of classes. Any student who scores a mark of 40% or higher, in the said test, shall proceed with the current mode of study, which enables such student to complete the first year mathematics courses in the first academic year of registration. The student who scores a mark below 40% shall proceed to a special mode in which the current content of first year mathematics is taught over a period of two years. The Two Modes modules are Basic Mathematics A (MAT3580), Analytic Geometry A (MAT3520), Matrices & Complex Numbers A (MAT3540) and Precalculus A (MAT3570).

M.3. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme of the Bachelor of Science degree. See the General Information & Regulations Prospectus and Fees Prospectus.

M.4. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Refer to the **General Information and Regulations Prospectus**.

M.5. PRACTICALS

Attendance of practical classes is compulsory.

M.6. CURRICULUM

M.6.1. MODULES, CREDITS AND CONTACT HOURS

One contact hour is equivalent to one (1) lecture period on the timetable of the Faculty of Science.
A full semester module carries 16 credits and is taught at four (4) contact hours per week over one semester, i.e. 56 contact hours per semester.
A half-module carries 8 credits and is taught at two (2) contact hours per week over one semester, i.e. 28 contact hours per semester. A half-module counts as one half (0.5) of a *module*.
A double-module carries 32 credits and is taught at four (4) contact hours per week over the full academic year (both semesters), i.e. 112 contact hours per academic year. A double-module is equivalent to two (2) *modules*.
Refer to the relevant programmes (to determine the credits and contact hours of any particular module).

M.6.2. CURRICULUM COMPILATION

To be awarded a Bachelor's degree Honours by the Faculty, a student must pass all the modules prescribed for each Major / Minor combination.
In the BSc Honours degree programme a student may compile his/her curriculum by selecting the major subjects and minor s subjects offered by a specific department, in accordance with Faculty and department regulations. For the Geology single major programme set curricula are prescribed, although Geology deparments allow some of their modules as minors to certain deparments options within the Faculty curriculum. Refer to the relevant degree programmes for detailed information.

M.6.3. STUDENT REGISTRATION

M.6.3.1. UNIVERSITY CORE CURRICULUM

All students will take the equivalent of three (4) modules (48 credits) in the University Core Curriculum in the first year of study as part of their curriculum (i.e. as part of the equivalent of eleven (10) first year level modules to be passed at first year level.

All students register for the following two (2) half-modules:

SEMESTER	CODE	MODULE NAME
2	CSI3580	Contemporary Social Issues (half-module)
1	CLC3509	Computer Literacy (half-module)

Students furthermore add the equivalent of two (2) full English modules from the University Core Curriculum to their curriculum according to the following rules:

Students with any one of the following qualifications in English will apply to be **credited** for LCE3419 English Communication and Study Skills and will register for the module below: (a) a pass (minimum grade 4) in English First Language at NSSC Higher Level or the equivalent; (b) grade 1, 2 or 3 in English Second Language at NSSC Higher Level or the equivalent.

SEMESTER	CODE	MODULE NAME
1	LCE3419	English Communication and Study Skills
2	LEA3519	English for Academic Purposes

Students with a D symbol in English First/Second Language at NSSC Ordinary Level, or the equivalent, register for only the double-module below:

SEMESTER	CODE	MODULE NAME
1 & 2	LEG 2410	English for General Communication *(double-module)*

M.6.3.2. UNIVERSITY CORE CURRICULUM MODULE DESCRIPTIONS

LCE3419 ENGLISH COMMUNICATION & STUDY SKILLS

Module title: **ENGLISH COMMUNICATION AND STUDY SKILLS**
Code: **LCE3419**
NQF Level: 4
Contact hours: 4 hours per week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment (60%): two tests (reading and writing), two reading assignments, one oral presentation Examination (40%): one three hour examination paper
Pre-requisites: None
Module description: This module is aimed at assisting students in the development of their reading, writing and speaking and listening skills, in order to cope with studying in a new academic environment and in a language which may not be their first language. The module also focuses on study skills that students need throughout their academic careers and beyond. The module serves as an introduction to university level academics, where styles of teaching and learning differ from those at secondary schools in that more responsibility is placed on the student. The module therefore, focuses on the skills that students need throughout their academic careers and beyond.

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Module title: **ENGLISH FOR ACADEMIC PURPOSES**
Code: **LEA3519**
NQF level: 5
Contact hours: 4 periods per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment (**60%**): 2 tests (reading and writing), 1 academic written essay,1 oral presentation Examination **(40%)** : One three hour examination paper
Prerequisites: None
Module description: This module develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.

CLC3509 COMPUTER LITERACY

Module title: **COMPUTER LITERACY**
Code: **CLC3509**
NQF level: 4
Contact hours: 1 lecture theory and 1 lecture practical per week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment **100%**: 2 Practical Tests 50%, 2 Theory Tests 50%
Prerequisites: University Entry
Module description: The aim of this module is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment.
Content: The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

CSI3580 **CONTEMPORARY SOCIAL ISSUES**

Module title: **CONTEMPORARY SOCIAL ISSUES**
Code: **CSI3580**
NQF level: 5
Contact Hours: 1 hour lecture per week for 28 weeks
Credits: 8
Course Assessment: Continuous Assessment **(100%).** Portfolio/Student's file **(90%)** and quizzes/tests **(10%)**
Prerequisite: None
Module Description: This course, Contemporary Social Issues (CSI), encourages behavioural change among UNAM students. It offers on an integrative and inter-disciplinary basis the six broad themes on teaching and learning strategies; norms, rules, and contact; citizenship, democracy, and common good; ethics and responsible leadership; health and human sexuality, environment and sustainability as well as stressing the interconnectedness of such issues/themes. The course shall empower students to responsible behaviour changes and to transform high risk behaviour to the common good and responsible citizenship, including broadening the student's scope and understanding of the environment and sustainability of the ecosystem services and how humans influence these. Therefore, critical transformative theory will under gird the content of CSI. After completion students shall be empowered and prepared to enjoy productive, meaningful careers and lives that benefit a society that increasingly resembles a global community. Flexible modes of assessment may be harnessed and may be combined with in-situ visits to appropriate sites. Compulsory attendance required.

M.6.3.3. FACULTY CORE CURRICULUM

All students must register for the following two (2) full modules (32 credits):

MAT3511 Basic Mathematics
MAT3512 Precalculus

C.6.3.4. FACULTY CORE CURRICULUM MODULE DESCRIPTIONS

MAT3511 BASIC MATHEMATICS

Module name: **BASIC MATHEMATICS**
Code: **MAT 3511**
NQF level: 5
Contact hours: 4 lectures per week for 14 weeks
2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests) Examination **50%** (3 hours examination paper).
Prerequisite: None
Module description: Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement. Algebraic expressions: simplification, expansion, polynomials, reminder and factor theorem, partial fractions. Trigonometry: trigonometric functions, basic trigonometric identities. The absolute value, linear equations, linear inequalities, quadratic equations, the quadratic formula, quadratic inequalities. Functions: domain, codomain, image, preimage, even function, odd function. Sequences: the general term, the geometric sequence, the arithmetic sequence. The Binomial Theorem.

MAT3512 PRECALCULUS

Module name: **PRECALCULUS**
Code: **MAT 3512**
NQF level: 5
Contact hours: 4 lectures per week for 14 weeks
2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: None
Module description: Functions: one-to-one and onto functions, horizontal line test, composition of functions, inverse of a function. Introduction to exponential and logarithmic functions. Limit of a function: definition, left and right limits, infinite limits, limits at infinity, continuity in terms of limits. Differentiation: rate of change, derivative of a function, rules of differentiation, increasing and decreasing functions and graph sketching. Integration: antiderivatives, the definite integral, area under a graph. Trigonometry: further trigonometric identities, area of a sector and segment of a circle, derivatives and integrals of trigonometric functions.

M.7. EXAMINATION REGULATIONS

For detailed examination and promotion rules see the General Prospectus: Information, Regulations and Fees. A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of **40%.** Examination will be administered at the end of each semester.

M.8. RE-ADMISSION INTO THE FACULTY OF SCIENCE

M.8.1. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted to the Faculty of Science for a particular year of registration, a student must have passed the minimum number of modules required as indicated below:

- **4** modules (equivalent to **64** credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core (30%)
- **9** modules (equivalent to **144** credits) by the end of the second year (45%)
- **16** modules (equivalent to **256** credits) by the end of the third year (57%)
- **25** modules (equivalent to **400** credits) by the end of the fourth year (69%)

A student will not be re-admitted into the Faculty if he/she has not passed the above modules.

M.8.2. PASS REQUIREMENTS

M.8.2.1. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the modules of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases, prerequisites for modules have to be passed before a student can proceed to register for modules that require prerequisites.

- From year **1** to year **2**:

At least **7** modules (equivalent to **112** credits) prescribed for year **1**.

- From year **2** to year **3**:

All first year modules plus at least **6** modules (equivalent to **96** credits) prescribed for year **2**.

- From year **3** to year **4**:

All second year modules plus at least **6** modules (equivalent to **96** credits) prescribed for year **3**.

M.8.2.2. MAXIMUM NUMBER OF MODULES PER YEAR

No student will be allowed to register for more than **12** modules per year

N. DEPARTMENT OF BIOLOGICAL SCIENCES

N.1 ENVIRONMENTAL BIOLOGY

N.1.1. MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: B.Sc. (Honours) Environmental Biology Major and Geology Minor

Students opting for a major in **Environmental Biology** (with minors in Geology) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Contemporary Social Issues	CSI3580	8		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study Skills	LCE3419	16		None
1	Introduction to Biology	BLG3511	16		None
	Geology Minor:				
1	Introduction to Physical Geology & Surface Processes	GLY3521	16		None
1	Physics for Life Sciences	PHY3501	16		None
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Introduction to Statistics	STS3522	8		None
2	Chemistry for Life Sciences	CHM3532	16		None
2	Diversity of Life	BLG3512	16		None
	Geology Minor:				
2	Introduction to Earth Systems	GLY3502	8		None
Total Credits					

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Animal Form and Function	BLG3611	16	BLG3511& BLG3512	None
1	Cell Molecular Biology and Genetics	MBL3631	16	BLG3511 & BLG3512,	None
1	Statistics for Life Sciences I	STS3621		STS3522	None
1	Introduction to Ecology	EBL3631	16	BLG3511 & BLG3512	None
	Geology Minor:				
1	Earth Resources	GLY3641	8	GLY3521	None
1	Introduction to Hydrology	GLY3621	8	GLY3521 & MAT3512	None
2	Plant Form and Function	BLG3612	16	BLG3511 & BLG3512	None
2	Introduction to Microbiology	MBL3632	16	BLG3511 & BLG3512	None
2	Statistics for Life Sciences II	STS3622		STS3511	None
2	Ecological Field Techniques	EBL3632	16	BLG3511 & BLG3512	None
	Geology Minor:				
2	Stratigraphy & Geological Mapping	GLY3612	16	GLY3521	None
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Field Ecology I	EBL3700	8	None	EBL3711& EBL3712 & EBL3732
1	Fresh Water & Marine Ecology	EBL3711	16	EBL3631	None
1	Population Ecology	EBL3731	16	EBL3631	None
1	Plant physiology	MBL3751	16	CHM3511 OR CHM3512 OR CHM3532	None
	Geology Minor:				
1	Plate Tectonics	GLY3721	8	GLY3612	None
1	Regional Geology of Namibia	GLY3761	8	GLY3521	None
2	Comparative Animal Physiology	MBL3752	16	BLG3611	None
2	Ecosystem Ecology	EBL3712	16	EBL3631	None
2	Conservation Biology & Biodiversity	EBL3732	16	EBL3631	EBL3731

2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
	Geology Minor:				
2	Sedimentology & Palaeontology	GLY3731	16	GLY3521 & GLY3612	None
Total Credits			**144**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Field Ecology II	EBL3800	8	None	EBL3811 & EBL3851 & EBL3832
1	Research Project	BLG3810	32	BLG3702 & STS3621 & STS3622,	None
1	Environmental Management	EBL3811	16	EBL3731 & EBL3712 & EBL3732	None
1	Biosystematics	EBL3831	16	EBL3632 & BLG3612 & BLG3611	None
1	Biogeography	EBL3851	16	EBL3631 & EBL3712	None
	Geology Minor: No offering				
2	Disturbance & Restoration Ecology	EBL3802	8	EBL3712 & EBL3732	None
2	Management of Natural Resources	EBL3832	16	EBL3731 & EBL3712 & EBL3732	None
2	Behavioural Ecology	EBL3812	16	EBL3731	None
2	Parasitology	MIC3802	8	MBL 3711	MBL3811
	Geology Minor: No offering				
Total Credits			***136***		

QUALIFICATION: Environmental Biology Major and Geography Minor

Students opting for a major in Environmental Biology (with minors in Geography) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Contemporary Social Issues	CSI3580	8		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study Skills	LCE3419	16		None
1	Introduction to Biology	BLG3511	16		None
	Geography Minor:				
1	Fundamentals of Physical Geography	GHE3581	16		
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3419	16		None
2	Introduction to Statistics	STS3522	8		None
2	Chemistry for Life Sciences	CHM3532			None
2	Diversity of Life	BLG3512	16		None
	Geography Minor:				
2	Fundamentals of Human Geography	GHE3582	16		None
Total Credits			**152**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Animal Form and Function	BLG3611	16	BLG3511 & BLG3512	None
1	Cell Molecular Biology and Genetics	MBL3631	16	BLG3511 & BLG3512	None
1	Statistics for Life Sciences I	STS3621	8	STS3522	None
1	Introduction to Ecology	EBL3631	16	BLG3511 & BLG3512	None
	Geography Minor:				
1	Climatology **and**	GHE3621	8	GHE3581	None
1	Geomorphology or	GHE 3601	8	GHE3581	None
2	Plant Form and Function	BLG3612	16	BLG3511 & BLG3512	None
2	Introduction to Microbiology	MBL3632	16	BLG3511 & BLG3512	None
2	Statistics for Life Sciences II	STS3622	8	STS3511	None
2	Ecological Field Techniques	EBL3632	16	BLG3511 & BLG3512	None
	Geography Minor:				
2	Social Geography	GHE3682	8	GHE3582	None
2	Pedology **or** Hydrology	GHE3662 **or** GPE3622	8	None None	GHE3601 GHE3621
Total Credits			**144**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Field Ecology I	EBL3700	8		EBL3711 & EBL3712 & EBL3732
1	Fresh Water & Marine Ecology	EBL3711	16	EBL3631	None
1	Population Ecology	EBL3731	16	EBL3631	None
1	Plant physiology	MBL3751	16	CHM3511 OR CHM3512 OR CHM3532	None
	Geography Minor:				
1	Geographic Analysis & Techniques	GIS3711	16		

2	Comparative Animal Physiology	MBL3752	16	BLG3611	None
2	Ecosystem Ecology	EBL3712	16	EBL3631	None
2	Conservation Biology & Biodiversity	EBL3732	16	EBL3631	EBL3731
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
	Geography Minor:				
2	Geographic Information Systems	GIS3732	16		None
Total Credits			**144**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Field Ecology II	EBL3800	8		EBL3811&EBL3851& EBL3832
1	Research Project	BLG3810	32	BLG3702 & STS3621 & STS3622	None
1	Environmental Management	EBL3811	16	EBL3731 & EBL3712 & EBL3732	None
1	Biosystematics	EBL3831	16	EBL3632 & BLG3612 & BLG3611	None
1	Biogeography	EBL3851	16	EBL3631 & EBL3712	None
	Geography Minor: No offering				
2	Disturbance & Restoration Ecology	EBL3802	8	EBL3712, EBL3732	None
2	Management of Natural Resources	EBL3832	16	EBL3731, EBL3712, EBL3732	None
2	Behavioural Ecology	EBL3812	16	EBL3731	None
2	Parasitology	MIC3802	8	MBL 3632	None
	Geography Minor: No offering				
Total Credits			***144***		

N.2. MICROBIOLOGY

N.2.1. MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: Microbiology Major and Biochemistry Minor

Students opting for a major in **Microbiology** (with minor s in Biochemistry) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Contemporary Social Issues	CSI3580	8		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study Skills	LCE3419	16		None
1	Introduction to Biology	BLG3511	16		None
1	Physics for Life Sciences I	PHY3501	8		None
	Biochemistry Minor:				
1	Chemistry IA	CHM3511	16		None
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Introduction to Statistics	STS3522	8		None
2	Diversity of Life	BLG3512	16		None
	Biochemistry Minor:				
2	Chemistry IB	CHM3512	16		None
Total credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Animal Form and Function	BLG3611	16	BLG3511 & BLG3512	None
1	Cell Molecular Biology and Genetics	MBL3631	16	BLG3511 & BLG3512	None
1	Statistics for Life Sciences I	STS3621	8	STS3522	None
	Biochemistry Minor:				
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None

2	Plant Form and Function	BLG3612	16	BLG3511 & BLG3512	None
2	Introduction to Microbiology	MBL3632	16	BLG3511& BLG3512	None
2	Statistics for Life Sciences II	STS3622	8	STS3511	None
2	Human Biology	MBL3652	16	BLG 3512 & CHM3511 & CHM 3512 OR CHM3532 (for education students only)	None
	Biochemistry Minor:				
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 OR CHM3532 & BLG3511	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total credits			**152**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Plant physiology	MBL3751	16	CHM3511 OR CHM3512 OR CHM3532	None
1	Microbial Genetics	MBL3711	16	MBL3632	None
1	Recombinant DNA Technology	MBL3731	16	MBL3632 & MBL3631	None
	Biochemistry Minor:				
1	Biochemistry III	CHB3701	8	CHB3612 & MBL3631	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
2	Comparative Animal Physiology	MBL3752	16	BLG3611	
2	Biotechnology	MBL3712	16	MBL3631 & CHB3611	MBL3731
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
	Biochemistry Minor:				
2	Biochemistry IV	CHB3712	16	CHM3612 & MBL3611	None
Total credits			***144***		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-/COREQUISITES	CO-REQUISITES
1	Research Project	BLG3810	32	STS3621 & STS3622 & BLG3702	None
1	Immunology	MBL3811	16	MBL3711	None
1	Applied Molecular Biology	MBL3831	16	MBL3731	None
1	Mycology	MIC3811	16	MBL3711	None
	Biochemistry Minor: No offering				
2	Medical Microbiology	MIC3822	8	MBL3632 & MBL3711	None
2	Environmental And Industrial Microbiology	MIC3812	16	MBL3711	None
2	Virology	MIC3832	16	MBL3711	None
2	Parasitology	MIC3802	8	MBL3711	MBL3811
	Biochemistry Minor: No offering				
Total credits			***128***		

QUALIFICATION: Microbiology Major and Chemistry Minor

Students opting for a major in **Microbiology** (with minors in Chemistry) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Contemporary Social Issues	CSI3580	8		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study Skills	LCE3419	16		None
1	Introduction to Biology	BLG3511	16		None
1	Physics for Life Sciences I	PHY3501	8		None
	Chemistry Minor:				
1	Chemistry IA	CHM3511	16		None
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Introduction to Statistics	STS3522	8		None
2	Diversity of Life	BLG3512	16		None
	Chemistry Minor:				
2	Chemistry IB	CHM3512	16		None
Total credits			***160***		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Animal Form and Function	BLG3611	16	BLG3511 & BLG3512	None
1	Cell Molecular Biology and Genetics	MBL3631	16	BLG3511 & BLG3512	None
1	Statistics for Life Sciences I	STS3621	8	STS3522	None
	Chemistry Minor:				
1	Inorganic Chemistry I	CHM3611	16	CHM3511 & CHM3512	None
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None
2	Plant Form and Function	BLG3612	16	BLG3511 & BLG3512	None
2	Introduction to Microbiology	MBL3632	16	BLG3511 & BLG3512	None
2	Statistics for Life Sciences II	STS3622	8	STS3522	None
2	Human Biology	MBL3652	16	BLG 3512 & CHM3511 & CHM 3512 OR CHM3532 (for education students only)	None
	Chemistry Minor:				
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total credits			***144***		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Plant physiology	MBL3751	16	CHM3511 OR CHM3512 OR CHM3532	None
1	Microbial Genetics	MBL3711	16	MBL3632	None
1	Recombinant DNA Technology	MBL3731	16	MBL3632 & MBL3631	None
	Chemistry Minor:				
1	Organic Chemistry II	CHM3711	16	CHM3612	None
1	Inorganic Chemistry II	CHM3701	8	CHM3611 & MAT3512	None
1	Industrial Chemistry I	CHM3761	8	CHM3611 & CHM3612	None
1	Physical Inorganic Chemistry	CHM3762	8	CHM3701	None

2	Comparative Animal Physiology	MBL3752	16	BLG3611	
2	Biotechnology	MBL3712	16	MBL3631 & CHB3611	MBL3731
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
	Chemistry Minor: No offering				
Total credits			***144***		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Research Project	BLG3810	32	STS3621 & STS3622 & BLG3702	None
1	Immunology	MBL3811	16	MBL3711	None
1	Applied Molecular Biology	MBL3831	16	MBL3731	None
1	Mycology	MIC3811	16	MBL3711	None
	Chemistry Minor: No offering				
2	Medical Microbiology	MIC3822	8	MBL3711	None
2	Environmental And Industrial Microbiology	MIC3812	16	MBL3711 & MBLI3732	None
2	Virology	MIC3832	16	MBL3711	None
2	Parasitology	MIC3802	8	MBL3711	MBL3811
	Chemistry Minor: No offering				
Total credits			***128***		

N.3. MOLECULAR BIOLOGY

N.3.1. MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: Molecular Biology Major and Biochemistry Minor

Students opting for a major in **Molecular Biology** (with minors in Biochemistry) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Contemporary Social Issues	CSI3580	8		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study Skills	LCE3419	16		None
1	Introduction to Biology	BLG3511	16		None
1	Physics for Life Sciences I	PHY3501	8		None
	Biochemistry Minor:				
1	Chemistry IA	CHM3511	16		None
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Introduction to Statistics	STS3522	8		None
2	Diversity of Life	BLG3512	16		None
	Biochemistry Minor:				
2	Chemistry IB	CHM3512	16		None
Total credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Animal Form and Function	BLG3611	16	BLG3511	None
1	Cell Molecular Biology and Genetics	MBL3631	16	BLG3511 & BLG3512	None
1	Statistics for Life Sciences I	STS3621	8	STS3522	None
	Biochemistry Minor:				
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None

2	Plant Form and Function	BLG3612	16	BLG3511 & BLG3512	None
2	Introduction to microbiology	MBL3632	16	BLG3511 & BLG3512	None
2	Statistics for Life Sciences II	STS3622	8	STS3522	None
2	Human Biology	MBL3652	16	BLG 3512 & CHM3511 & CHM 3512 OR CHM3532 (for education students only)	None
	Biochemistry Minor:				
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 OR CHM3532 & BLG3511	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total credits			**144**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Plant Physiology	MBL3751	16	CHM3511 OR CHM3512 OR CHM3532	None
1	Microbiology	MBL3711	16	MBL3632	None
1	Recombinant DNA Technology	MBL3731	16	MBL3632 & MBL3631	None
	Biochemistry Minor:				
1	Biochemistry III	CHB3701	8	CHB3612 & MBL3631	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
2	Comparative Animal Physiology	MBL3752	16	BLG 3611	None
2	Biotechnology	MBL3712	16	MBL3632 & MBL3631	None
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research methodology	BLG3702	8	STS3621 & STS3622	None
	Biochemistry Minor:				
2	Biochemistry IV	CHB3712	16	CHM3612 & MBL3611	None
Total credits			**128**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Research Project	BLG3810	32	STS3621 & STS3622 & BLG3702	None
1	Immunology	MBL3811	16	MBL3711	None
1	Applied Molecular Biology	MBL3831	16	MBL3731	None
1	Bioinformatics	MOL3811	16	MBL3631 & MBL3632 & MBL3732	None
	Biochemistry Minor: No offering				
2	Applied Genetics	MOL3812	16	MBL3732	None
2	Plant Growth and Development	MOL3832	16	CHM3511 & CHM3512	None
2	Animal Growth and Development	MOL3852	16	BLG 3611 & MBL 3732	None
	Biochemistry Minor: No offering				
Total credits			***128***		

QUALIFICATION: B.Sc. (Honours) Molecular Biology Major and Chemistry Minor

Students opting for a major in **Molecular Biology** (with minors in Chemistry) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Contemporary Social Issues	CSI3580	8		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study Skills	LCE3419	16		None
1	Introduction to Biology	BLG3511	16		None
1	Physics for Life Sciences I	PHY3501	8		None
	Chemistry Minor:				
1	Chemistry IA	CHM3511	16		None
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Introduction to Statistics	STS3522	8		None
2	Diversity of Life	BLG3512	16		None
	Chemistry Minor:				
2	Chemistry IB	CHM3512	16		None
Total credits			***160***		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-/COREQUISITES	CO-REQUISITES
1	Animal Form and Function	BLG3611	16	BLG3511	None
1	Cell Molecular Biology and Genetics	MBL3631	16	BLG3511 & BLG3512	None
1	Statistics for Life Sciences I	STS3621	8	STS35422	None
	Chemistry Minor:				
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None
1	Inorganic Chemistry	CHM3611	16	CHM3511 & CHM3512	None
2	Plant Form and Function	BLG3612	16	BLG3511 & BLG3512	None
2	Introduction to Microbiology	MBL3632	16	BLG3511 & BLG3512	None
2	Statistics for Life Sciences II	STS3622	8	STS3522	None
2	Human Biology	MBL3652	16	BLG 3512 & CHM3511 & CHM 3512 OR CHM3532 (for education students only)	None
	Chemistry Minor:				
2	Organic Chemistry I	CHM3612	16	CHM3511,CHM3512	None
Total credits			***144***		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Plant Physiology	MBL3751	16	CHM3511 OR CHM3512 OR CHM3532	None
1	Microbiology	MBL3711	16	MBL3632	None
1	Recombinant DNA Technology	MBL3731	16	MBL3632 & MBL3631	None
	Chemistry Minor:				
1	Inorganic Chemistry II	CHM3701	8	CHM3611 & MAT3512	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
1	Industrial Chemistry	CHM3761	8	CHM3611 & CHM3612	None
1	Physical Inorganic Chemistry	CHM3762	8	CHM3701	None
2	Comparative Animal Physiology	MBL3752	16	BLG 3611	None
2	Biotechnology	MBL3712	16	MBL3632 & MBL3631	None
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
	Chemistry Minor: : No offering				
Total credits			***144***		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Research Project	BLG3810	32	STS3621 & STS3622 & BLG3702	None
1	Immunology	MBL3811	16	MBL3711	None
1	Applied Molecular Biology	MBL3831	16	MBL3731	None
1	Bioinformatics	MOL3811	16	MBL3631 & MBL3632 & MBL3732	
	Chemistry Minor: No offering				
2	Applied Genetics	MOL3812	16	MBL3732	None
2	Plant Growth and Development	MOL3832	16	CHM3511 & CHM3512	None
2	Animal Growth and Development	MOL3852	16	BLG 3611 & MBL 3732	None
	Chemistry Minor: No offering				
Total credits			**128**		

N.4. DEPARTMENT OF BIOLOGICAL SCIENCES CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

BLG3511 INTRODUCTION TO BIOLOGY

Module title: **INTRODUCTION TO BIOLOGY**
Code: **BLG 3511**
NQF level: 5
Contact hours: 4 lectures/ week for 14 weeks and one 3-hour practical session per week.
Credits: 16
Module assessment: Continuous assessment **(40%):** Theory (not less than 3 tests and 2 assignments), 40% Practicals (not less than 10 marked assignment), 60% Examination **(60%)**: 3 hour theory examination paper.
Prerequisites: **NSCC** (Biology C or better)
Module description: It will consider organization of life, chemical basis of life, carbohydrates, proteins, nucleic acids, lipids and fats, water, cell structure and function, prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell communication, mitosis, meiosis, cell reproduction, cell cycle, and cell death. The following topics will be covered: Introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdoms and the three domain system. Definitions and categories/groups within the five kingdoms, evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. Concepts such as homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered. The course content will also include genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance, linkage and cross-over, recombination, sex determination. The course content will also cover an introduction to Ecology: Definitions, history, scales in ecology, application of ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources.

BLG3512 DIVERSITY OF LIFE

Module title: **DIVERSITY OF LIFE**
Code: **BLG 3512**
NQF level: 5
Contact hours: 4 lecture periods / week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment **(40%)**: Theory 50% (not less that 3 tests and 2 assignments); Practicals 50% (not less that 10 marked assignments) Examination **(60%)**: 1 x 3 hour theory paper
Prerequisites: **NSCC** (Biology C or better)
Module description: This module is designed to give students a detailed understanding of the diversity of life. It gives students the broader appreciation of biodiversity in the different ecological habitats. The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each Phylum shall follow a phylogenetic (evolutionary) approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted. This module prepares students to understand subsequent courses such as Introduction to Ecology and Microbiology, Population Ecology, Comparative physiology, Biogeography, Plant and Animal Form and Function.Topics covered will include viral, bacterial, fungal, algal, animal and plant diversity. It then considers the characteristics and life cycles of the following important algae, plant and animal groups: Chlorophyta, Phaeophyta, Rhodophyta, Chrysophyta, Euglenophyta, Pyrrophyta, Cryptophyta, bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia). Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.

SECOND YEAR MODULES

BLG3611 ANIMAL FORM AND FUNCTION

Module title: **ANIMAL FORM AND FUNCTION**
Code: **BLG3611**
NQF Level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment **(40%)**: Theory 50% (not less than 2 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments); Examination **(60%)**: 1x3 hour theory examination paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: This module intends to provide the student with a thorough understanding of the structures and functions of different body organs and systems in various animal species. Structure, types and general characteristics and functions of epithelial tissues, cell-to-cell contact , structure and function of soft and specialized connective tissues, structure and functions of skeletal, smooth and cardiac muscles, structure and functions of neurons, types of neurons, neuralgia and their functions. Mechanisms of homeostasis, positive feedback, information flow. Communication lines of vertebrate nervous systems, sodium-potassium pumps, chemical synapses and neurotransmitters. The invertebrate nervous system, the nerve net and function, the nerve cord. Functional divisions of vertebrate nervous systems, brain cavities and canals, blood – brain – barrier, the limbic system. Mechanoreceptors, thermo-receptors, pain receptors, chemo-receptors, osmo-receptors, photoreceptors. Senses of taste and smell, sense of balance.
The structure and function of vertebrate eye and ear. The structure and functions of the endocrine glands. Prostaglandins-types and functions. Feedback control of hormonal secretions. Role of hormones in arthropod metamorphosis. Integumentary system, vertebrate skin and structure and its functions. Bone structure and functions, skeletal joints, skeletal muscular system. The vertebrate and invertebrate circulatory systems, links with lymphatic system, functions of blood, blood volume and composition, the heart and dorsal vessel-structure and functions, blood pressure, cardiovascular disorders, the defense system – barrier to infection, specific and non-specific responses, inflammation, control of immune response, cell-mediated and antibody mediated responses, immunoglobulins and lymphocytes. Gas exchange, factors influencing gas exchange, gas transport pigments, vertebrate lungs and structures, breathing mechanisms, respiratory cycle, oxygen and carbon dioxide transport, chemoreceptors (carotid bodies and aortic bodies), respiratory systems of mammals, fish, birds and arthropods. Reproduction in vertebrates and invertebrates. Temperature regulation.

EBL3631 INTRODUCTION TO ECOLOGY

Module title: **INTRODUCTION TO ECOLOGY**
Code: **EBL3631**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous Assessment **(40%)**: Practicals 50% (no less than 5 assessed practicals), Theory 50% (3 tests, 1 assignment) Examination **60%**: 1 x 3 hr theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: This module provides solid background knowledge on the various sub-disciplines of Ecology while providing sound explanations of the basic terminology and definitions in Ecology. This module lays the foundation for environmental studies at higher level.The module starts by revising topics covered in Introduction to Biology and then proceed to the following sub-disciplines of Ecology: Population Ecology- Characteristics of populations: birth, death, movement, size, age structure, and sex ratios. Community Ecology- Patterns in conditions and resources, measuring biodiversity, biomes. Ecosystem ecology- Primary productivity, flux of matter and trophic structures, food chains and food webs, biogeochemical cycles (hydrological-, carbon-, nitrogen-, and sulfur and phosphorous- cycles. Conservation Ecology and Biodiversity- Definitions of biodiversity, distribution of the world's and Namibia's biodiversity; the current human caused mass extinction. History, concepts and definitions of Conservation Biology. Aquatic Ecology- The physical properties of water, Stream Ecology, Lake Ecology, Oceans, Coasts, Estuaries.

MBL3631 CELL MOLECULAR BIOLOGY AND GENETICS

Module title: CELL MOLECULAR BIOLOGY AND GENETICS
Code: **MBL3631**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment **(40%)**: Theory - minimum of 2 tests and 1 assignment; Practicals – no less than 10 marked practicals Examination **(60%)**: 3 hour theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: An introduction to the chemical basis of cellular processes: important elements, compounds and molecules as well as chemical bonds and their importance and roles in biochemical reactions are being looked at. The organization of the chloroplast and mitochondrion and their principal metabolic pathways are also reviewed. An introduction to cancer starting with the distinction between normal and abnormal cell division as well as studying at the genetic basis of cancer. There will be an overview of Mendelian & non-Mendelian Genetics: chromosomal theory of inheritance, sex determination & sex-linked genes, basic genetic linkage and chromosome mapping, and the Genetic Code. Structure and function of eukaryotic chromosomes and mutations as the basis for genetic variations. This leads to the study of macromolecules such as proteins, enzymes and nucleic acids and their roles in cellular organization. This unit also examines the organization and control of genetic information in the production of proteins. The structure of DNA and and genome size and complexity will be described in the course as the fountation for Molecular Biology. An introduction to nucleic acid processes such as DNA replication covering the unit of replication (replicon), apparatus for DNA replication (primosomes and replisomes). An outline of Eukaryotic transcription and RNA processing: transcription complex including promoters, transcription factors ,RNA polymerase and the description of mechanisms of RNA splicing. An outline of Prokaryotic gene expression : control at initiation, RNA polymerase-promoter interactions, panolopy of operons and control at termination. Translation of Proteins through successive steps(initiation, elongation and termination) exploiting tRNA as the translational adaptor and ribosomes as the translational factory. The practical content in this will focus on: isolation of DNA from whole blood and tissues, introduction to gel electophoresis and introduction to PCR.

BLG3612 PLANT FORM AND FUNCTION

Module title: **PLANT FORM AND FUNCTION**
Code: **BLG3612**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Module assessment: Continuous assessment (**40%)**: Theory 50% (not less than 2 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments)
Examination **(60%)**: 1 x 3 hour theory paper (70%); 1x2 hour practical paper (30 %)
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: This is a full course for one semester where a survey of vascular plants using evolutionary and ecological principles to interpret patterns of diversity in vascular plant form and function. Topics include morphological adaptations of plants, the genetic properties of plant populations, plant reproduction and mating system variation, a survey of biotic and abiotic ecological interactions important to flowering plants. The focus of the course is on the anatomy and functional morphology of photosynthetic organisms in both aquatic and terrestrial systems. Laboratory work will include a survey of flowering plant taxonomy and plant forms and functions. Laboratory projects will demonstrate methods used for establishing evolutionary relationships, assessing genetic structure in natural populations, and identifying adaptive features of plant form and function.

EBL3632 ECOLOGICAL FIELD TECHNIQUES

Module title: **ECOLOGICAL FIELD TECHNIQUES**
Code: **EBL3632**
NQF Level: 6
Contact hours: 4 lecture periods per week for 14 weeks, 3 hours practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (at least 5 assessed practicals (35%); 3 tests (35%); specimen collecting and preservation mini-project (30%) Examination **60%**: 1 x 3 hrs theory paper
Pre-requisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Module description: This module will emphasize the practical field component where students should learn more hands-on practice and experience. In addition to other important aspects, the module places emphasis on the Scientific Method and specimen identification. This module lays the foundation for biodiversity studies at higher level.
Introduction and definitions; scientific method; important considerations in planning ecological research; important considerations in field sampling (objectives of sampling, type and behaviour of organism, habitat considerations, equipment requirements, selection of appropriate method, sampling design and strategy, data recording and storage, sampling regime); methods of sampling terrestrial vascular plants; methods of surveying fungi, lichens and mosses; methods of sampling aquatic macrophytes and algae; methods of sampling invertebrates in the field; methods of inventorying small mammals; methods of surveying large mammals; methods of sampling reptiles; methods of sampling birds and bats; methods of sampling fish and other aquatic animals. All the discussions on methods must include their applicability, advantages and disadvantages of in every case. Preserving organisms for natural history collections (killing jars and their uses, herbarium specimens, 'spirit' collections, dry mounts, various agents of preservation and their advantages and disadvantages); simple dichotomous keys and their uses (parallel keys, indented keys, flow-chart keys only); methods of assessing abiotic variables, data analysis methods (include basic statistics).

MBL3632 INTRODUCTION TO MICROBIOLOGY

Module title: **INTRODUCTION TO MICROBIOLOGY**
Code: **MBL3632**
NQA level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Module assessment: Continuous assessment **(40%)**: Theory 50% (not less than 2 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments) Examination **(60%)**: 1 x 3-hour theory paper.
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life.
Module description: The course will include principles of microbiology, importance of microorganisms, microorganisms as cells, microorganisms and their natural environments, impacts of microorganisms on humans, and pathways of discovery in microbiology. It will also give an overview of microbial life, cell structure and evolutionary history, physiological diversity of microorganisms, prokaryotic diversity, and eukaryotic microorganisms. Other topics are microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and chemotaxis, staining techniques, microbial nutrition, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, microbial evolution and systematics, Eubacteria, Archae, eukaryotic microorganisms, viruses, bacteriophages, prions, diversity of microbial metabolism, microbial ecology, and methods in microbial ecology.

MBL3652 HUMAN BIOLOGY

Module title: **HUMAN BIOLOGY**
Code: **MBL3652**
NQF Level: 6
Contact hours: 4 lecture periods per week for 14 weeks, 1P/week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%);
Examination: **60%** (1 x 3h examination paper)
Prerequisite: **CHM3532** Chemistry for Life Sciences (for Edcuations students only), **BLG3512** Diversity of Life, **CHM3511** Chemistry 1A, **CHM3512** Chemistry 1B
Module description: This module intends to provide the student with a thorough understanding of the structures and functions of different human body organs and systems, various diseases afflicting humans, e.g. Cancer, Stress and HIV/AIDS as well as the harmful effects of narcotic drugs. It will cover the following topics: Organs and accessory organs of the digestive system and their functions, digestion, absorption and nutrition of carbohydrates, proteins, lipids and, digestive enzymes, minerals and vitamins. The cardiovascular system, the structure and functions of the heart, blood vessels and cells. The pulmonary circuit and systemic circuit. Functions of blood, blood clotting mechanism and blood groups. The lymphatic system, structures of the lymphatic vessels and organs. The structures and functions of the respiratory system, external, internal and cellular respiration. Lung volumes. Exchange of gases in the alveoli. The functions of the respiratory epithelium and the mucus blanket. Factors affecting pulmonary ventilation. Kidney structure and functions. Glomerular filtration, tubular reabsorption and secretion. The role of juxtaglomerular apparatus in blood pressure regulation. The role of kidneys in electrolyte and acid base balance and homeostasis. The structure and functions of the peripheral nervous system, cranial and spinal nerves, action and resting potentials. Impulse transmission across synapses and neurotransmitters. The neuroglia and their functions. The somatic and autonomic systems. The sympathetic and parasympathetic systems. The reflex arch. The structure and functions of the central nervous system. The structures and functions of the eye and the ear. The chemoreceptors and olfactory cells. The structure of the endocrine glands, their hormones and functions. Structures and functions of the male and female reproductive organs.
The formation of male and female gametes. The role of hormones in reproduction. Human development and aging. Human population growth and pollution. Sexually-transmitted diseases including HIV/AIDS. Causes and prevention of cancers. Carcinogens, heredity and immunodeficiency. Characteristics of cancer cells and classification of cancers. Stress and the role of hormones in stress development. Drug Abuse: alcohol, nicotine, marijuana, cocaine, heroine, and their effects on body systems

THIRD YEAR MODULES

EBL3700 FIELD ECOLOGY I

Module title: **FIELD ECOLOGY I**
Code: **EBL3700**
NQF level: 7
Contact hours: 4 weeks (up to) field trip for all modules combined
Credits: 8
Module assessment: Continuous assessment: **100%** (Field reports)
Co-requisites: **EBL3711** Freshwater & Marine Ecology (1st semester), **EBL3712** Ecosystem Ecology and **EBL3732** Conservation Biology & Biodiversity (both 2nd semester)
Module description: Students must carry out compulsory field courses for the modules EBL3711 Freshwater and Marine Ecology (1st semester), EBL3712 Ecosystem Ecology and EBL3732 Conservation Biology & Biodiversity (both 2nd semester). The field courses will be conducted in various localities, either jointly or separately and tasks may vary from year to year depending on the issues at hand.

Any student who does not take part in the field course will NOT be allowed to sit the examinations of the respective modules.

EBL3711 FRESHWATER AND MARINE ECOLOGY

Module title: **FRESHWATER AND MARINE ECOLOGY**
Code: **EBL3711**
NQF Level: 7
Contact hours: 4 lectures / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%**: 1 x 3 hours theory paper
Prerequisites: **EBL3631** Introduction to Ecology
Module description: Aquatic ecosystems cover more than 70% of the Earth's surface and play an important role in global geochemical cycles, which affect the global climate. In addition, Namibia is an arid country with a limited amount of surface water. It is also a country with a highly productive coastline, because of upwelling processes. The study of freshwater and marine ecology is therefore crucial to provide the students a basis for further studies that will allow proper management of our wetland ecosystems. Any student who does not take part in the field course in EBL3700 Field Ecology I will NOT be allowed to sit the examination. Freshwater Ecology: Ecology of lakes and dams (lentic ecosystems): Thermal stratification of lentic systems and its effects on primary production; Seasonal lake turnover and its effect on primary production and the ecology of lentic systems; Energy flow and food webs in lentic systems; Eutrophication and algal blooms. Ecology of rivers and streams (lotic ecosystems): Distinguishing characteristics of rivers; The river continuum concept; Ephemeral river dynamics; floodplain dynamics; Energy flow and food webs in lotic systems. Freshwater wetland systems of Namibia. Principles of freshwater aquaculture (Aquaculture in Namibian state dams, aquaculture in traditional settings, general problems experienced in aquaculture).Marine Ecology: Physical and chemical Oceanography (the extent and depth of the oceans, Ocean currents, Temperature, Pressure, Illumination, Gases, chemical composition of seawater). Ocean circulation; the great conveyer system in the Ocean; the physics of waves in the ocean. The generation of tides – physical processes. Upwelling: Physical processes involved in upwelling – Ekman drift; the importance of upwelling in productivity; The Namibian upwelling system as one of the most productive upwelling systems in the world. Organic production in the marine environment (Nutrients, Plankton, Red tides, Sulfur eruption on the Namibian coast, Energy flow and food webs in the pelagic marine environment). Intertidal zone ecology – Rocky shores and sandy shores. Life in the deep oceans (adaptations of organisms). Aquatic biogeochemistry and ecology: The carbon, nitrogen, sulfur and iron cycles in freshwater and marine aquatic environments. Discuss the difference between these cycles in the sediment and in the water column of aquatic systems. Define what is meant by fluxes out of the sediment and its importance in the biogeochemical cycles. The measurement and calculation of biogeochemical rates and fluxes in sediments. The use of radioactive and stable isotopes in biogeochemistry. Extreme Marine environments (Hydrothermal vents, Hypersaline aquatic environments, cold seeps, sea ice). Ocean fertilization and its effect on the biogeochemical cycles in aquatic systems.

EBL3731 POPULATION ECOLOGY

Module title: **POPULATION ECOLOGY**
Code: **EBL3731**
NQF Level: 7
Contact hours: 4 lecture periods per/ week; 3 hours practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%** (1 x 3 hr theory paper)
Pre-requisites: **EBL3631** Introduction to Ecology
Module description: This module is designed to equip students with the necessary understanding of population dynamics. This forms the basis of understanding concepts of interactions among different species and between species and their environment.
This will enable them to fully understand the importance of these issues with respect to managing these species and their environments. It also prepares students for later modules in conservation biology, behavioural ecology, natural resources management and others.
Introduction and definitions; Properties of populations (population density, population dispersion, age structure, sex ratios); Mortality, natality and survivorship; Population growth (density-dependent, density-independent, population fluctuations and cycles, key factor analysis, extinction); Population regulation (mechanisms of population regulation, intra-specific competition, dispersal, social interactions); Life history patterns (mating systems, types of sexual reproduction, reproductive effort, r- and k-selection, sexual selection); Inter-specific competition (competitive exclusion principle, resource partitioning, differential resource utilization); Predation (models of predation, classical predator-prey systems, plant-herbivore interactions, functional response, numerical response, foraging theory, cannibalism); Parasitism (classes of parasites, hosts as habitats, parasite population dynamics, evolutionary aspects of parasitism, social parasitism – kleptoparasitism and brood parasitism); Population genetics (genetic variation, natural selection, inbreeding, genetic drift); Mutualism (definitions, types and examples of mutualism); Pest control and management (definitions, chemical control, biological control, genetic control, integrated pest management).

MBL3751 PLANT PHYSIOLOGY

Module title: **PLANT PHYSIOLOGY**
Code: **MBL3751**
NQF level: 7
Contact hours: 4 lecture periods per week for 14 weeks, 3 hour practicals per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment: **40%** (at least 2 tests and 8 practical marks) Examination: **60%** (1 x 3h theory paper)
Prerequisites: **CHM3511** Chemistry 1A OR **CHM3512** Chemistry 1B OR **CHM3532** Chemistry for Life Sciences
Module description: This module intends to provide students with a sound knowledge of plant metabolism and water relations, with emphasis on how physiological adaptations contribute to the ecological success of plants. The module will introduce the concept of energy and its use by plants energy transformations and the role of electron carriers and ATP. The process of photosynthesis will be examined by discussing aspects such as the leaf as a photosynthetic machine, photochemical reactions, the regulation of energy distribution, photoinhibition of photosynthesis, the PCR cycle and its regulation. This leads to an explanation of C4 and CAM photosynthesis and the ecological advantages of these adaptations. Aerobic and anaerobic respiration as well as the alternative electron transport pathways found in plants and their ecological implications will be discussed in detail. The module will further consider biological nitrogen fixation, nitrogen assimilation and nitrogen cycling. Water & solute uptake by plant cells will be discussed against the background of the concept of water potential, and principles and energetics of solute absorption. The soil as main source of mineral nutrition, as well as ways in which plants supplement this nutrition through bacterial and fungal interactions will be investigated. The module will conclude with a discussion of the photosynthesis-transpiration compromise, the cohesion theory of transpiration, cavitations and the vulnerability of the xylem, hydraulic lift, source-sink relationships, the Münch pressure flow model, as well as phloem loading and unloading.

EBL3712 ECOSYSTEM ECOLOGY

Module title: **ECOSYSTEM ECOLOGY**
Code: **EBL3712**
NQF level: 7
Contact hours: 4 hours lectures / week, 3 hrs practicals per week
Credits: 16
Module assessment: Continuous assessment **40%:** Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%** (1x3 hours theory paper)
Prerequisites: **EBL3631** Introduction to Ecology

Module description: This module will provide an insight into the structure and function of nature at the community, ecosystem and biome levels of biological organization. Students will be introduced to the science of ecosystem ecology, a study of communities of plants and animals and how they interact with each other and their physical environment. Applied aspects of ecology such as deforestation and desertification will also form an important component of the module. Any student who does not take part in the field course in EBL3700 Field Ecology I will NOT be allowed to sit the examination.

Basic components of ecological systems, essential processes of ecological systems: Photosynthesis and decomposition. Nature of ecosystem energetics. Primary production; environmental factors facilitating and / or limiting primary production. Secondary production; environmental factors facilitating and / or limiting, food chains and food webs; trophic levels and ecological pyramids, Food chains and poisons in the environment, models of energy flow in ecosystems. Biogeochemical cycles: Gaseous cycles (oxygen cycle, carbon cycle, nitrogen cycle) Sedimentary cycles (phosphorous cycle, surphur cycle). What is a community? Physical (vertical and horizontal) structure, biological structure (species dominance, species diversity); species diversity hypotheses, species abundance, edge communities, community population interactions, community patterns in space and time. Theory of island biogeography, habitat fragmentation, habitat corridors, applications of island biogeography theory to design of protected areas. ecological disturbance? Characteristics of ecological disturbance (intensity, frequency and scale), Causes of disturbance, impacts of disturbance on nutrient cycling, Responses of animals to disturbance, disturbance and community stability. What is community succession? Process of ecological community succession, Types of succession; primary and secondary succession, Causes of succession; models of succession, climax succession state; climax community, theories of climax succession, fluctuations in climax communities, attributes of succession during succession, time and direction in succession, changes in ecosystem attributes, time and direction of succession, succession and animal life, degradative succession. Definition and classification of biomes. Desert biome, Tropical savanna biome, Tropical rain forest biome, grassland biome. For each biome, shall cover: geographic location, climate, soils, life forms, and human activities. Classification of biomes of Namibia. Desert biome, savanna biome, woodland biome, Karroo biome, Coastal and marine biome, wetland biome, land use practices in terrestrial and aquatic biomes of Namibia.

What are arid environments? Causes and classification of arid ecosystems, characteristics of arid ecosystems; water (surface and ground), floods, Humidity, temperature, wind and wind erosion, soils, dust & dust storms, adaptations of organisms to arid environments. What is desertification? Causes of desertification (proximate and ultimate causes), manifestations of desertification, action to combat desertification, What is deforestation? Causes of deforestation (proximate and ultimate causes), Effects of deforestation; deforestation in Namibia, possible solutions to deforestation.

BLG3702 RESEARCH METHODOLOGY

Module title: **RESEARCH METHODOLOGY**
Code: **BLG3702**
NQF level: 7
Contact hours: 2 lecture session per week, 3 hour practical every other week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **100%** (5 assessed assignments, 1 test)
Prerequisites: **STS3621** Statistics for Life Sciences I and **STS3622** Statistics for Life Sciences II

Module description: This module is designed to provide students with understanding of the general theoretical aspects of scientific principles that are followed in order to conduct research and communicate scientific results. The scientific method will form the basis of discussion in this module. In the module, students will acquire relevant skills in planning, developing as well as conducting scientific researchOverview of research. Ethics of research. The scientific method: logic and the scientific, natural observations, asking questions and formulation of hypothesis, predictions. Types of hypotheses; null, alternative, research. Biological variation, populations and sampling. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance, Testing hypotheses. Experimental (research study /project) design. Data collection & keeping / documenting research data & other records. Presentation of data in the scientific reports/ theses / dissertation. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review. Report writing. Giving a good oral presentation (including use of power point).

EBL3732 CONSERVATION BIOLOGY AND BIODIVERSITY

Module title: **CONSERVATION BIOLOGY AND BIODIVERSITY**
Code: **EBL3732**
NQF level: 7
Contact hours: 4 lecture period per week for 14 weeks, 3 hours practical per week for 14 weeks
Credits: 16
Module assessment: Continuous Assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%**: 1 x 3 hr theory paper
Prerequisites: **EBL3631** Introduction to Ecology, **EBL 3731** Population Ecology
Module description: Any student who does not take part in the field course in EBL3700 Field Ecology I will NOT be allowed to sit the examination. Students will study in depth: Global patterns, distribution and measurement of biodiversity with special emphasis on Namibian biodiversity; Biodiversity inventories; rapid biodiversity assessment. Environmental ethics, Ecological Economics (valuation of biodiversity) with emphasis on the direct use value, indirect use value, option value, and existence value. Threats to biological diversity and extinction with special emphasis on the causes of extinction (habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease) as well as species vulnerability to extinction; Applying the Island Biogeography model to estimation of extinction rates. Conservation at the population and species level: Species categories (keystone, indicator, flagship, umbrella and economically important species), Essential concepts and problems of small populations, Applied population biology: Studying populations, population viability analysis, metapopulations, establishing new populations, Ex Situ conservation, Conserving biological communities: Prioritising, establishing and classifying protected areas, Reserve design and conservation networks, SLOSS model, managing protected areas. Restoration Ecology. Biodiversity conservation agreements.

MBL3752 COMPARATIVE ANIMAL PHYSIOLOGY

Module title: **COMPARATIVE ANIMAL PHYSIOLOGY**
Code: **MBL3752**
NQF Level: 7
Contact hours: 4 lecture periods per week for 14 weeks, 1 practical session per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%); Examination: **60%** (1 x 3h examination paper)
Pre-requisites: **BLG3611** Animal Formand Function
Module description: This module intends to provide the student with a thorough understanding of the functioning of different animal species and their adaptations that enable them to survive in different environments. It will cover the following topics: Cellular and animal energetics, physico-chemical effects of temperature, avenues for heat exchange between animals and their environments, patterns of thermoregulation in various animal groups. Metabolism in hibernating animals. Membrane physiology and solute regulation by cells and electrophysiology of cells. Physiology of excitable cells (sensory physiology and nervous systems). Animal movement by means of cilia, flagella and muscular contractions, animal locomotion in water, land and air. Control of various body functions e.g. growth and regeneration, reproduction, iono-and osmoregulation, cellular metabolism and color by neurohormonal and classic hormonal systems. Aquatic and aerial respiration and how physical principles involved in gas exchange apply to various gas exchange structures e.g. body surface, gills, lungs and tracheal system. Structures and functions of circulatory system. Physiological role of water and solute regulation in terrestrial and aquatic animals. Structures and functions of specific excretory organs, e.g. coelomoducts, nephrons, Malpighian tubules, etc. Structures and functions of respiratory systems (lungs, gills, skin, tracheae, etc). Feeding mechanisms, cell secretion and movement (secretion and peristalsis by gut tube), cellular biochemistry (digestive enzymes and biochemistry of hydrolysis of various organic substrates) and nutrition (role of vitamins). Adaptations to low and high temperatures and altitude.

MBL3711 MICROBIOLOGY

Module title: **MICROBIOLOGY**
Code: **MBL3711**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (minimum of 2 tests and 2 Assignments), Examination **60%** (1 x 2 hour examination paper)
Prerequisites: **MBL3632** Introduction to Microbiology
Module description: Identification of bacteria: Microscopy, culture characteristics, biochemical tests, rapid methods. Bacterial photosynthesis: oxygenic photosynthesis, anoxigenic photosynthesis. Microbial metabolism: chemolithotrophy,, reduction of inorganic molecules, Generation of energy: Breakdown of glucose to pyruvate, Embden-Meyerhof-Parnas pathway, Entner-Doudoroff pathway, Pentose-phosphate pathway. Aerobic and anaerobic respiration, fermentations. Oxidation of inorganic molecules, methanogenesis, acetogenesis. Microbial genetics and genetic engineering: Organization and replication of prokaryotic DNA. Mutations: point mutations, base-pair substitution, frameshift mutations, pyrimidine dimmers. Causes of mutations: UVlight/radiation, chemical base analogues, mutagenesis. Mutation repair mechanisms: SOS repair, post-transcription repair, base excision repair. Conjugation, transformation and transduction. Isolation, specific cleavage and synthesis of DNA. Vectors, Transformation, Identifying recombinants. Good microbiology laboratory practice, techniques in microbiology.

MBL3731 RECOMBINANT DNA TECHNOLOGY

Module title: **RECOMBINANT DNA TECHNOLOGY**
Code: **MBL 3731**
NQF level: 7
Contact hours: 4 L / week for 14 weeks + 3h P/week for 14 weeks
Credits: 16
Module assessment: Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%)
Examination: **60%** (1 x 3h examination paper)
Prerequisites: **MBL3632** Introduction to Microbiology, **MBL3631** Cell Molecular Biology and Genetics
Module description: Recombinant DNA techniques were developed through discoveries in Molecular Biology. Although the experimental techniques used may vary, depending on the objectives of the investigation, a number of experimental protocols have been developed that could be considered to form the basic techniques in recombinant DNA technology. The students will critically assess and analyse the links between the research questions and the techniques to be used in order to develop the student's understanding of and appreciation for molecular biological processes. Students will have hands-on experience in laboratory sessions in both planning and executing experimental procedures. The principles and applications of the following techniques will be discussed: nucleic acid extraction, gel electrophoresis, restriction and other modifying enzymes, cloning vehicles and the cloning process, polymerase chain reaction, transformation, gene libraries, identifying recombinants, sequencing and characterizing genes.

MBL3712 BIOTECHNOLOGY

Module title: **BIOTECHNOLOGY**
Code: **MBL 3712**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment: 40% (3 tests and at least 10 practical marks)
Examination: 60% (1 x 3h examination paper)
Prerequisites: **MBL3631** Cell Molecular Biology and Genetics,
Co-requsites: **MBL3731** Recombinant DNA Technology
Module description: This course is aimed at giving students a sound basic knowledge and skills in biotechnology related topics: **Introduction to biotechnology:** Definitions, scope of biotechnology, principles and techniques in genetics, biochemistry and microbiology, issues around GMOs. **Genomics**: Definitions, concepts of gene expression and analysis, techniques-genomic libraries and analysis, southern blots, applications. **Proteomics:** definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. **Transcriptomics**: definitions, concepts of gene regulation in prokaryotes and eukaryotes and analysis, Techniques- cDNA libraries and analysis, Northern blots, applications. **Metabolomics:** definitions, concepts of metabolism and analysis, primary and secondary metabolites, Techniques-metabolic pathways and analysis.

MBL3732 GENETICS

Module title: **GENETICS**
Code: **MBL 3732**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals and 2 theory tests.
Examination **60%**: 1 x 3 hour theory paper.
Prerequisites: **MBL3631** Cell Molecular Biology and Genetics, **MBL3632** Introduction to Microbiology
Module description: Introduction to genetics; heredity and variation; Mendelian genetics; Extensions to Mendelian genetics; chromosome theory and mapping; sex chromosomes and sex determination; genes that regulate development in selected model organisms; population genetics: allele frequencies, Hardy-Weinberg law, natural selection, genetic drift; and evolutionary genetics including speciation.

4TH YEAR MODULES

EBL 3800 FIELD ECOLOGY II	
Module title:	**FIELD ECOLOGY II**
Code:	**EBI3800**
NQF level:	8
Contact hours:	4 weeks field trip (2 weeks in each semester – up to one week for each module))
Credits:	8
Module assessment:	Continuous assessment: **100%** (field report)
Co-requisites:	**EBL3811** Environmental Management, **EBL3851** Biogeography (both 1st semester), **EBL3852** Behavioural Ecology, **EBL3832** Management of Natural Resources (both 2nd semester)

Module description: Students must carry out compulsory field courses for the modules **EBL3811** Environmental Management and **EBL 3851** Biogeography (both 1st semester), **EBL3852** Behavioural Ecology and **EBL3832** Management of Natural Resources (both 2nd semester). The field courses will be conducted in various localities, either jointly or separately and tasks may vary from year to year depending on the issues at hand. Any student who does not take part in the field course will NOT be allowed to sit the examinations of the respective modules.

BLG3810 RESEARCH PROJECT	
Module title:	**RESEARCH PROJECT**
Code:	**BLG3810**
NQF level:	8
Contact hours:	Research project for one year
Credits:	32
Module assessment:	Continuous assessment: **100%** (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%)
Prerequisites:	**BLG3702** Research Methodology

Module description: This module is designed to develop the research skills of students through the completion of a research project on an approved topic in the context of the major. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion.

MBL3811 IMMUNOLOGY	
Module title:	**IMMUNOLOGY**
Code:	**MBL3811**
NQF level:	8
Contact hours:	4 lecture periods per week and 3 hour practical per week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment **40%** (minimum of 2 tests and 1 assignment) Examination **60%** (3 hour examination paper)
Prerequisites:	**MBL 3711** Microbiology

Module description: The course will introduce the immune system by addressing procesess and components such as : immunoglobulin classes, structure and functions of antibody molecules, lymphoid organs , antigen processing ,cells involved in the immune system, T-cell receptors, Major-Histocompatiblity Complex and complement pathways. Different types of immunity such cellular mediated immunity,humoral immunity and autoimmunity will also be addressed in the course. Various human diseases caused by viruses, bacteria and parasites such as HIV/AIDS tuberculosis and malaria will then be discussed in order to give an applied perspective of immunology. Related aspects like vaccination and drug efficacy will also be covered as complementary components of the course. Contemporary issues pertaining to immunology such as gene therapy, and stem cell research will also be looked at. The practical content will include preparation of serum from whole blood, doing the Enzyme Linked Immuno-Sorbent Assays(ELISA), doing agglutination tests, antibody conjugation assays and inoculation of laboratory animals and monitoring antibody titre.

EBL3811 ENVIRONMENTAL MANAGEMENT

Module title:	**ENVIRONMENTAL MANAGEMENT**
Code:	**EBL3811**
NQF level:	8
Contact hours:	4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits:	16
Module assessment:	Continuous Assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%**: 1x 3 hours theory paper
Pre-requisites:	**EBL3731** Population Ecology, and **EBL3712** Ecosystem Ecology, and **EBL3732** Conservation Biology and Biodiversity

Module description: This course is multidisciplinary and aims to provide students with in-depth understanding of environmental management and its application. It addresses biophysical, social and economic issues affecting natural resources such as water, soil, air, plant and animal communities and their use through agriculture, forestry, fisheries, human settlement and industry. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. The concept of sustainable development and management of natural resources. Principles of environmental management, Human dimension in resource and environmental management, International Environmental conventions and treaties, Environmental legislation and policies in environmental protection with special reference to Namibia. Environmental Management Systems (EMS); ISO 14000 series of standards, Integrated Environmental Management Systems (IMS); Principles of IMS, proactive planning, informed decision making, open participatory approach, accountability for decisions and information on which they are based. Environmental impact assessment (EIA): history and evolution of EIA, the overall EIA process. Social Impact assessment; Law, policy and institutional arrangements for EIA systems, Public involvement, screening, scoping, assessment of impacts, mitigation and impact management, Reporting, Review, decision-making, monitoring and implementation. Environmental Management Plans. Project management, Environmental Audits, Environmental Cost Benefit Analysis, Clean technologies: current and best practices in methodologies of clean technology in waste minimization, prevention of pollution, cleaner production, cleaner processing. Problems associated with generation of waste and pollution. Management of solid and hazardous waste; current issues in environmental management.

EBL3831 BIOSYSTEMATICS

Module title:	**BIOSYSTEMATICS**
Code:	**EBL3831**
NQF Level:	8
Contact hours:	4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment **40%**: Practicals 35% (5 or more assessed practicals), Theory 50% (2 tests, 1 assignment), Specimen Collecting project (15%). Examination **60%**: (1 x 3 hours theory paper)
Pre-requisites:	**EBL3632** Ecological Field Techniques, and **BLG3612** Plant Form & Function, and **BLG3611** Animal Form & Function

Module description: This module is designed to thoroughly prepare candidates for biodiversity assessments and curation of natural history collections. The module emphasizes the collection, identification, curation (physical and taxonomic) and general management of natural history collections – thus endowing candidates with the necessary knowledge and skills to meet the above objective. Definitions, scope and importance of biosystematics; History and Development of biosystematics; Sources of taxonomic information; Types, use and construction of taxonomic keys; Evolution, variation and biosystematics; Principles of taxonomy; Principles of biological nomenclature, including provisions of Codes of Botanical and Zoological Nomenclature; Classification systems (The process of classification, Phenetic classification, Phylogenetic classification, Cladistics and the use of molecular techniques in phylogenetic analyses); Natural history collections (Collection and preservation of specimens, Herbarium collections and their management, Museum collections and their management, The value of Natural History Collections); Current issues in biosystematics; Biosystematics Collecting Project (Students will be required to carry out a compulsory mini-project on the collection and preservation of selected plant and animal specimens. These specimens will be accessioned as the UNAM Natural History Museum and UNAM Herbarium).

EBL3851 BIOGEOGRAPHY

Module title: **BIOGEOGRAPHY**
Code: **EBL3851**
NQF level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous Assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (1 assignment, 2 tests) Examination **60%**: (1x3 hours theory paper)
Pre-requisites: **EBL3631** Introduction to Ecology and **EBL3712** Ecosystem Ecology
Module description: This module will introduce students to the science of BIOGEOGRAPHY; a study of the distribution of past and present life on the earth. This module will cover the distribution patterns of wild plants and animals over the earth's surface. It will describe factors that determine temporal (in time) and spatial (in space) patterns of biological diversity (biodiversity). Historical changes in distribution of plants and animals will be examined using data and concepts from different disciplines such as geology, ecology, evolutionary biology and physical geography.

Important biogeographic processes such as speciation, dispersal and extinction will be covered. The course will further describe past changes in the physical geography of the earth in an attempt to understand the role of such changes to the present and past distribution of plants and animals. As far as possible, and where applicable, relevant and appropriate examples from Namibia will be used. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Biogeography: definition, relationship with other sciences, philosophy and basic principals, brief history, applications of biogeography, Limits of species distributions: ecological niche, physical limiting factors, limitation by biotic interactions, adaptation and gene flow. Historical biogeography: Past changes in the physical geography of the earth: Geologic time scale, continental drift model, continents of the Paleozoic and early Mesozoic and early past changes in the physical geography of the earth: break-up of Gondwanaland. Speciation and extinctions: speciation, adaptive radiation, extinction, species selection. Dispersal: definition, mechanisms of biotic movement, nature of barriers to biotic movement, establishing a colony, dispersal routes. Invasive species will be used as case studies to illustrate various aspects of dispersal. Endemism, Provincialism & Disjunction: endemism, cosmopolitanism, types of endemics; provincialism – terrestrial biogeographic regions, biogeographic lines, classifying islands, aquatic regions and provinces, quantifying similarity among biota; Disjunction- definition & causes. Biogeographic distribution patterns of terrestrial animals: abilities of land creatures to cross water barriers amphibians, reptiles, mammals. Biogeographic distribution patterns of flying animals: bird, bats and insects. Biogeographic distribution patterns of plants: factors limiting growth and reproductive success of plants, regional endemism and patterns of speciation in plants, distribution patterns of non-vascular plants. Latitudinal taxonomic diversity gradients; latitudinal gradients in species. diversity, factors that may account for geographic patterns of species diversity: historical perturbations, productivity, harshness, climatic stability, habitat heterogeneity, competition, predation, mutualism.

EBL3802 DISTURBANCE AND RESTORATION ECOLOGY

Module title: **DISTURBANCE AND RESTORATION ECOLOGY**
Code: **EBL3802**
NQF Level: 8
Contact hours: 2 lecture periods per week, 3 hour practical per week for 7 weeks
Credits: 8
Module assessment: Continuous assessment **40%**: Practicals 50% (at least 3 assessed practicals), Theory 50% (1 test, 1 assignment) Examination **60%**: (1 x 2 hour theory paper)
Pre-requisites:EBL3712 Ecosystem Ecology and **EBL3732** Conservation Biology and Biodiversity
Module description: The world today is grappling with problems of degradation of habitats due to various factors. Such factors are usually referred to as 'disturbance factors' since they make these habitats less suitable for the original species to occupy. Such habitats have to be restored, somewhat, in order to conserve biological diversity. This module is designed to equip students with the knowledge about various disturbance factors and their impacts on the quality of habitats. The module also presents various approaches of restoring degraded/disturbed landscapes.

Disturbance ecology: Introduction (definitions, importance of disturbance, natural and anthropogenic disturbance, short-term and long-term aspects of disturbance, temporal and spatial aspects, reversible and non-reversible disturbance, disturbance regimes); resilience and stability in the face of disturbance; susceptibility to disturbance; types of disturbances and their impacts on ecosystem structure, function and productivity (include case examples to demonstrate impacts of fire, pollution, deforestation, unsustainable land management practices, over-exploitation, climate change, volcanoes, alien species, etc on the provision of goods and services by various ecosystems); interactive/synergistic impacts of disturbance factors; responses to disturbance from the organism level upwards the hierarchy, disturbance and biodiversity (include the intermediate disturbance hypothesis); modeling as a tool in disturbance ecology.

Restoration Ecology: Introduction (definitions, the need and importance of restoration); indicators of ecosystem degradation; principles of ecological restoration; planning for ecological restoration (various ecosystems); ecological restoration in practice (include case examples on various ecosystems); natural restoration; involvement of local communities in restoration work (case examples); Bio-monitoring and evaluation of the restoration process; challenges and opportunities for improving degraded landscapes.

EBL3832 MANAGEMENT OF NATURAL RESOURCES

Module title: **MANAGEMENT OF NATURAL RESOURCES**
Code: **EBL3832**
NQF Level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%:** (1 x 3 hrs theory paper)
Pre-requisites: **EBL3731** Population Ecology, and **EBL3712** Ecosystem Ecology, and **EBL3732** Conservation Biology and Biodiversity

Module description: This module prepares students to be able to get employment in sectors dealing with natural resources management such as Forestry, Fisheries and National Parks. It is designed to give good grounding in natural resources management on which candidates can build. It is expected that candidates will quickly adapt to the work environment after doing this course, once employed. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Definitions: management, sustainable management, natural resources; Objectives of natural resources management; classification of natural resources and how the classes may be linked (stock, flow, renewable, non-renewable, perpetual, exhaustible, non-exhaustible); measures of stock resource availability (resource base, proven reserves, conditional, reserves, hypothetical resources, speculative resources, ultimately recoverable resources); measures of flow resource availability (maximum resource potential, sustainable capacity, absorptive capacity, carrying capacity); indigenous traditional/technical knowledge (ITK) systems in natural resource management; Community based natural resource management (CBNRM) practices in southern Africa; Adaptive management of natural resources; Communities and protected areas (conflicts in natural resource use including human-wildlife conflict, biosphere reserve concept); Management of fisheries resources (commercial fisheries (include yield models), seaweeds, fisheries regulations, causes and consequences of coastal pollution); Wildlife/Game management (management of game for tourism and harvest, manipulation of animal numbers, concept of maximum sustained yield, CITES and international trade (selected case species); management of forest resources (include non-timber forest products); natural resource accounting and economic valuation (cost-benefit analysis, multi-objective cost-benefit analysis, identifying cost-benefit flows – problems of selection bias, calculating material costs and benefits, placing money values on non-market goods); current issues in natural resources management.

EBL3812 BEHAVIOURAL ECOLOGY

Module title: **BEHAVIOURAL ECOLOGY**
Code: **EBL3812**
NQF level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits: 16
Module assessment: Continuous Assessment **40%**: Theory 50% (at least 5 assessed practicals), Theory 50% (2 tests) Examination **60%**: (1x 3 hours theory paper)
Pre-requisites: EBL3731 Population Ecology

Module description: This module will introduce students to the role of behavior in understanding ecology of organisms. Special emphasis will be given to the genetic basis of behavior, how behavior evolved (phylogeny) as well as how it develops in organisms (ontogeny). These will provide a foundation to understand learned and innate behavior and how behavioral ecology is instrumental in applied ecology disciplines such as conservation biology. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination.

Introduction: definition of behavior, nervous system and behavior, simple (reflexes) and complex behavior. Development (Ontogeny) of behaviour: nature and nurture, instinct and learning in their biological setting, maturation-development involving growth, hormones and early development, play, imprinting and early experience. Evolution (Phylogeny) of behaviour: natural selection and behaviour, genetic basis of behaviour, the adaptiveness of behaviour, ritualisation. Diversity of behaviour: Innate behaviour, innate releasing mechanisms, fixed action patterns. Learned behaviour: habituation, conditioned reflex Type 1, trial & error learning, latent learning, insight learning. Communication: definition, evolution and use of signals in communication, information content of signals e.g. honey bees, manipulation in communication, cost, honesty/deceit & handicaps. Sex and sexual selection, advantages of sex (why two sexes), selection on males and females, Mate choice (male/female competition and female/male choice), Intra-and inter-sexual selection, sperm competition and mate guarding. Feeding and anti-predator behaviour: Feeding behaviour, diversity of prey capture techniques (prey detection and capture), optimal foraging behaviour, costs & benefits, optimality models, constraints in foraging efficiency; Anti-predator behaviour: detection of predators, chemical defenses, warning colouration, mimicry, alarm signals, improved vigilance, selfish herd effect. Dilution effect; Social organisation; group living (advantages), types of mating systems (e.g. polyandry, polygyny, monogamy, lek), social dominance, cooperation, aggression, altruism, parental care, territoriality , primate social organisation, insect social organisation.

MBL3831 APPLIED MOLECULAR BIOLOGY

Module title: **APPLIED MOLECULAR BIOLOGY**
Code: **MBL 3831**
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks and one three hour practical session
Credits: 16
Module assessment: Continuous assessment **40%**: Theory (not less that 2 tests and 2 assignments) 40%, Practicals (not less that 10 marked assignments) 50% Examination: **60%** (1 x 3 hour examination paper)
Prerequisites: **MBL 3731** Recombinant DNA Technology

Module description: This course will deal with new and exciting concepts and applications of molecular biology.. This module aims to develop a better understanding of the many molecular methodologies that are utilized in current research. Topics such as FISH, GISH techniques, Advanced PCR techniques, Site- directed mutagenesis and analysis, Recombinant protein expression, Foot print technologies, Techniques for measuring transcript levels, RNA subtraction techniques, Reporter gene technologies, How to study protein-protein interactions - yeast 2-hybrid and immuno-precipitation technologies, Gene fusions, epitope- and fluorescent-tagging of proteins, How transgenic organisms are made, Examples of generating transgenic plants and animals and Biosafety aspects will be covered. This will be provided via consideration of DNA, RNA and proteins separately. A detailed account will be provided of how they are made and of the available methods for studying and manipulating them. Methodologies for the creation of transgenic organisms will also be provided and biosafety. Student will also gain hands on experience of some of the basic skills in molecular biology. This course will have laboratory sessions and the lectures will be given in a highly interactive manner.

MIC3811 MYCOLOGY

Module title: **MYCOLOGY**
Code: **MIC3811**
Course Equivalent: none
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks and one three hour practical session per week per semester
Credits: 16
Module assessment: Continuous assessment: **40%** Theory (not less than 2 tests and 2 assignments) 40%, Practicals(not less than 10 marked assignments) 50% Examination: **60%** (1 x 3 hour examination paper)
Prerequisites:MBL3711: Microbiology

Module description: This course will deal with concepts and applications of mycology. Topics will include Morphology, genetics, classification, ecology, and economic importance of Imperfect Fungi, Oomycetes, and Zygomycetes. Emphasis in the laboratory is on isolation, culture, and laboratory techniques. A survey of those fungi classified as Ascomycetes (such as yeasts, morels, powdery mildews and as Basidiomycetes (such as rusts, smuts, boletes, mushrooms, polypores). Emphasi in the laboratory is on anatomy and morphology as well as field identification. Biology of diseases affecting trees in the forest and forest nursery. Emphasis is on field identification using symptoms exhibited by diseases tree and characteristics of the pathogens. This course is intended to introduce the student to a quite diverse group of organisms and the many roles that they play in everyday life. The fungal kingdom and other organisms traditionally considered as fungi profoundly impact humans and the environment in both positive and negative ways. Certain fungi are responsible for production of food, while others have been responsible for devastating famines. Fungi have led to great advances in the treatment of infections through the discovery of antibiotics yet some fungi are the agents that cause many serious illnesses, especially among immuno-compromised patients. One of the most important roles that fungi play is that of recycler of organic material, which reduces complex molecules to simpler ones that can be re-used by other organisms. The course will involve group discussions of recent papers in mycological journals. This course will also include excursions to industries and the lectures will be given in a highly interactive manner.

MIC3802 PARASITOLOGY

Module title: **PARASITOLOGY**
Code: **MIC3802**
NQF level: 8
Contact hours: 2 lecture periods and 1 practical period per week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment **40%** (2 tests). Examination **60%** (2 hour paper)
Prerequisites: Microbiology **(MBL3711)** (Pre), Immunology **MBL3811** (Co)

Module description: Emphasis will be put on major parasitic groups that include parasitic protozoa, monogeneans, digeneans, cestodes, nematodes, acanthocephalans, and parasitic arthropods. Parasites will be studied based on life cycles, host specificity, parasite biochemistry, molecular parasitology and parasites behavior. There will be a substantial basic introduction to endoparasites, ectoparasites, obligate parasites, facultative parasites as well as host-parasite interaction aspects such as symbiosis, commensalisms and mutualism. Medical Parasitology focusing on parasites that infect man and causing diseases like malaria, trypanosomiasis, leishmaniasis, schistosomiasis and etc will constitute an important component of the course. The course will also address Veterinary Parasitology to discuss those parasites that are causing economic losses in agriculture and aquaculture or which infect companion animal. The practical content will include: identification and isolation of intestinal parasites using Glucose Flotation Method/Sedimentation. Method and the microscopic preparation and examination of blood parasites.

MIC3822 MEDICAL MICROBIOLOGY

Module title: **MEDICAL MICROBIOLOGY**
Code: **MIC 3822**
NQF level: 8
Contact hours: 2 lectures per week for 14 weeks and one 2-hour practical session per week per semester.
Credits: 8
Module assessment: Continuous assessment **(40%)**: Theory (not less than 2 tests and 2 assignments, 50%, Practicals (not less than 10 marked assignments) 50% Examination **(60%)**: One 3-hour examination paper.
Prerequisites: Introduction to Microbiology **(MBL3632)** and Microbiology **(MBL3711)**
Module description: This is an applied course equivalent to Clinical Microbiology or Diagnostic Microbiology. It will start with a discussion of the purpose and philosophy of medical microbiology, laboratory safety, laboratory organization, quality control and assessment, sterilization and disinfection, managing a clinical laboratory, handling clinical specimens. The course will then look at normal microbial flora versus pathogens, morphology and taxonomy, optical methods for laboratory diagnosis of infectious disease, cultivation and isolation of viable pathogens, conventional and rapid microbiological methods for identification of pathogens. Non-traditional methods for identification and detection of pathogens or their products (particle agglutination, ELISA, flourogenic substrates, genetic probes, blotting techniques, PCR), diagnostic immunological principles and methods, antibiotics, antiviral strategies, methods for testing antimicrobial effectiveness, principles of automated methods of diagnosis, biochemical tests, histology, and histochemistry. Specific examples will be drawn from microorganisms encountered in the blood, cerebrospinal fluid, respiratory tract, gastrointestinal tract, urinary tract, wounds, abscesses, skin, soft tissue lesions, bones, head and neck, genital and sexually transmitted pathogens. Methods for identification of aetiological agents of infectious diseases will be based on selected examples such as parvo- and adenoviruses, herpes, and poxviruses, hepatitis viruses, picornaviruses, reo- and rotaviruses, arthropod- and rodent-borne viruses, orthomyxoviruses, paramyxoviruses and rubella, coronaviruses, rabies, prion diseases, lentiviruses and HIV, tumour viruses, bacilli, clostridium, anaerobes, corynebacterium, Listeria, actinomycetes, Streptococcus, Enterococci, Staphylococcus, Vibrio, Campylobacter, Helicobacter, Haemophilus, Brucella, Bordetella, Yersinia, Francisella, Pasteurella, Pseudomonas, Chlamydia, Neisseria, fungi, protozoa, and helminthes.

MIC3812 ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY

Module title: **ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY**
Code: **MIC 3812**
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (minimum of 2 tests and 2 assignments)
Examination **60%** (1 x 2 hour examination paper)
Prerequisites: Microbiology **MBL 3711**, Genetics **MBL 3732**,
Co-requisites: Recombinant DNA Technology **MBL 3731**, **CHB3612** Biochemistry II
Module description: Industrial fermentation: Bioprocess development- isolation and screening of target organisms, strain selection, strain improvement, master culture preservation, media design, scale-up, fermentation vessels, oxygen transfer rate, bioprocess control, downstream processing. Batch culture, fed-batch culture, continuous culture, Crabtree effect, Pasteur effect. Production of antibiotics (eg. Penicillin), vaccines (eg. hepatitis B vaccine), beer, aminoacids (eg. Lysine, glutamate), organic acids (eg. Citric acid) and vitamins (eg. ascorbic acid), algal cultures. Design, operation and monitoring of a facility for manufacture of sterile products. Bioconversions, biodegradation, bioleaching. Factors that may influence sterility in manufacturing. Environmental microbiology: The role of microorganisms in the Environment. Terrestrial Environment: soils. Soil microorganism associations with plants. Marine Environment and Freshwater Environment including lakes and rivers. Sewage treatment: Conventional sewage and wastewater treatment , anaerobic digesters, constructed wetlands, septic tanks. Analysis of water purity. Indicator organisms, biocontrol, Baculovirus as a control agent, biomining, bioremediation, biostimulation, bioaugmentation.

MIC3832 VIROLOGY

Module title: **VIROLOGY**
Code: **MIC3832**
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks and one three hour practical session per week per semester
Credits: 16
Module assessment: Continuous assessment**40%**: Theory (not less than 2 tests and 2 assignments) 40%, Practicals (not less than 10 marked assignments) 50% Examination: **60%** (1 x 3 hour examination paper)
Prerequisites: MBL3711 Microbiology
Module description: This course will deal with exciting concepts of virology and is intended to provide students with the latest information in virological methods and provide advanced knowledge,. Topics will include an introduction to viruses, their nature and structure. Nomenclature, classification and diversity of viruses. Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, assembly, maturation and release. Replicative strategies employed by plant and animal DNA and RNA viruses. Identification of virus prototypes associated with different RNA and DNA virus replication CHEmes. Bacterial, plant and animal virus genetics. Host–virus interactions with emphasis on phenomena occurring at the molecular level and on the regulated control of gene expression in virus-infected cells. Viral pathogenesis and treatment using examples of common and emerging animal and plant viruses. Throughout the virology course, attempts are made at emphasizing those infectious diseases that are of great actual or potential importance to humans.

MOL3811 BIOINFORMATICS 4L + 1PS / week

Module title: **BIOINFORMATICS**
Code: **MOL3811**
NQF level: 8
Contact hours: 4 L / week for 14 weeks + 3h P/week for 14 weeks
Credits: 16
Module assessment: Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%)
Examination: **60%** (1 x 3h examination paper)
Prerequisites: Cell Molecular Biology and Genetics **MBL3631**, Genetics **MBL3732**,
Co-requisite Applied Molecular Biology **MBL3831**
Module description: The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and interactive course in which students will acquire knowledge on information networks, the World Wide Web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed. The information retrieval and analysis tools such as sequence similarity and alignment will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. The module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences The course will consist of lectures, student presentations and assignments.

MOL3812 APPLIED GENETICS 4L + 1PS / week

Module title: **APPLIED GENETICS**
Code: **MBL3812**
Course Equivalent: none
NQF level: 8
Contact hours: 4 lecture periods/week for 14 weeks and one three hour practical session per week per semester
Credits: 16
Module assessment: Continuous assessment **40%**: Theory (not less than 2 tests and 2 assignments) 40%
Practicals (not less than 10 marked assignments) 50%
Examination: **60%** (1 x 3 hour examination paper)
Prerequisites: **MBL3732** Genetics
Module description: This is a senior undergraduate course designed to allow students to conceptualise the applications of genetics in dealing with day to day situations in agriculture, medicine and the environment. This course will deal with exciting concepts in genetics. Topics will include plant breeding, animal breeding, medical genetics and the genetics of industrial fungi. These are usually taught separately, but they are all linked by strong central concepts regarding the generation, control, fate and use of genetic variation at the levels of genes, chromosomes, genomes and populations. Systematically, the course with cover: Aims of Applied Genetics, The Inheritance and Analysis of Qualitative and Quantitative Characters. Regression, Transgression, Environmental Effects and Heritability, Correlations between Characters, Genotype, Phenotype and Breeding Values. Applied aspects of Population Genetics: Allele Frequencies, Genetic Equilibria, Population Mixing, Genetic Drift and Gene Flow. Types and uses of Selection. Departures from Random Mating. Mutation and its uses. Recombination and mapping. Breeding methods and examples. Applied aspects of human and medical genetics. Genetic Engineering in Plants, Animals and Micro-Organisms, and Human Gene Therapy. Genetic Variation in Wild and Agricultural Populations, Genetics of Conservation. Genetic methods of insect Pest Control. Reproductive Physiology in Plants, Animals and Humans, Crossing Methods. Applied fungal genetics. The economics of Agricultural Products and Breeding programmes.

MOL3852 ANIMAL GROWTH AND DEVELOPMENT 4L + 1PS / week

Module title: ANIMAL GROWTH AND DEVELOPMENT
Code: **MOL3852**
Course equivalent: Animal Growth and Development (MBL3432)
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (minimum of 2 tests and 2 Assignments)
Examination **60%** (1 x 2 hour examination paper)
Prerequisites: Animal Form and Function **BLG3611**, Genetics **MBL 3732**
Module description: This course will cover animal growth, including the genetic control of cell growth, differentiation and morphogenesis, development of the gametes, fertilization, all stages of pre-embryonic and post-embryonic development such as cleavage, blastulation, gastrulation and organogenesis. The two developmental paths followed by animals namely regulative development and mosaic development will be discussed. Evolutionary Development. Aging: Telomere-deletion hypothesis, wear-and-tear hypothesis, Gene-clock hypothesis, accumulated mutation hypothesis and effects of various physiological and Environmental factors affecting these processes. Cancer: cell-cycle regulation and genetics of cancer, causes and development of cancer. Stem cells: embryonic stem cells, somatic stem cells, therapeutic stem cell cloning etc. Animal tissue culture and Cloning: tissue culture techniques, tissue culture media, cloning.

MOL3832 PLANT GROWTH AND DEVELOPMENT 4L + 1PS / week

Module title:	**PLANT GROWTH AND DEVELOPMENT**
Code:	**MOL3832**
NQF level:	8
Contact hours:	4 L/week for 14 weeks + 3h P/week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment **40%**: (at least 2 tests and at least 8 practical marks) Examination **60%**: (1 x 3h paper)

Prerequisites: CHM3511 (Chemistry 1A) OR **CHM3512** (Chemistry 1B) or **CHM3532** Chemistry for Life Sciences

Module description: This module is designed to provide students with an understanding and appreciation of the complex processes of plant growth and development from a molecular perspective. The module will examine the characteristics of plant growth, with emphasis on the meristematic nature of this growth,. The process of growth will be discussed from a physical perspective taking into account Heyn's concept of cell wall extensibility and the role of pH and expansins. A number of developmental control mechanisms will be considered with emphasis on the interdependency between genetic, hormonal and environmental mechanisms, as well as signal perception and transduction by second messengers. The role of the six classes of plant hormones in the regulation of cell division, cell enlargement, cell differentiation with emphasis on tissue cultures, will be discussed. The control of processes such as seed development, shoot & root development, senescence and abscission, as well as flower and fruit development will be investigated, mainly from results obtained with mutagenic studies. The module will further examine the structure, characteristics and functions of plant photoreceptors with emphasis on photocontrol of seed germination, the processes of etiolation & de-etiolation, canopy shading and photoreceptor signal transduction. Plant movements such as nyctinasty, thigmonasty, phototropism and gravitropism will be discussed in detail. The concept of photoperiodism and the role of biological clocks will be investigated taking into account the ecological aspects of photoperiodism, response types, perception of the photoperiodic signal, transduction of the floral stimulus, rhythmic responses, Zeitgebers, and time measurement in photoperiodism. The module will conclude with an investigation of flowering by considering aspects such as floral induction and floral development. .

N.6. SERVICE MODULES FOR EDUCATION STUDENTS ONLY

MBE3771 CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS

Module Title: **CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS**
Code: **MBE 3771**
Module equivalent: New module
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (minimum of 2 tests and 2Assignments) Examination **60%** (1 x 3hour examination paper)
Prerequisites: BLG3612 Plant Form and Function, **BLG3611** Animal Form and Function, **MBL3652** Human Biology
Module description: This is a broad based course that will start with an introduction to the chemical basis of cellular processes, an overview of mitosis and meiosis, Mendelian & non-Mendelian Genetics: monohybrid crosses, dihydrid cross, test crosses, chromosomal theory of inheritance, sex determination & sex-linked genes, basic genetic linkage and chromosome mapping, and the genetic code; structure and function of eukaryotic chromosomes and mutations as the basis for genetic variations and their effects and natural selection. Macromolecules : proteins, carbohydrates fatty acids and nucleic acids and their roles in cellular organization; the structure of DNA and genome sizes and complexity; DNA replication; Eukaryotic transcription and RNA processing. The module will include principles of microbiology, importance of microorganisms, microbial cell structure, physiological diversity of microorganisms, prokaryotic diversity, microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and bacterial taxis, staining techniques, microbial nutrition and metabolism, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, Identification of bacteria; Microbial genetics and genetic engineering: conjugation, transformation and transduction; Mutations, causes and uses of mutations; DNA Isolation; molecular cloning, genetic recombination, detection of variation in proteins and DNA. Genetically Modified Organisms: examples, risks and benefits.

EBE3772 ENVIRONMENTAL BIOLOGY FOR EDUCATORS

Module Title: **ENVIRONMENTAL BIOLOGY FOR EDUCATORS**
Module Code: **EBE 3772**
Module equivalent: New Module
NQF Level: 7
Credits: 16
Module Assessment: CA **40%** Exam **60%** - 1 x 3 hour paper
Prerequisite: BLG3611 Animal Form and Function, **BLG 3612** Plant Form and Function

Module description: This module is designed to equip students with the necessary understanding of various topics in environmental studies. The main focus of this module is to enhance understanding of relationships of organisms with one another and with their environment including the human dimension.

The following will be covered in this module: Ecology and environment: definitions. Basic components of ecological systems, essential processes of ecological systems: photosynthesis and decomposition. Primary and secondary production, energy flow and flux of matter and trophic structures, food chains and food webs, trophic levels and ecological pyramids, Food chains and poisons in the environment. Biogeochemical cycles (water-, carbon- nitrogen and phosphorous -cycles) and human influence cycles. Climate change: definition, causes, mitigation and adaptations. Climate change conventions and protocols. Namibia and climate change. Biomes: definition, classification and characteristics of biomes of the world and biomes of Namibia. Population Ecology: characteristics of populations- birth, death, immigration, emigration, size, age structure, and sex ratios. Population density, dispersion, mortality, natality and survivorship, population growth, parasitism (classes and characteristics of parasites, hosts as habitats, parasite population dynamics, evolutionary aspects of parasitism, social parasitism), Population regulation (mechanisms of population regulation, intra-specific competition, dispersal, social interactions). Arid environments: causes, classification and characteristics of arid ecosystems, surface and ground water, floods, Humidity, temperature, wind and wind erosion, soils, dust & dust storms, adaptations of organisms to arid environments. Desertification: definitions, causes of desertification (proximate or immediate and ultimate or underlying causes), manifestations of desertification, action to combat desertification. Deforestation: causes (proximate or immediate and ultimate or underlying causes) and effects of deforestation, deforestation in Namibia and possible solutions to deforestation. Conservation ecology: definitions, global patterns, distribution and measurement of biodiversity with special emphasis on Namibian. Conservation and sustainable exploitation of natural resources. Threats to biological diversity (including habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease). Human influences on ecosystems; damage to the environment, urbanization. Aquatic Ecology: the physical properties of water, stream ecology, lake ecology, physical and chemical properties of oceans, food chains and webs in the marine environment, estuarine ecology.

N.7. DEPARTMENT OF BIOLOGICAL SCIENCES MODULE EQUIVALENTS

YEAR	NEW MODULES (from 2013)	OLD CURRICULUM MODULES (up to 2012)
1	BLG3511Introduction to Biology	BLG3511 Introduction to Biology
	BLG3512 Diversity of Life	BLG3512 Diversity of Life
2	BLG 3611 Animal Form and Function	BLG 3611Animal Form and Function
	MBL3631 Cell Molecular Biology and Genetics	MBL3631Cell Molecular Biology and Genetics
	BLG3621Biometrics I	STS3621Statistics for Life Sciences I
	EBL3631 Introduction to Ecology	EBL3631 Introduction to Ecology
	MBL3611Microbial Systematics	None/New module
	BLG3612 Plant Form and Function	BLG3612 Plant Form and Function
	MBL3632 Introduction to Microbiology	MBL3632 Introduction to Microbiology
	BLG3622 Biometrics II	STS3622 Statistics for Life Sciences II
	EBL3632 Ecological Field Techniques	EBL3632 Ecological Field Techniques
3	BLG3701Microbial Ecology	None/New Module
	EBL3711Aquatic Ecology	EBL3711 Fresh Water & Marine Ecology
	EBL3721Biosystematics I	EBL3831Biosystematics***
	EBL3771Conservation Biology and Biodiversity	EBL3771 Conservation Biology and Biodiversity
	EBL3741Ecological systems and Climate Change	None/New module
	MBL3771Physiology	MBL3752 Comparative animal physiology
	MBL3771Physiology	MBL3751Plant physiology
	MBL3711 Microbial Genetics	MBL3711 Microbiology
	MBL3701Recombinant DNA Technology	MBL3731 Recombinant DNA Technology
	EBL3712 Ecosystem Ecology	EBL3712 Ecosystem Ecology
	EBL3752 Ecophysiology	MBL3751 Plant Physiology
	EBL3752 Ecophysiology	MBL3752 Comparative Animal Physiology
	EBL3722 Biosystematics II*	EBL383 Biosystematics
	BLG3702 Research Methodology	BLG3702 Research Methodology
	MBL3712 Biotechnology	MBL3712 Biotechnology
	MBL3732 Genetics	MBL3732 Genetics
	MIC3800 Internship	None/New Module
4	BLG3810 Research Project	BLG3810 Research Project
	EBF3800 Field Ecology	EBL3700 Field Ecology I
	EBF3800 Field Ecology	EBL3800 Field Ecology II
	EBL3841 Integrated Natural Resources Management I	EBL3832 Management of Natural Resources
	EBL3841 Integrated Natural Resources Management I	EBL3811 Environmental Management
	EBL3871Population Ecology	EBL3731 Population Ecology
	EBL3851Biogeography	EBL3851 Biogeography
	MIC3831Environmental and Industrial Microbiology	MIC3812 Environmental and Industrial Microbiology
	MIC3811Mycology	MIC3811Mycology
	MBL3801 Bioinformatics	MOL3811Bioinformatics
	EBL3852 Integrated Natural Resources Management II	EBL3832 Management of Natural Resources
	EBL3852 Integrated Natural Resources Management II	EBL3811 Environmental Management
	EBL3802 Disturbance & Restoration Ecology	EBL3802 Disturbance & Restoration Ecology
	EBL3812 Behavioural Ecology	EBL3812 Behavioural Ecology
	EBL3822 Entomology	MIC3802 Parasitology
	MBL3812 Immunology	MBL3811Immunology
	MIC3842 Virology	MIC3832 Virology
	MIC3822 Medical Bacteriology	MIC3822 Medical Bacteriology
	MOL3822 Applied Genetics	MOL3812 Applied Genetics
	MIC3852 Parasitology	MIC3802 Parasitology
	MIC3872 Developmental Biology **	MOL3852 Animal growth and development
	MIC3872 Developmental Biology **	MOL3832 Plant growth and development

*Students who fail MOL3811 will be allowed to repeat the old module to ensure they have enough credits at level 8.
**Students who fail MOL3852 and/or MOL3832 will be allowed to repeat them to ensure they have enough credits at level 8.
***Students who fail the old module, Biosystematics (EBL3831) will be still be offered to them.

O. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

O.1. DEPARTMENTAL REGULATIONS

Students who want to register for Chemistry and Biochemistry must have at least a "C" symbol in Physical Science at NSSC-O level (IGCSE level).
All practical sessions are compulsory. At least **80%** of practical attendance is required to qualify for the final examination.
Tutorial sessions are compulsory in the modules where they are offered.
To qualify for the second opportunity examination, you need a final mark of between **45-49%**, a subminimum of **40%** for the exam mark as well as a **50%** in either your exam or CA mark.

O.2. CHEMISTRY MAJOR & MINORS, CURRICULUM, PREREQUISITES & COREREQUISITES

QUALIFICATION: Chemistry Major and Physics Minor 11BCHP

Students opting for a major in **Chemistry** (with minor in Physics) must take all of the following modules:
YEAR 1

SEMESTER	MODULE NAME	CODES	CREDIT	PRE- REQUISITES	CO-REQUISITES
1	Chemistry 1A	CHM3511	16		None
1	Analytic Geometry,	MAT3501	8		None
1	Matrices and Complex Numbers	MAT3521	8		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication and Study Skills	LCE3419	16		None
	Physics Minor:				
1	Physics for Physical Sciences I	PHY3511	16		None
2	Chemistry 1B	CHM3512	16		None
2	Precalculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Computer Literacy	CLC3509	8		None
	Physics Minor:				
2	Physics for Physical Sciences II	PHY3512	16		None
Total Credits					

YEAR 2

SEMESTER	MODULE NAME	CODES	CREDIT	PRE- REQUISITES	CO-REQUISITES
1	Inorganic Chemistry I	CHM3611	16	CHM3511 & CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511 & CHM3512,& MAT3511, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512 + 1 Full Mathematics Module	None
	Physics Minor:				
1	Classical Mechanics	PHY3611	16	PHY3511, MAT3511, MAT3512	None
1	Waves and Optics	PHY3631	16	PHY3511, PHY3512	None
2	Analytical Chemistry I	CHM3602	8	CHM3511 & CHM3512	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
2	Introduction to Statistics	STS3522	8	Faculty Entry Requirements	None
2	Calculus II	MAT3612	16	MAT3512 + 1 Full Mathematics Module	None
2	Elementary Linear Algebra	MAT3652	16	MAT3511	None
	Physics Minor:				
2	Modern Physics I	PHY3602	8	PHY3511, PHY3512, MAT3511, MAT3512	None
Total Credits			**152**		

YEAR 3

SEMESTER	MODULE NAME	CODES	CREDIT	PRE- REQUISITES	CO-REQUISITES
1	Industrial Chemistry I	CHM3761	16	CHM3611, CHM3612	None
1	Inorganic Chemistry II	CHM3701	8	CHM3611,MAT3512	None
1	Analytical Chemistry II	CHM3721	8	CHM3602	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
1	Numerical Methods	MAT3621	8	Any 2 full 1st Year Mathematics Modules	None
1	Programming Fundamentals I	CMP3511	16		None
	Physics Minor:				
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3611, MAT3612	None
1	Computational Physics with C++	PHY3721	8	None	None
2	Instrumental Analysis I	CHM3702	8	CHM3602, CHM3612	None
2	Physical Chemistry II	CHM3712	16	CHM3631, MAT3611, MAT3612	None
2	Ordinary Differential Equations	MAT3642	8	Any 2 full 1st Year Mathematics Modules	None
2	Research Methodology	CHM3722	8	All second year chemistry modules	None
	Physics Minor:				
2	Modern Physics II	PHY3732	16	PHY3602	None
Total Credits			**144**		

YEAR 4

SEMESTER	MODULE NAME	CODES	CREDIT	PRE- REQUISITES	CO-REQUISITES
1	Instrumental Analysis II	CHM3801	8	CHM3702, CHM3711	None
1	Organic Chemistry III	CHM3811	16	CHM3711	None
1	Physical Chemistry III	CHM3831	16	CHM3631, MAT3612	None
1	Research Projects	CHM3810	16	All third year chemistry modules	None
1	Physical Inorganic Chemistry	CHM3841	8	CHM3701	None
	Physics Minor: No offering				
2	Inorganic Chemistry III	CHM3802	8	CHM3701	None
2	Industrial Chemistry II	CHM3812	16	CHM3712, CHM3761	None
2	Molecular Spectroscopy	CHM3832	16	CHM3631, MAT3612	None
2	Advanced Topics in Chemistry	CHM3842	8	All third year chemistry modules	None
2	Research Projects	CHM3810	32	All third year chemistry modules	None
	Physics Minor: No offering				
Total Credits			**144**		

QUALIFICATION: Chemistry Major and Biology Minor 11BCHB

Students opting for a major in **Chemistry** (with minor in Biology) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Chemistry 1A	CHM3511	16		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication and Study Skills	LCE3419	16		None
	Biology Minor				
1	Introduction to Biology	BLG3511	16	NSSC Biology C	None
2	Chemistry 1B	CHM3512	16		None
2	Precalculus	MAT3512	16		None
2	Computer Literacy	CLC3509	8		None
2	Contemporary Social Issues	CSI3580	8		None
2	English for Academic Purposes	LEA3519	16		None
	Biology Minor				
2	Diversity of Life	BLG3512	16	NSSC Biology C	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Inorganic Chemistry I	CHM3611	16	CHM3511 & CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511 & CHM3512, & MAT3511, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512 + 1 Full Mathematics Module	None
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None
	Biology Minor				
1	Cell Molecular Biology & Genetics	MBL3631	16	BLG3511, BLG3512	None
2	Analytical Chemistry I	CHM3602	8	CHM3511 & CHM3512	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
2	Calculus II	MAT3612	16	MAT3512 + 1 Full Mathematics Module	None
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 & BLG3511	None
2	Introduction to Statistics	STS3522	8	Faculty Entry Requirements	None
	Biology Minor				
2	Introduction to Microbiology	MBL3632	16	BLG3511, BLG3512	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Industrial Chemistry I	CHM3761	8	CHM3611, CHM3612	None
1	Inorganic Chemistry II	CHM3701	8	CHM3611, MAT3512	None
1	Analytical Chemistry II	CHM3721	8	CHM3602	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
1	Biochemistry III	CHB3701	16	CHB3612, MBL3631	None
	Biology Minor				
1	Microbiology	MBL3711	16	MBL3632	None
1	Recombinant DNA Technology	MBL3731	16	MBL3631, MBL3632	None
2	Instrumental Analysis I	CHM3702	8	CHM3602, CHM3612	None
2	Physical Chemistry II	CHM3712	16	CHM3631, MAT3611, MAT3612	None
2	Biochemistry IV	CHB3712	16	CHB3612, MBL3631	None
2	Research Methodology	CHM3722	8	All second year chemistry modules	None
	Biology Minor: No offering				
Total Credits			**136**		

YEAR 4

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Instrumental Analysis II	CHM3801	8	CHM3702, CHM3711	None
1	Organic Chemistry III	CHM3811	16	CHM3711	None
1	Physical Chemistry III	CHM3831	16	CHM3631, MAT3612	None
1	Natural Product Chemistry I	CHB3821	8	CHM3711	None
1	Physical Inorganic Chemistry	CHM3841	8	CHM3701	None
	Biology Minor: No offering				

SEMESTER	Module Name	CODES		PRE- REQUISITES	CO-REQUISITES
2	Inorganic Chemistry III	CHM3802	8	CHM3701	None
2	Industrial Chemistry II	CHM3812	16	CHM3712, CHM3761	None
2	Natural Product Chemistry II	CHB3822	8	CHM3711	None
2	Advanced Topics in Chemistry	CHM3842	8	All third year modules	None
1&2	Research Projects	CHM3810	32	All third year modules	None
	Biology Minor: No offering				
Total Credits			**128**		

QUALIFICATION: Chemistry Major and Geology Minor 11BCHG

Students opting for a major in **Chemistry** and (with minor in Geology) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Chemistry 1A	CHM3511	16		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry, Complex Numbers & Matrices	MAT3531	16		None
1	English Communication and Study Skills	LCE3419	16		None
	Geology Minor:				
1	Intro. to Physical Geology & Surface Processes	GLY3521	8		None

2	Chemistry 1B	CHM3512	16		None
2	Precalculus	MAT3512	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Computer Literacy	CLC3509	8		None
2	English for Academic Purposes	LEA3519	16		None
	Geology Minor:				
2	Intro. To Earth Systems	GLY3502	8		None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Inorganic Chemistry I	CHM3611	16	CHM3511 & CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511 & CHM3512, & MAT3511, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512 + 1 Full Mathematics Module	None
	Geology Minor:				
1	Earth Resources	GLY3641	8	GLY3521	None
1	Introduction to Hydrology	GLY3621	8	MAT3512 & GLY3521	None

2	Analytical Chemistry I	CHM3602	8	CHM3511 & CHM3512	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
2	Physics for Physical Sciences II	PHY3512	16	Faculty Entry Requirements	None
2	Calculus II	MAT3612	16	MAT3512 + 1 Full Mathematics Module	None
2	Introduction to Statistics	STS3522	8	Faculty Entry Requirements	None
	Geology Minor:				
2	Introduction to Geochemistry	GLY3642	8	GLY3521 & MAT3512 & CHM3512	None
2	Crystallography and Mineral Chemistry	GLY3632	16	MAT3512 & CHM3512	None
Total Credits			**150**		

YEAR 3

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Industrial Chemistry I	CHM3761	8	CHM3611, CHM3612	None
1	Inorganic Chemistry II	CHM3701	8	CHM3611, MAT3512	None
1	Analytical Chemistry II	CHM3721	8	CHM3602	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
	Geology Minor:				
1	Coal, Petroleum & Gas	GLY3701	8	GLY3521	None
1	Regional Geology of Namibia	GLY3761	8	GLY3521	None
1	Mineralogy	GLY3711	16	GLY3632 & GLY3632	None
1	Field Geology I	GLY3600	8	GLY3521	None
2	Instrumental Analysis I	CHM3702	8	CHM3602, CHM3612	None
2	Physical Chemistry II	CHM3712	16	CHM3631, MAT3611, MAT3612	None
2	Research Methodology	CHM3722	8	All second year chemistry modules	None
	Geology Minor:				
2	Exploration Geochemistry & Geostatistics	GLY3782	8	GLY3642; GLY3600 (co-requisite)	None
2	Hydrogeology I	GLY3702	8	GLY3621 & GLY3642	None
2	Field Geology I	GLY3600	8	GLY3521	None
Total Credits			**136**		

YEAR 4

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Instrumental Analysis II	CHM3801	8	CHM3702, CHM3711	None
1	Organic Chemistry III	CHM3811	16	CHM3711	None
1	Physical Chemistry III	CHM3831	16	CHM3631, MAT3612	None
1	Physical Inorganic Chemistry	CHM3841	8	CHM3701	None
	Geology Minor: No offering				
2	Inorganic Chemistry III	CHM3802	8	CHM3701	None
2	Industrial Chemistry II	CHM3812	16	CHM3712, CHM3761	None
2	Molecular Spectroscopy	CHM3832	16	CHM3631, MAT3612	None
2	Advanced Topics in Chemistry	CHM3842	8	All third year chemistry modules	None
1&2	Research Projects	CHM3810	32	All third year chemistry modules	None
	Geology Minor: No offering				
Total Credits			**128**		

QUALIFICATION: Biochemistry Major and Biology Minor 11BCBB

Students opting for a major in **Biochemistry** and (with minor in Biology) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Chemistry 1A	CHM3511	16		None
1	Physics for Life Sciences I	PHY3501	8		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication and Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
	Biology Minor:				
1	Introduction to Biology	BLG3511	16	NSSC Biology C	
2	Chemistry 1B	CHM3512	16		None
2	Precalculus	MAT3512	16		None
2	Introduction to Statistics	STS3522	8		None
2	Contemporary Social Issues	CSI3580	8		None
2	English for Academic Purposes	LEA3519	16		None
	Biology Minor:				
2	Diversity of Life	BLG3512	16	NSSC Biology C	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Inorganic Chemistry I	CHM3611	16	CHM3511 & CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511 & CHM3512, & MAT3511, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512 + 1 Full Mathematics Module	None
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None
1	Statistics for Life Sciences I	STS3621	8	STS3522	None
	Biology Minor:				
1	Cell Molecular Biology & Genetics	MBL3631	16	BLG3511, BLG3512	
2	Analytical Chemistry I	CHM3602	8	CHM3511 & CHM3512	None
2	Organic Chemistry I	CHM3612	8	CHM3511 & CHM3512	None
2	Statistics for Life Sciences II	STS3622	8	STS3522	None
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 & BLG3511	None
	Biology Minor:				
2	Introduction to Microbiology	MBL3632	16	BLG3511, BLG3512	None
Total Credits			**144**		

YEAR 3

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Inorganic Chemistry II	CHM3701	8	CHM3611, MAT3512	None
1	Analytical Chemistry II	CHM3721	8	CHM3602	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
1	Biochemistry III	CHB3701	8	CHB3612, MBL3631	None
	Biology Minor:				
1	Microbiology	MBL3711	16	MBL3632	None
1	Recombinant DNA Technology	MBL3731	16	MBL3631, MBL3632	None
2	Instrumental Analysis I	CHM3702	8	CHM3602, CHM3612	None
2	Research Methodology	CHM3722	8	All second year chemistry modules	None
2	Biochemistry IV	CHB3712	16	CHB3612, MBL3631	None
2	Medical Biochemistry	CHB3732	16	CHB3612	None
	Biology Minor:				
2	Genetics	MBL3732	16	MBL3632, MBL3631	None
Total Credits			**136**		

YEAR 4

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Nutritional Biochemistry	CHB3801	8	CHB3612, CHM3702	None
1	Natural Product Chemistry I	CHB3821	8	CHM3711	None
1	Bioinformatics for Biochemistry	CHB3831	16	CHB3612, MBL3631	None
1	Physical Inorganic Chemistry	CHM3841	8	CHM3701	None
	Biology Minor: No offering				
2	Professional Training in Biochemistry	CHB3832	16	CHB3712, MBL3632	None
2	Environmental Biochemistry	CHB3812	16	CHB3702	None
2	Natural Product Chemistry II	CHB3822	8	CHM3711	None
2	Advanced Topics in Biochemistry	CHB3852	16	All third year chemistry modules	None
2	Research Projects	CHB3810	32	All third year chemistry modules	None
	Biology Minor: No offering				
Total Credits			**128**		

QUALIFICATION: Biochemistry Major and Chemistry Minor 11BCBC

Students opting for a major in **Biochemistry** and (with minor in Chemistry) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Chemistry 1A	CHM3511	16		None
1	Physics for Life Sciences I	PHY3501	8		None
1	Introduction to Biology	BLG3511	16		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication and Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
2	Precalculus	MAT3512	16		None
2	Diversity of Life	BLG3512	16	NSSC Biology C	None
2	Chemistry 1B	CHM3512	16		None
2	Introduction to Statistics	STS3522	8		None
2	Contemporary Social Issues	CSI3580	8		None
2	English for Academic Purposes	LEA3519	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512 + 1 Full Mathematics Module	None
1	Biochemistry I	CHB3611	16	CHM3511 & CHM3512 & BLG3511	None
1	Cell Molecular Biology & Genetics	MBL3631	16	BLG3511, BLG3512	None
1	Statistics for Life Sciences I	STS3621	8	STS3522	None
	Chemistry Minor:				
1	Inorganic Chemistry I	CHM3611	16	CHM3511 & CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511 & CHM3512, & MAT3511, MAT3512	None
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 & BLG3511	None
2	Introduction to Microbiology	MBL3632	16	BLG3511, BLG3512	None
2	Calculus II	MAT3612	16	MAT3512 + 1 Full Mathematics Module	None
	Chemistry Minor:				
2	Analytical Chemistry I	CHM3602	8	CHM3511 & CHM3512	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Biochemistry III	CHB3701	8	CHB3612, MBL3631	None
1	Recombinant DNA Technology	MBL3731	16	MBL3631, MBL3632	None
	Chemistry Minor:				
1	Industrial Chemistry I	CHM3761	8	CHM3611, CHM3612	None
1	Inorganic Chemistry II	CHM3701	8	CHM3611, MAT3512	None
1	Analytical Chemistry II	CHM3721	8	CHM3602	None
1	Organic Chemistry II	CHM3711	16	CHM3612	None
2	Biochemistry IV	CHB3712	16	CHB3612,MBL3631	None
2	Research Methodology	CHM3722	8	All second year chemistry modules	None
2	Medical Biochemistry	CHB3732	16	CHB3612	None
	Chemistry Minor:				
2	Instrumental Analysis I	CHM3702	8	CHM3602, CHM3612	None
2	Physical Chemistry II	CHM3712	16	CHM3631, MAT3611, MAT3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	CODES	CREDITS	PRE- REQUISITES	CO-REQUISITES
1	Nutritional Biochemistry	CHB3801	8	CHB3612, CHM3702	None
1	Natural Product Chemistry I	CHB3821	8	CHM3711	None
1	Bioinformatics for Biochemistry	CHB3831	16	CHB3612, MBL3631	None
1	Physical Inorganic Chemistry	CHM3841	8	CHM3701	None
	Chemistry Minor: No offering				
2	Professional Training in Biochemistry	CHB3832	16	CHB3712, MBL3632	None
2	Environmental Biochemistry	CHB3812	16	CHB3702	None
2	Natural Product Chemistry II	CHB3822	8	CHM3711	None
2	Advanced Topics in Biochemistry	CHB3852	16	All third year chemistry modules	None
2	Research Projects	CHB3810	32	All third year chemistry modules	None
	Chemistry Minor: No offering				
Total Credits			**128**		

O.3. CHEMISTRY & BIOCHEMISTRY CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

CHM3511 CHEMISTRY 1A

Module Title: **CHEMISTRY 1A**
Code: **CHM3511**
NQF Level: 5
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 75 %, laboratory component 15 %, tutorial assignments 10%). Final Exam: **50%**; (1 x 3 hour exam paper)
Prerequisites: Faculty Entry Requirements
Module Description: This module is a brief introduction to general chemistry and it lays the foundation of basic facts necessary for further studies in chemistry. The following topics are covered:
Content: An Introduction To Chemistry: Classification of Matter; The Three States of Matter; Physical and Chemical Properties of Matter; Measurement; Handling Numbers (scientific notation, significant figures); Factor-Label Method in Solving Problems. Atoms, Molecules and Ions: The Structure of the Atom; Atomic Number, Mass Number, and Isotopes; Molecules and Ions; Chemical Formulas (molecular and empirical); Naming Compounds. Mass Relationships in Chemical Reactions: Atomic Mass; Avogadro's Number and Molar mass; Molecular Mass; Percent Composition of Compounds; Experimental Determination of Empirical Formulas; Chemical Reactions and Chemical Equations; Stoichiometry (amounts of reactants and products); Limiting & Excess Reagents; Reaction Yield; Concentration of Solutions. Reactions in Aqueous Solutions: General Properties of Aqueous Solutions; Precipitation Reactions; Acid-Base Reactions; Oxidation and Reduction Reactions (assigning oxidation states, writing redox equations, balancing redox reactions). Quantum Theory and the Electronic Structure of Atoms: The Photoelectric Effect; Bohr's Theory of the Hydrogen Atom; Quantum Numbers; Atomic Orbitals; Electron Configuration; The Building-up Principle. Periodic Relationships Among Elements: Periodic Classification of the Elements; Periodic Variation in Physical Properties (effective nuclear charge, atomic radius, ionic radius); Ionization Energy; Electron Affinity; Variation in Chemical Properties of the Representative Elements (main group elements). Chemical Bonding: Lewis Dot Symbols; Ionic Bonding; Covalent Bonding; Metallic Bonding; Electronegativity; Writing Lewis Structures; Formal Charge; Concept of Resonance; Bond Enthalpy. Basic Molecular Geometry and Hybridization of Atomic Orbitals: Molecular Geometry; Dipole Moments; Valence Bond Theory; Hybridization of Atomic Orbitals; Molecular Orbital Theory; Molecular Orbital Configurations.

CHM3512 CHEMISTRY 1B

Module Title: **CHEMISTRY 1B**
Code: **CHM3512**
NQF Level: 5
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 75%, laboratory component 15%, and tutorial assignments 10%) Final Exam: **50%**; (1 x 3 hour exam paper)
Prerequisites: Faculty Entry Requirements
Module Description: This module is a continuation of Chemistry 1A and it introduces the students to properties of gases, thermochemistry, chemical kinetics, chemical equilibrium, Introduction to laws of thermodynamics, electrochemistry and organic chemistry. The following topics are covered:
Content: Gases: Pressure of a Gas; The Gas Laws; The Ideal Gas Equation; Gas Stoichiometry; The Kinetic-Molecular Theory of Gases; Deviation from Ideal Behaviour. Basic Thermochemistry: The Nature of Energy and Types of Energy; Energy Changes in Chemical Reactions; Introduction to Thermodynamics; Enthalpy of Chemical Reactions; Calorimetry; Standard Enthalpy of Formation and Reaction; Heat of Solution and Dilution. Introductory Chemical Kinetics: Rate of Reaction; Rate Law; Relation between Reactant Concentration and Time; Activation Energy and Temperature Dependence of Rate Constants; Reaction Mechanisms; Catalysis. Introduction to Chemical Equilibrium: The Equilibrium Constant; Writing Equilibrium Constant Expressions; Relationship between Chemical Kinetics and Chemical Equilibrium; What Does the Equilibrium Constant tell Us? Factors that Affect Chemical Equilibrium. Acid-Base Equilibria & Solubilty Equilibria: The Common Ion Effect; Buffer Solution; Acid – Base Titrations; Acid-Base Indicators; Solubility Equilibria; Separation of Ions by Fractional Precipitation; The Common Effect and Solubility; pH and Solubility; Complex Ion Equilibria and Solubility. Entropy, Free Energy and Equilibrium: The Three Laws of Thermodynamics; Spontaneous Processes; Entropy; The Second Law of Thermodynamics; Gibbs Free Energy; Free Energy and Chemical Equilibrium; Thermodynamics in Living Systems. Introduction to Electrochemistry: Galvanic Cells; Standard Reduction Potentials; Spontaneity of Redox Reactions; Effect of Concentration of Cell EMF; Electrolysis. Introduction to Organic Chemistry: Classes of Organic Compounds; Structure and Nomenclature Main Functional Groups (alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids, esters, amines, amides). Introduction to carbohydrates, lipids and porphyrins.

THE FOLLOWING SERVICE MODULE IS OFFERED FOR AGRICULTURE AND ENVIRONMENTAL BIOLOGY STUDENTS ONLY.

CHM3532 CHEMISTRY FOR LIFE SCIENCES

Module Title:	**CHEMISTRY FOR LIFE SCIENCES**
Code:	**CHM3532**
NQF Level:	5
Contact Hours:	4 lecture periods per week and 1 practical session per week for 14 weeks.
Credits:	16
Module Assessment:	CA: **50%** (minimum 3 tests 75%, laboratory component 15%, tutorial assignments 10%) Final Exam: **50%**; (1 x 3 hour exam paper)

Pre-requisites: Faculty Entry Requirements

Module Description: This module is designed for students that have insufficient background in chemistry and for non-chemistry majors .It is an introduction to topics in general and organic chemistry, and biochemistry. The following will be covered:

Content: Classification of Matter: Mixtures and Pure substances; Physical States of Matter; Physical and Chemical Properties. Extensive and Intensive properties. Measurements: Units, Significant figures; Precision and Accuracy, Factor Label Method. Atomic structure and the Periodic table; Electron configuration; Physical and Chemical properties as predicted from groups. Ionic compounds and Molecular compounds: Writing chemical formulae and naming of ionic and molecular compounds. Average Atomic Mass. The Mole Concept; Percent Composition, Empirical formula and Molecular formula. Stoichiometry: limiting reagent, percent yield. Solutions: electrolytes and non-electrolytes, aqueous solutions, ionic equations; concentrations: percent concentration; molarity, molality; dilution of solutions; structure and solubility. Types of bonds; Lewis structures; Resonance structures; Molecular geometry: the VSEPR model, Polarity of molecules. Acid-base equilibrium: properties of acids and bases; relations of acids and bases, self ionisation of water; strengths of acids and bases; the pH scale; hydrolysis of salts; buffers; acid-base titration. Introduction to organic chemistry: organic compounds; structural formulae and conformations; functional groups; Classes of hydrocarbons: alkanes, cycloalkanes: alkanes; alkenes and alkynes; oxidation and reduction; addition reactions; stereo-isomerism. Alcohols, phenols, thiols, ethers: organic compounds of oxygen; common alcohols and phenols. Carboxylic acids and esters, amines and amides: Introduction to carbohydrates, lipids and porphyrins.

SECOND YEAR MODULES

CHM3611 INORGANIC CHEMISTRY I

Module Title: **INORGANIC CHEMISTRY I**
Code: **CHM3611**
NQF level: 6
Contact hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests and assignments 80%, laboratory component 20%)
Final Exam: **50%** (1 x 3 hour exam paper)
Prerequisite: CHM3511 (Chemistry 1A), **CHM3512** (Chemistry 1B)
Module Description: This is an introductory course to inorganic chemistry. It builds upon what is covered in the First Year chemistry courses. Students are expected to review the structure of the atom on their own, then the course progresses into its reactivity to form simple and complex molecule.
Content: Atomic parameters:- radii, ionization energy, electronegativity,and electron affinity; In-depth studies of chemical bonding; (valence bond theory (VBT), shapes of molecules and hybridization; molecular orbital theory (MOT) in diatomic and polyatomic molecules); Delocalized multiple bonding. S-block elements: The chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides; Brief introduction to the organometallic chemistry of s-block elements with emphasis on organometallic chemistry of lithium and magnesium; Brief introduction to d-block chemistry: Occurrence, recovery and common oxidation states and compounds.

CHM3631 PHYSICAL CHEMISTRY I

Module title: **PHYSICAL CHEMISTRY I**
Code: **CHM3631**
NQF Level: 6
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks.
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%)
Final Exam: **50%**; (1 x 3 hour exam paper)
Pre-requisites: CHM3511 (Chemistry 1A), **CHM3512** (Chemistry 1B), **MAT3511** (Basic Mathematics), **MAT3512** (Precalculus)
Module Description: The course deals with equilibrium thermodynamics for chemistry majors and minors. Laws of thermodynamics are treated in a more rigorous way and applied to chemical problems. The following topics are covered:
Content: Empirical gas laws. The perfect gas. The Kinetic model of gases. Real Gases: Molecular interaction, The van der Waals equation. The principle of corresponding states. The First Law of Thermodynamics. Work, heat, and energy, The internal energy, Expansion Work, Heat transactions, Enthalpy, Adiabatic Changes. Thermochemistry. Standard enthalpy changes, Standard enthalpies of formation, The temperature-dependence of reaction enthalpies. State functions and exact differentials, Exact and inexact differentials, Changes in internal energy, The Joule-Thompson effect. The Second Law of Thermodynamics. The direction of spontaneous change and The dispersal of energy, Entropy, Canot Cycle, Entropy changes accompanying specific processes, The Third Law of thermodynamics, The Helmholtz and Gibbs energies, Standard reaction Gibbs energies. Combining the First and Second Laws of Thermodynamics, The properties of internal energy, The properties of Gibbs energy. Physical Transformations of Pure Substances. Phase diagrams, The stabilities of phases, Phase boundaries, The thermodynamics criterion of equilibrium, The location of phase boundaries, Ehrenfest classification of phase transitions. Simple Mixtures. The thermodynamic description of mixtures, Partial molar quantities, The thermodynamics of mixing, The chemical potentials of liquids. The properties of solutions, Liquid mixtures, Colligative Properties. Two-component systems: Vapour pressure diagrams, Temperature-composition diagrams, Liquid-liquid phase diagrams, Liquid-solid phase diagrams. Chemical equilibrium. The Gibbs energy minimum. The description of equilibrium, The response of equilibria to pressure and temperature.

CHB3611 BIOCHEMISTRY I

Module Title: **BIOCHEMISTRY I**
Code: **CHB3611**
NQF Level: 6
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests and assignments 80%, laboratory component 20%,)
Final Exam: 50% (1 x 3 hour exam paper)
Prerequisites:CHM3511 (Chemistry 1A, and **CHM3512** (Chemistry 1B) and **BLG3511** (Introduction to Biology)
Module Description: This module forms the basis for further studies in biochemistry. The following topics are covered:
Content: Chemical bonds in Biochemistry; Composition and structure of biochemicals; Biochemical reactions in aqueous solutions; Energy and biochemical reactions; Application of stereoisomers and chirality in biochemical systems; In-depth studies of Carbohydrates: classification and configurations; glycosides; and reactions; Lipids: classification; terpenes and steroids; fatty acids; triacylglycerols; glycerophospholipids and glycosphingolipids; Active and passive transport of ions; Biomineralization; metabolism and activation; occurrence and function of essential elements; Proteins: structure of amino acids, structure of proteins; physical and chemical properties; ionisation; folding and conformation; Introduction to Enzymes: nomenclature; proteins as catalysts; kinetics measurements; factors influencing enzyme-catalysed reactions.

CHM3602 ANALYTICAL CHEMISTRY I

Module Title: **ANALYTICAL CHEMISTRY I**
Code: **CHM3602**
NQF Level: 6
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Final Exam: **50%**; (1 x 2 hour exam paper)
Prerequisites: **CHM3511** (Chemistry 1A), **CHM3512** (Chemistry 1B)
Module Description: This module provides general introduction to sampling and evaluation of analytical data. It deals in depth with analytical tools like titrimetric analysis, gravimetric analysis and it gives basic information about spectroscopic methods of analysis.
Content: Review of some fundamental concepts; sampling and sample preparation; expressions of concentration and content; evaluation of analytical data; measures of accuracy and precision; random and systematic errors; aqueous equilibria; mass and charge balance equations and their use in solving multiple ion and complex ion equilibria; principles of titrimetry; acid-base titrations; titration curves and indicators; polyprotic acid-base equilibria, applications of acid-base titrations; gravimetric methods of analysis; solubility and solubility product; common ion and diverse ion effects; precipitation titrations; indicators used in precipitation titrations.

CHM3612 ORGANIC CHEMISTRY I

Module Title: **ORGANIC CHEMISTRY I**
Code: **CHM3612**
NQF Level: 6
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%) Exam: **50%**; (1 x 3 hour exam)
Prerequisites: **CHM3511** (Chemistry IA), **CHM3512** (Chemistry IB)
Module Description: This module is a survey of the chemistry of carbon compounds, their nomenclature, physical properties, structure and reactions with an introduction to reaction mechanisms and stereochemistry. The following topics will be covered.
Content: Alkanes and cycloalkanes: nomenclature, physical properties, bond rotation, conformations, ring strain, bicyclic and polycyclic alkanes, reactions and synthesis of alkanes. Alkenes and alkynes: Properties and synthesis, hydrogenation, index of hydrogen deficiency, preparation, addition reactions, Markovnikov's rule, hydroboration, Radical reactions: free radicals, halogenation of alkanes, chain reactions. Alcohols and ethers: synthesis, reactions, mesylates and tosylates, epoxides, crown ethers, phase transfer catalysis. Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, racemates, meso compounds, optical activity, resolution. Nucleophilic substitution and elimination: nucleophiles and electrophiles, SN2 and SN1 reactions; carbocations and carbanions, E1 and E2 reactions.

CHB3612 BIOCHEMISTRY II

Module Title: **BIOCHEMISTRY II**
Code: **CHM3612**
NQF Level: 6
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%, Exam: **50%** (1 x 3 hour exam paper)
Prerequisites: **CHM3511** (Chemistry 1A, and **CHM3512** (Chemistry 1B) and **BLG3511** (Introduction to Biology)
Module Description: This module introduces the students to glycogen and amino acids metabolism, fat catabolism, synthesis of lipids, citric acid cycle. The following topics are covered:
Content: Metabolism: catabolism and anabolism pathways; glycolysis; gluconeogenesis; glyoxylate cycle, regulation of central metabolism. Glycogen metabolism: (structure and function, synthesis and degradation, and storage). Lipid synthesis and transport: fatty acids and triglycerol; biosynthesis; bile acids; complex lipids; prostaglandins and related compounds; phospholipids and glycolipids. Citric acid cycle: stoichiometry and regulation; hexose monophosphate pathways. Fat catabolism: digestion and absorption. Amino Acids metabolism: digestion of dietary proteins; transport of amino acids into cells; removal of nitrogen from amino acids; urea cycle; metabolism of ammonia; catabolism of the carbon skeletons of amino acids; role of folic acid in amino acid metabolism, biosynthesis of non essential amino acids.

THE FOLLOWING SERVICE MODULE IS OFFERED FOR EDUCATION STUDENTS ONLY.

CHE3622 ORGANIC CHEMISTRY FOR EDUCATORS (FOR EDUCATION STUDENTS ONLY!)

Module Title:	**ORGANIC CHEMISTRY FOR EDUCATORS**
Code:	**CHE3622**
NQF Level:	6
Contact Hours:	28 hours lectures, 21 hours of practical sessions
Credits:	8

Module Assessment: CA:**50%** (minimum 2 tests 80%, laboratory component 20%) Exam:**50%**; (1 x 2 hour exam paper)
Prerequisites: CHM3511 (Chemistry IA), **CHM3512** (Chemistry IB)
Module Description:This module is a survey of the chemistry of carbon compounds, their nomenclature, physical properties, structure and reactions with an introduction to reaction mechanisms and stereochemistry. The following topics will be covered.
Content: Alkanes and cycloalkanes: nomenclature, physical properties, bond rotation, conformations, ring strain, bicyclic and polycyclic alkanes, synthesis and reactions of alkanes; Alkenes and alkynes: physical properties and synthesis (Zaytev's Rule), addition reactions (hydrogenations, halogenations, hydrations), Markovnikov's Rule, index of hydrogen deficiency; Ionic reactions: nucleophilic substitutions, elimination reactions; Radical reactions: free radicals, halogenation of alkanes, chain reactions; Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, meso compounds, optical activity. Alkyl halides: physical properties, synthesis, reactions; Alcohols and ethers: physical properties, synthesis, reactions.

THIRD YEAR MODULES

CHM3701 INORGANIC CHEMISTRY II

Module Title: **INORGANIC CHEMISTRY II**
Code: **CHM3701**
NQF Level: 7
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Exam: **50%** (1 x 2 hour exam paper)
Prerequisite: CHM3611 (Inorganic Chemistry I), **MAT3512** (Precalculus)
Module Description: This course covers the chemistry of transition metals. This means the student would have been equipped with adequate background from the chemistry of main group elements. With such a background the student will be in a position to follow the chemistry of transition metals.
Content: Transition metal chemistry: transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Bonding-Application of Valence Bond Theory (VBT); Crystal Field Theory (CFT); Ligand Field Theory (LFT). Molecular Orbital Theory (MOT); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes; Molecular symmetry: symmetry elements; plane of symmetry; proper and improper axes; principal axis; point of inversion ; classification of molecules into point groups.

THE FOLLOWING SERVICE MODULE IS OFFERED FOR EDUCATION STUDENTS ONLY.

CHE3732 INORGANIC CHEMISTRY FOR EDUCATORS (FOR EDUCATION STUDENTS ONLY)

Module Title: **INORGANIC CHEMISTRY FOR EDUCATORS**
Code: **CHE3732**
NQF Level: 7
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%)Exam: 50% (1 x 3 hour exam paper)
Prerequisite: CHM3511 (Chemistry IA), **CHM3512** (Chemistry IB)
Module Description: This course covers the chemistry of transition metals. This means the student would have been equipped with adequate background from the chemistry of main group elements. With such a background the student will be in a position to follow the chemistry of transition metals.
Content: The brief introduction to the chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides. Delocalized multiple bonding. S-block elements. In-depth studies of chemical bonding (valence bond theory (VBT), shapes of molecules and hybridization, molecular orbital theory (MOT) in diatomic and polyatomic molecules) and Bonding-Application of VBT; CFT; LFT, MOT; Introduction to transition metal chemistry (d-block elements): transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes; Molecular symmetry: symmetry elements; plane of symmetry; proper and improper axes; principal axis; point of inversion ; classification of molecules into point groups. Introduction to the organometallic chemistry of s-block elements (magnesium and lithium).

CHM3711 ORGANIC CHEMISTRY II

Module Title: **ORGANIC CHEMISTRY II**
Code: **CHM3711**
NQF Level: 7
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%) Exam: **50%**; (1 x 3 hour exam paper)
Prerequisites:CHM3612 (Organic Chemistry I)
Module Description: This module is a continuation of Organic Chemistry I. Units covered include an in-depth study of the following topics show below.
Content: Conjugated systems: allyl radical and allyl cation, alkadienes and polyunsaturated hydrocarbons, 1, 2- and 1,4-addition, Diels-Alder reaction. Aromatic compounds: Hückel's rule, aromatic-, antiaromatic-, nonaromatic-classification; annulenes, fullerenes, nanotubes. Heterocyclic compounds. Electrophilic aromatic substitution: halogenation of benzene, nitration, sulfonation, Friedel-Crafts-alkylations and acylations. Aldehydes and ketones: synthesis; addition to carbon-oxygen double bond, hydride, hydrogen cyanide, alcohols, derivatives of ammonia; Wittig reaction. Tautomers, enolates, aldol reactions, aldol condensation. Protecting and blocking groups. Retrosynthetic analysis.

CHM3721 ANALYTICAL CHEMISTRY II

Module Title: **ANALYTICAL CHEMISTRY II**
Code: **CHM3721**
NQF Level: 7
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks.
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80 %, laboratory component 20%) Exam: **50%;** (1 x 2 hour exampaper)
Prerequisites:CHM3602 (Analytical Chemistry I)
Module Description: This module introduces the students to EDTA titrations and provides detain information about voltaic cells, redox titrations and potentiometric methods of analysis.
Content: Complexometric and EDTA titrations; oxidation reduction, oxidation states and balancing redox equations, the half cell concept; voltaic cells and the Nernst equation; redox titrations and redox titration curves; applications of redox titrimetry. Potentiometric methods; Coulometry and electrogravimetry.

CHB3701 BIOCHEMISTRY III

Module Title: **BIOCHEMISTRY III**
Code: **CHB3701**
NQF Level: 7
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%,Exam: **50%** (1 x 2 hour exam paper)
Prerequisites: CHB3612 (Biochemistry II), **MBL3631** (Cell Molecular Biology & Genetics)
Module Description: This module is designed to teach the students the biochemistry of Nucleic acids. The following topics are covered:
Content: Expression and transmission of genetic information: Nucleic acids structure and functions; chemical modification of nucleotides and nucleic acids; Primary, secondary and tertiary of DNA and RNA (different types and its synthesis control of transcription, processing) and sequence induced conformation types, gene expression and protein synthesis. Sequence based analysis and functional regions and genome analysis; Fidelity of DNA replication; Translation: Genetic code; transfer RNA and its aminoacylation; Protein degradation. Exploring genes, manipulating the genes of Eukaryotes; Hybridization of nucleic acid strands, process of thermodynamics and kinetics, nucleic acids binding proteins, enzymology of gene manipulation.

CHM3761 INDUSTRIAL CHEMISTRY I

Module Title: **INDUSTRIAL CHEMISTRY I**
Code: **CHM3761**
NQF Level: 7
Contact hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%);Final Exam **50%** (1 × 2 hour exam paper)
Prerequisites: Inorganic Chemistry I **(CHM3611)**, Organic Chemistry I **(CHM3612)**
Module Description: This module introduces the processes and technologies in industrial chemistry, the techniques of treatment and control of pollution, and technological economics in chemical industry. The following topics are covered
Content: Sources of chemical industry: inorganic chemicals, organic chemicals from biomass, coke, natural gas, crude oil. The world's major chemical industries: introduce the major companies and products. Environmental pollution control: the techniques of pollution control including physic, chemical and biological methods. Material and energy balance: equations of balances. Technological economics: cost and profit of producing processes, effects of scale and flow rate of operation. Oil and fat industry: structure, isolation, additives, applications. Coatings industry: composition, pigments, binders, solvents. Soap and domestic industry: soap, surfactant, detergent. Leather industry: softening, evaluating effects of fat in leather. Flavor industry: vehicles, fixatives, synthetics used in perfume and flavors; perfume formation. Pharmaceutical industry: type of drugs, antibacterial agents, steroids, analgesics, antihistamines. Meat industry, fish industry; dairy industry: prepared and preserved products. Biotechnology industry: beer, cheese. Sulfuric acid and fertilizer industry: manufacture of sulfuric acid and fertilizer. Salt industry: manufacture of caustic. Uranium industry: extraction, concentration and purification of uranium. Cement industry: the compositions and manufacture of cement, processes in the solidification cement.

CHM3702 INSTRUMENTAL ANALYSIS I

Module Title: **INSTRUMENTAL ANALYSIS I**
Code: **CHM3702**
NQF Level: 7
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Exam: **50%**; (1 x 2 hour exam paper)
Prerequisites: **CHM3602** (Analytical Chemistry I), **CHM3612** (Organic Chemistry I)
Module Description: This module provides general introduction to flame emission and atomic absorption spectrometry. It provides the students with the necessary information to analyze NMR, mass spectrometry and infrared data.
Content: Instrumental methods of analysis; Flame emission and atomic absorption spectrometry; ICP; X-ray methods; Molecular fluorescence and phosphorescence; NMR spectroscopy; theory and experimental methods of NMR spectroscopy; applications of proton and C-13 NMR spectroscopy. Mass spectrometry; ultraviolet; Infrared absorption spectroscopy; Theory and applications of IR and Raman spectroscopy.

CHM3712 PHYSICAL CHEMISTRY II

Module title: **PHYSICAL CHEMISTRY II**
Code: **CHM3712**
NQF level: 7
Contact hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%) Exam: **50%** (1 x 3 hour exam paper)
Pre-requisites: **CHM3631** (Physical Chemistry I), **MAT3611** (Calculus I), **MAT3612** (Calculus II)

Module Description: The course is for chemistry major students. It deals with chemical kinetics, chemical dynamics, equilibrium electrochemistry, dynamic electrochemistry, molecular interactions and processes at the solid surfaces. The following topics are covered:

Content: Chemical kinetics: Rate and rate law. Order and molecularity. Integrated rate equations and half-life expressions for 0, 1, 2, 3 and nth order reactions. Pseudo-order reactions. Kinetics of radioactive decay and carbon dating. Methods of determining order and rate coefficient. Temperature dependence of rate coefficients (Arrhenius equation). Complex reactions – parallel, opposing, consecutive and chain reactions. Mechanisms.
Theories of reaction rates – unimolecular and bimolecular reactions. Activated complex. Effect of catalyst. Experimental methods for studying slow and fast reactions. Electrochemistry: Definitions and units relating to electricity. Ohm's law. Faraday's laws of electrolysis. Definition and measurement of conductivity and molar conductivity. Strong/weak electrolytes. Arrhenius theory. van't Hoff measurements. Ostwald dilution law. Kohlrausch's law of independent migration. Ionic mobilities and transport numbers. Applications of conductivity measurements – dissociation constant, solubilities and solubility products of sparingly soluble salts, conductometric titrations. Thermodynamics of electrolyte solutions. Electrochemical cells and electrode processes. Fuel cells. Photovoltaics (as renewable energy technology). Overpotential. Corrosion. Thermodynamics of electrochemical cells, Surface chemistry and colloids: Chemical, biological and medicinal applications of colloids. Surface tension and interfacial tension, Spreading of one liquid on another. Insoluble monolayer films and their application in water evaporation control. Detergency. Formation and stability of emulsions, Adsorption and absorption isotherms, Langmuir, Freundlich, BET and Tempkin adsorption equations, Chermisorption and heterogeneous catalysis–Langmuir-Hinshelwood and Eley-Rideal mechanisms.

CHM3722 RESEARCH METHODOLOGY

Module Title: **RESEARCH METHODOLOGY**
Code: **CHM3722**
NQF Level: 8
Contact Hours: 2 lecture periods per week
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests and assignments) Final Exam **50%**. (1 x 2 hour exam paper)
Prerequisites: Pass in all second year chemistry modules

Module description: This module is designed to provide students with knowledge of theoretical aspects of scientific principles that are followed in order to conduct research, analyze and interpret data, and communicate scientific results properly.

Content: Ethics of Research; The scientific method: Logic and scientific, natural observations, asking questions and formulation of hypotheses, Predictions, Types of hypotheses (null, alternative, research); Chemostatics Topics: Handling experimental data; Processing and reporting; Significant tests; Analysis of variants (ANOVA); Regression analysis; Validation of experimental data (quality control); Experimental design; Optimization of parameters; Use of existing literature; Using the internet and the university library; Report Writing; Oral presentation using state-of-the-art equipment; Ethical considerations in research; Plagiarism; Finding and using literature references; Citation of references; Writing a literature review; Presenting results as posters.

CHB3732 MEDICAL BIOCHEMISTRY

Module Title: **MEDICAL BIOCHEMISTRY**
Code: **CHB3732**
NQF Level: 7
Contact hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%) Final Exam: **50%** (1 x 3 hour exam paper)
Prerequisites: CHB3612 (Biochemistry II)

Module Description: This module is designed for students that are considering a career in research into the biochemical basis of disease and therapeutic medicine. It discusses some of the current developments in the area of medical biochemistry. The following topics are covered:

Content: Blood and Transport Proteins, Hemostasis and Thrombosis. Bioenergetics and Oxidative Metabolism. Anaerobic Metabolism of Glucose in the Red Cell. Carbohydrate Storage: Synthesis in Liver and Muscles; obesity. Biosynthesis of Cholesterol in Liver. Special Liver Function. Muscle: Energy Metabolism and Contraction. Glucose Homeostasis and Fuel Metabolism. Water and Electrolyte Balance: Kidney Function. Diseases of the Lung and Kidneys: The Control of Acid-Base Balance. Calcium and Bone: osteoporosis; Metabolism. Neurochemistry. Neurotransmitters: psychosis and other nervous disorders.

CHB3712 BIOCHEMISTRY IV

Module Title: **BIOCHEMISTRY IV**
Code: **CHB3712**
NQF Level: 7
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80 %, laboratory component 20 %) Exam: **50%** (1 x 3 hour exam paper)
Prerequisites: CHB3612 (Biochemistry II), **MBL3631** (Cell Molecular Biology & Genetics)
Module Description: This module is designed to deepen the knowledge of inheritance and, biochemical evolution. The following topics are covered:
Content: In depth discussion of inheritance in eukaryotes; Biochemistry and the Genomic Revolution: Studying the relationship between form and function through DNA. Biochemical unity as a basis for biological diversity; Biochemical Evolution: How organic molecules are utilized by living systems; Energy transformations necessary for sustaining living systems; Cells and their response to changes in the environment; Novel Proteins which can be engineered by site specific mutagenesis; Immunobiochemistry: Synthesis of plasma membrane; secretory pathways and lysosomal proteins; interaction between antigens and antibodies; control of the immune response. Protein separation and analytical techniques (chromatography, electrophoresis, protein and enzyme activity determination).

FOURTH YEAR MODULES

CHM3811 ORGANIC CHEMISTRY III

Module Title: **ORGANIC CHEMISTRY III**
Code: **CHM3811**
NQF Level: 8
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, 20% laboratory component) Exam: **50%**; (1 x 3 hour exam paper)
Prerequisites:CHM3711 (Organic Chemistry II)
Module Description: This module is a description of Carboxylic acids and their derivatives and various rearrangement reactions.
Content: Carboxylic acids and their derivatives: acids, acyl chlorides, acid anhydrides, esters, lactones, amides and imides, lactams. Amines: preparations, reactions, Hofmann and Cope elimination reactions. Phenols. Organo-sulfur compounds. Rearrangement reactions: Baeyer-Villiger, Beckmann, pinacol-pinacolone. Pericyclic reactions: electrocyclic and cycloaddition reactions; sigmatropic rearrangements. Chemistry of carbohydrates. Selected examples of multistep synthesis of organic compounds.

CHM3831 PHYSICAL CHEMISTRY III

Module title: **PHYSICAL CHEMISTRY III**
Code: **CHM3831**
NQF Level: 8
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests, tutorial tests and assignments 80%, laboratory component 20%)
Final Exam: **50%**; (1 x 3 hour exam paper)
Pre-requisites: CHM3631 (Physical Chemistry I), **MAT3612** (Calculus II)
Module Description: It introduces topics in quantum mechanics with applications to chemical systems. The second part of the course deals with statistical thermodynamics. The following topics are covered:
Content: Quantum Chemistry: Classical mechanics and failure; Quantization of energy; Wave and particle nature of light and electrons; Experimental evidence of diffraction of the light and electrons and photoelectric effect; de Broglie relationship; Electromagnetic radiation and the electromagnetic spectrum; Spectrum of the hydrogen atom; Operators; Schrödinger wave equation and its solution; Interpretation of the wave function; Wave functions for (1) particle-in-a-box: application to conjugated systems and (2) simple harmonic oscillator as model of vibrating molecule; Postulates of quantum mechanics; Operators; Eigenvalues; Zero point energy; Vibrational - Infrared and Raman spectroscopy; Electronic spectroscopy of atoms and molecules; Electron spin resonance spectroscopy; Nuclear magnetic resonance; Photoelectron spectroscopy.Statistical Thermodynamics: The distribution of molecular states, configuration and weights, the Boltzmann distribution; the molecular partition function; the internal energy and entropy, the canonical partition function; the thermodynamic function and the molecular partition function; using statistical thermodynamics (mean energies, heat capacities, equations of state, residual entropies and equilibrium constants). Translational, rotational, vibrational and electronic partition functions.

CHM3841 PHYSICAL INORGANIC CHEMISTRY

Module Title: **PHYSICAL INORGANIC CHEMISTRY**
Code: **CHM 3841**
NQF Level: 8
Contact hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%,) Exam: **50%** (1 x 2 hour exam paper)
Prerequisite: CHM3701 (Inorganic Chemistry II)
Module Description: This course applies simple concepts of group theory to molecular geometry. Certain aspects of vibrational and electronic properties of molecules can be deduced from the molecular geometry using simple group theory concepts.
Content: Chemical applications of group theory: Continuation of symmetry elements and symmetry operations, point group and character table. Symmetry applications; Infrared and Raman spectroscopy. In-depth treatment of chemical bonding and molecular orbital theory; Electronic spectra of transition metal complexes; Russell-Saunders and ligand field terms, selection rules and electronic transitions.

CHM3801 INSTRUMENTAL ANALYSIS II

Module Title: **INSTRUMENTAL ANALYSIS II**
Code: **CHM3801**
NQF Level: 8
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Exam: **50%**; (1 x 2 hour exam paper)
Prerequisites: **CHM3702** (Instrumental Analysis I)

Module Description: This module is designed to teach the students about different methods of separation, provide enough information about different types of chromatography with emphasis on high performance liquid chromatography (HPLC). The module also provides information about advanced NMR and 2-dimensional NMR.

Content: Separation methods; fractional processes; solvent extraction; introduction to chromatographic methods of separation; general description of chromatography. GC, GLC, LC, TLC, HPLC; supercritical fluid chromatography; important relationships from chromatography; qualitative and quantitative analysis by chromatography; gas chromatography; principles of gas-liquid chromatography; high performance liquid chromatography, column efficiency and chromatographic mobile phases; partition chromatography; adsorption chromatography ion-exchange chromatography; size exclusion chromatography; planar chromatography; different types of detectors used in chromatographic separations; solid phase extraction (SPE) method; Advanced NMR: Fourier Transformation in NMR, 1-dimensional NMR, DEPT, NOE, 2 dimensional NMR, theory, experimental methods and interpretation of spectra, 1H-1H COSY, HETCOR, NOESY.

CHB3801 NUTRITIONAL BIOCHEMISTRY

Module Title: **NUTRITIONAL BIOCHEMISTRY**
Code: **CHB3801**
NQF Level: 8
Contact hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Exam: **50%** (1 x 2 hour exam paper)
Prerequisites: CHB3612 (Biochemistry II), **MBL3632** (Introduction to Microbiology)

Module Description: This module is designed to enhance the students' knowledge of nutrition and metabolism. The following topics are covered:

Content: Biochemistry and Nutrition (proximate of nutrients, function of water, vitamins and minerals); Food groups and how these are linked to Digestion and Absorption; Nutrition and Metabolism; Link between food and health (A case study in connectivity among metabolic pathways, nutrition, regulation and immune system); Concept of energy, specific dynamic action, basal metabolism, measurement of food stuff, caloric value of protein.

CHB3821 NATURAL PRODUCT CHEMISTRY I

Module Title: **NATURAL PRODUCT CHEMISTRY I**
Code: **CHB3821**
NQF Level: 8
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks.
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Exam: **50%**; (1 x 2 hour exam paper)
Prerequisites: **CHM3711** (Organic Chemistry II)

Module Description: This module explores the basic biosynthesis pathway of secondary metabolites. We will learn how natural products are normally classified according to their biosynthetic origins and chemical properties. A special emphasis will be placed on how chemical structure affects the physiological function of various natural products. The following will be covered.

Content: Distinguishing primary and secondary metabolites; NMR techniques in biosynthesis studies (13C NMR, Isotopic incorporation). Polyketide pathway: Fatty acids, cyclization of polyketides to aromatics, skeletal types of polyketides. The shikimic acid pathway: biosynthesis of shikimic acid and aromatic amino acids, phenylpropanoid metabolism, other metabolites from shikimate pathway. Isoprenoids: biosynthesis of mevalonic acids, monoterpenes, sesquiterpenes, diterpernes, sesterterpenes, triterpenes, tetraterpenes and steroids.

CHB3831 BIOINFORMATICS FOR BIOCHEMISTRY

Module Title: **BIOINFORMATICS FOR BIOCHEMISTRY**
Code: **CHB3831**
NQF Level: 8
Contact hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%) Exam: **50%** (1 x 3 hour exam paper)
Prerequisites: **CHB3612** (Biochemistry II), **MBL3631** (Cell Molecular Biology and Genetics,

Module Description: The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and interactive course in which students will acquire knowledge on information networks, the world wide web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed. The information retrieval and analysis tools such as sequence similarity and alignment will be discussed and applied in depth.

This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. The module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences. The course will consist of lectures, student presentations and assignments.

CHM3810 RESEARCH PROJECTS (FOR CHEMISTRY MAJORS ONLY)

Module Title: **RESEARCH PROJECT**
Code: **CHM3810**
NQF Level: 8
Contact Hours: Research project for one year.
Credits: 32
Module Assessment: CA: **100%** (Oral presentation of results – 30%, Consultation and efforts shown during the year- 20 %; written research report - 50%)
Prerequisites: Pass in all third year chemistry modules and at least one statistics module
Module description: This module is designed to provide students with knowledge of theoretical aspects of scientific principles that are followed in order to conduct research, analyze and interpret data, and communicate scientific results properly.
Content: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The competed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by oral examination.

CHB3810 RESEARCH PROJECTS (FOR BIOCHEMISTRY MAJORS ONLY)

Module Title: **RESEARCH PROJECT**
Code: **CHB3810**
NQF Level: 8
Contact Hours: Research project for one year.
Credits: 32
Module Assessment: CA: **100%** (Oral presentation of results – 30%, Consultation and efforts shown during the year- 20 %; written research report - 50%)
Prerequisites: Pass in all third year chemistry modules and at least one statistics module
Module description: This module is designed to provide students with knowledge of theoretical aspects of scientific principles that are followed in order to conduct research, analyze and interpret data, and communicate scientific results properly.
Content: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The competed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by oral examination.

CHM3802 INORGANIC CHEMISTRY III

Module Title: **INORGANIC CHEMISTRY III**
Code: **CHM3802**
NQF level: 8
Contact hours: 2 lecture periods per week and 1 practical session per week for 7 weeks.
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%, Exam: **50%** (1 x 2 hour exam paper)
Prerequisite: CHM3701 (Inorganic chemistry II), **CHM3711** (Organic chemistry II)
Module Description: This course deals with the organometallic chemistry which is a hybrid discipline comprising the knowledge of inorganic and organic chemistry.
Content: Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds. Chemistry of f-block elements; Nuclear Chemistry.

THE FOLLOWING SERVICE MODULE IS OFFERED FOR EDUCATION STUDENTS ONLY.

CHE3862 INORGANIC CHEMISTRY III (FOR EDUCATION STUDENTS ONLY)

Module Title: **INORGANIC CHEMISTRY III (FOR EDUCATION STUDENTS ONLY)**
Code: **CHE3862**
NQF level: 8
Contact hours: 28 hours lectures, 21 hours practical sessions.
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%, Exam: **50%** (1 x 2 hour exam paper)
Prerequisite: CHE3732 (Inorganic Chemistry for Educators)
Module Description: This course deals with the organometallic chemistry which is a hybrid discipline comprising the knowledge of inorganic and organic chemistry.
Content: Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds. Chemistry of f-block elements; Nuclear Chemistry.

CHM3812 INDUSTRIAL CHEMISTRY II

Module Title: **INDUSTRIAL CHEMISTRY II**
CODE: **CHM3812**
NQF Level: 8
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%); Exam **50%** (1 × 3 hours exampaper)
Prerequisites: Physical Chemistry II **(CHM3712)**; Industrial Chemistry I **(CHM3761)**
Module Description: This module introduces the principles of fluid flow, heat exchange, distillation and their applications. The students will be able to calculate and analyse the equipments in chemical industry.
Content: Petroleum industry: technologies and equipments of producing petrochemicals including ethylene, propylene, aromatics. Fluid mechanics: fluid statics and its applications; fluid-flow phenomena; Basic equations of fluid flow; Flow of incompressible fluids in conduits and thin layers; Flow past immersed bodies; transportation of fluid. Heat transfer and its applications: heat transfer by conduction in solids; principles of heat flow in fluids; heat transfer to fluids without phase change; heat transfer to fluids with phase change; radiation heat transfer; heat-exchange equipment and its applications. Mass transfer and its applications: equilibrium-stage operations; distillation: flash distillation, continuous distillation, operating lines, design and operating characteristics of plate columns, enthalpy balances for fractionating columns.

CHB3812 ENVIRONMENTAL BIOCHEMISTRY

Module Title: **ENVIRONMENTAL BIOCHEMISTRY**
Code: **CHB3812**
NQF Level: 8
Contact hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%,)Exam: **50%** (1 x 2 hour exam paper)
Prerequisites: CHB3712 (Biochemistry IV)
Module Description: This module is designed to study the interactions between environmental contaminants and living organisms. It looks at the behaviour of xenobiotics into living organisms particularly the biotransformation reactions and reactive species formation and it also looks at the effects that chemical xenobiotics can cause on biological processes.
Content: Chemical Xenobiotics: classification and behaviours. Bioaccumulation and biomagnification of xenobiotics. Behaviour of xenobiotics into living organisms: absorption, distribution, biotransformation, toxic effects and elimination. The fate and impact of synthetic and natural molecules in the environment. Important pollutants will be used as case studies to illustrate the principles. Principles of toxicology; chemical and biochemical mechanism; pesticide toxicity. Analysis of specific health and environmental impact of hazardous waste.

CHM3832 MOLECULAR SPECTROSCOPY

Module title: **MOLECULAR SPECTROSCOPY**
Code: **CHM3832**
NQF Level: 8
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests, tutorial tests and assignments 80%, laboratory component 20%)
Final Exam: **50%**; (1 x 3 hour exam paper)
Pre-requisites: CHM3631 (Physical Chemistry I), **MAT3612** (Calculus II)
Module Description: This course is designed for chemistry majors who preferably have taken Physical Chemistry III (CHM 3831). The course is a theoretical approach to molecular spectroscopy using quantum mechanics:
Content: Brief review of matrix algebra, group theory and quantum chemistry. Polarization and the Clausius_Mosotti relation: induced polarization (nonpolar molecules), orientation polarization (polar molecules), distortion polarization in an alternating field. The Time-Dependent Schroendinger Equation. The Einstein Absorption and Emission Coefficients. Magnetic dipole and electric quadrupole transitions. Spectral line widths. Theoretical treatment of microwave spectroscopy and molecular rotation: applications to diatomic and polyatomic molecules Theoretical treatment of infrared and Raman spectroscopy and molecular vibration: applications to diatomic and polyatomic molecules. Theoretical treatment of UV-visible spectroscopy and molecular electronic energy levels: applications to diatomic and polyatomic molecules. Nonlinear optics. Production of excited states. Radiation processes: fluorescence, phosphorescence, kinetics, quantum yields and lifetimes. Radiationless processes: the statistical limit, the resonance limit and the intermediate case.

CHB3822 NATURAL PRODUCT CHEMISTRY II

Module Title: **NATURAL PRODUCT CHEMISTRY II**
Code: **CHB3822**
NQF Level: 8
Contact Hours: 2 lecture periods per week and 1 practical session per week for 7 weeks
Credits: 8
Module Assessment: CA: **50%** (minimum 2 tests 80%, laboratory component 20%) Exam: **50%**; (1 x 2 hour exam)
Prerequisites: **CHM3711** (Organic Chemistry II)

Module Description: This is the continuation of natural products chemistry I. In this module, the student will be provided with sound knowledge on principles and techniques involved in the extraction and isolation of chemical constituents from natural sources and how to determine their structures

Content: Alkaloids; alkaloids derived from ornithine and lysine, alkaloids derived from tyrosine, alkaloids derived from tryptophan. Metabolites of mixed biosynthetic origin: metabolites derived from acetate and mavalonate; metabolites derived from shikimate and mevalonate; metabolites derived from acetate and shikimate; and metabolites derived from tryptophan and mevalonate. Isolation of natural products: Chemical screening of different classes/groups of natural products; Bioassay-directed isolation of natural products; (use of different bioassay and chromatographic techniques). Determining the chemical structure of isolated compounds: Techniques; IR, UV, NMR and mass spectroscopy (very brief theoretical treatment, but detailed application of these techniques in structure determination).

CHB3832 PROFESSIONAL TRAINING IN BIOCHEMISTRY

Module Title: **PROFESSIONAL TRAINING IN BIOCHEMISTRY**
Code: CHB3832
NQF Level: 8
Contact hours: 4 lecture periods per week and 2 weeks full-time practical in-service training in industry during recess period if possible or one practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50%** (minimum 3 tests 80%, laboratory component 20%, assign 10 %) Exam: **50%** (1 x 3 hour exam)
Prerequisites: CHB3712 (Biochemistry IV), **MBL3632** (Introduction to Microbiology)

Module Description: This module is designed to expose the students to the application of biochemistry in the industries. The course will be jointly delivered by academics and professionals in the selected fields. Method of delivery will include seminars, workshops and job attachments. Following topics under each profession will be covered. However, delivery of some topics will depend on the availability of expertise in a specific field. It covers the following topics: **Pharmacology:** Careers in Pharmacology, the kinetics of drug-receptor interaction, drug metabolism, pharmacokinetics and molecular pharmacology. **Forensic science:** Careers in forensic science, History and Nature of Forensic Science, Crime Scene Investigation, Biological Evidence, Forensic DNA Analysis, Illicit Drugs; Forensic Toxicology. **Oncology:** Careers in oncology, biochemical and molecular basis of cancer, multistage nature of cancer, including the roles of the environment and somatic mutation, Explore the known genetic mechanisms leading to cancer, Discuss approaches to targeted therapies for different cancers. **Toxicology:** Careers in toxicology, Methods in isolating, identifying and quantifying toxic substances or radiation; assessing toxicity and creating safety profiles, Safe handling of toxic substances and radiation, risk assessments on potential new drugs. **Pathology:** Careers in pathology, scientific investigation of the biology of human disease, 'Genes and the cell in health and disease' and 'Infection, Inflammation and immunity, Histochemistry, Immunocytochemistry. **Brewing science:** Brewing technologies, Quality control and management. **Veterinary Science:** Animal diseases, Food hygiene, Best practices in veterinary science.

CHM3842 ADVANCED TOPICS IN CHEMISTRY

Module Title: **ADVANCED TOPICS IN CHEMISTRY**
Code: **CHM3842**
NQF Level: 8
Contact Hours: 2 lecture periods per week for 14 weeks
Credits: 8
Module Assessment: CA: **50%**; Final Exam **50%.**
Prerequisites: Pass in all third year chemistry modules
Module Description: The course reviews aspects of advanced developments in the field of Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Biotechnology and Biochemistry, which relate to the interests of the students. Only two topics are covered every year. Topics to be covered include:
Content: Waste Water Treatment: Water quality parameters; Drinking water processing; Primary chemical processes involved in water treatment for example, Chlorination and Ozonation; Biological wastewater treatment; Chemical wastewater treatment. Electronic Structure Calculations: Z-matrix for simple molecules; Spin multiplicities for any system; basis sets with regards to electronic structure calculations; The number of functions and primitives employed for a given molecule in electronic structure. Natural Product Chemistry: Introduction & History of Natural Product Research; Discovery and development of drugs from natural resources. Chemical characterization of pharmacologically active compounds from plants. Agricultural Biotechnology and Nanotechnology: The science behind biotechnology: Scope; Principles and techniques of agricultural biotechnology (genetic engineering). Technology Studies: Risk assessment; Pesticide producing crops; Herbicide-tolerant transgenic crops; Insect-resistance transgenic crops. Environmental and food safety of transgenic crops; Ethical and cultural issues in biotechnology; cloning and tissue engineering; Patenting Life; Surveying of Methods and Uses of Animal Biotechnology. Considerations regarding animal biotechnology; human safety; animal welfare; and sociological effects. Scope, principles and techniques of nanotechnology; preparation of nano particles and their properties, application of nanotechnology in biotechnology. Principles of bioethics and biolaw: ethics; philosophy; law issues in relation to biosciences; Regulation of human tissue and stem cells; International environmental law; Intellectual property law and the biosciences.Sustainable Renewable Energy: Desirable characteristics of energy sources; Current and potential energy sources. Solar energy: How solar energy can be converted to other forms of energy; Principles of using solar energy for space heating; Discuss the methods for converting solar energy into electricity; Converting solar energy into electricity Inorganic Chemistry: Explain the basic features of electronic spectra of transition metal complexes. Industrial Chemistry: Petroleum refinement: petroleum separation and cracking.

CHB3852 ADVANCED TOPICS IN BIOCHEMISTRY

Module Title: **ADVANCED TOPICS IN BIOCHEMISTRY**
Code: **CHB3852**
NQF Level: 8
Contact Hours: 4 lecture periods per week and 1 practical session per week for 14 weeks
Credits: 16
Module Assessment: CA: **50 %** (minimum 3 tests 80%, 42 hours practical sessions 20%) Exam: **50 %** (1 x 3 hour exam paper)
Prerequisites: All third year biochemistry modules
Module Description: The course reviews aspects of advanced developments in the field of Biotechnology and Biochemistry, which relate to the interests of the students. Topics to be covered include:
Content: Criminology, Crime Detection and Investigation, Enforcement, Substantive Criminal Aspects, Human Behaviour, Criminal and Delinquent Behaviour, Introduction to Research Methods in Criminology, Environmental Chemistry, Introduction to Archaeology and Anthropological fieldwork, Textiles Evaluation, Crime Scene Investigation, Crime Scene Analysis using modern techniques, DNA Fingerprints, Shoe and lip prints, Forensic DNA profiling, Chromatography techniques, ELISA techniques, Sequencing, Molecular markers, Micro-arrays, Method validations.

O.4. CHEMISTRY AND BIOCHEMISTRY MODULE EQUIVALENTS

List of Equivalent modules

OLD MODULE			NEW/REVISED MODULE	
CHM3511	Chemistry IA		CHM3511	Chemistry IA
CHM3512	Chemistry IB		CHM3512	Chemistry IB
CHM3611	Inorganic Chemistry I		CHM3611	Inorganic Chemistry I
CHM3631	Physical Chemistry I		CHM3631	Physical Chemistry I
CHB3611	Biochemistry I		CHB3612	Biomolecules and Catalysis
CHM3602	Analytical Chemistry I		CHM3602	Analytical Chemistry I
CHM3612	Organic Chemistry I		CHM3651	Organic Chemistry I
CHB3612	Biochemistry II		CHB3731	Bioenergetics and Metabolism
CHM3701	Inorganic Chemistry II		CHM3751	Inorganic Chemistry II
CHM3711	Organic Chemistry II		CHM3752	Organic Chemistry II
CHM3721	Analytical Chemistry II		CHM3721	Analytical Chemistry II
CHM3761	Industrial Chemistry I		CHM3761	Industrial Chemistry I
CHM3702	Instrumental Analysis I		CHM3702	Instrumental Analysis I
CHM3712	Physical Chemistry II		CHM3712	Physical Chemistry II
CHB3701	Biochemistry III		CHB3722	Transmission of Genetic Information
CHM3722	Research Methodology		CHM3722	Research Methodology
CHM3811	Organic Chemistry III		CHM3851	Organic Chemistry III
CHM3831	Physical Chemistry III		CHM3831	Physical Chemistry III
CHM3801	Instrumental Analysis II		CHM3801	Instrumental Analysis II
CHM3812	Industrial Chemistry II		CHM3812	Industrial Chemistry II
CHB3822	Natural Product Chemistry II		CHB3822	Natural Product Chemistry II
CHB3821	Natural Product Chemistry I		CHB3821	Natural Product Chemistry I
CHM3802	Inorganic Chemistry III		CHM3802	Inorganic Chemistry III
CHM3810	Research Projects		CHM3810	Research Projects
CHB3810	Research Projects(for Biochemistry majors)		CHB3810	Research Projects(for Biochemistry majors)

P. DEPARTMENT OF COMPUTER SCIENCE

P.1. DEPARTMENTAL REGULATIONS

P.1.1. COMPULSORY REQUIREMENTS

- In addition to the Faculty of Science entry requirements, students wishing to major in Computer Science will be expected to pass a Departmental Entry Requirement test. This test is an aptitude test and will in no way affect students that are coming from backgrounds without computer studies as a subject. The test is normally taken a week after the registration, but before subject changes for the Faculty are closed, to enable students who do not qualify to select other majors/minors.
- All fourth years are required to do a Research Project: CMP3810 (prerequisite for this course the student should have passed all third year modules).
- The MSc Infromation Technology (IT) Programme (11MSCI) is based on a pool of taught courses and the completion of a dissertation.

P.1.2. COMPILATION OF THE CA MARK

- Details on how the CA for each module is compiled are given under the respective modules.

P.1.3. WEIGHTING OF CA AND EXAM MARKS

- Unless otherwise indicated, the relationship between the CA mark and the Examination mark is **50:50**.

P.2. COMPUTER SCIENCE MAJOR

P.2.1. MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: Computer Science Major and Information Technology Minor 11BCMI
Students opting for a major in **Computer Science** (with minor in Information Technology) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
1	Fundamentals of Digital Electronics	CMP3521	8	Departmental Entry Test	None
	Information Technology Minor:				
1	Introduction to Information Technology	CME3511	16	Departmental Entry Test	None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8		None
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
2	Computer Organization	CMP3532	16	Departmental Entry Test	None
2	Introduction to Statistics	STS3522	8		None
	Information Technology Minor:				
2	Introduction to Web Design	CME3512	16	Departmental Entry Test	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Introduction to Database Systems	CMP3611	16	CMP3511 Programming Fundamentals I	None
1	Object Oriented Programming	CMP3631	16	CMP3511 Programming Fundamentals I	None
1	Software Engineering I	CMP3641	8	CMP3511 Programming Fundamentals I	None
1	Mathematics for Computer Science I	CMP3671	16	MAT3511 Basic Mathematics	None
	Information Technology Minor:				
1	Telecommunications	CME3611	16	CMP3521 Fundamentals of Digital Electronics	None
2	Advanced Databases	CMP3622	8	Co-Requisite: CMP3611 Introduction to Database Systems	None
2	Data Structures and Algorithms	CMP3612	8	Co-Requisite: CMP3631 Object Oriented Programming	None
2	Foundations of Data Communications	CMP3632	16	CMP 3532 Computer Organization	None
2	Software Engineering II	CMP3652	16	Co-Requisite: CMP3641 Software Engineering I	None
2	Mathematics for Computer Science II	CMP3672	16	Co-Requisite: CMP3671 Mathematics for Computer Science I	None
	Information Technology Minor:				
2	Networking and Emerging Technologies	CME3612	16	CME3511 Introduction to Information Technology Co-Requisite: CME3611 Telecommunications	None
Total Credits			**152**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Computer Networks	CMP3721	8	CMP3632 Foundations of Data Communications	None
1	Computer Theory	CMP3741	8	CMP3672 Mathematics for Computer Science II	None
1	Computer Architecture	CMP3761	8	CMP3532 Computer Organization CMP3521 Fundamentals of Digital Electronics	None
1	Artificial Intelligence	CMP3771	16	CMP3511 Programming Fundamentals I	None
	Research Methodology I	CMP3701	8	STS3522 Introduction to Statistics **OR** STS3531 Descriptive Statistics	None
	Information Technology Minor:				
1	Introduction to Network Security	CME3731	16	CME3612 Networking and Emerging Technologies	None
2	Operating Systems	CMP3722	8	CMP 3532 Computer Organization **OR** CMP 3612 Data Structures and Algorithms	None
2	Human Computer Interaction and Computer Ethics	CMP3742	8	CMP 3652 Software Engineering II	None
2	Computer Graphics	CMP3762	8	CMP 3612 Data Structures and Algorithms	None
2	Internet Technologies and Applications	CMP3712	16	Co-Requisite: CMP 3721 Computer Networks	None
2	Research Methodology II	CMP3702	8	Co-Requisite: CMP 3701 Research Methodology I	None
	Information Technology Minor:				
2	Advanced Web Programming	CME3732	16	CME 3512 Introduction to Web Design CMP 3512 Programming Fundamentals II	None
Total Credits			**176**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Network Systems Security	CMP3821	8	CMP 3721 Computer Networks	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3721 Computer Networks	None
1	Software Project Management	CMP3819	16	CMP 3742 Human computer Interaction and Computer Ethics	None
1	Operations Research	CMP3831	16	CMP3672 Mathematics for Computer Science II **OR** EEM3672 Intermediate Mathematical Economics	None
1&2	Research Project	CMP3810	32	Pass all Third Year Modules	None
2	Field Attachment	CMP3802	8	Pass all Third Year Modules	None
2	Data Warehousing and Data Mining	CMP3822	8	CMP3622 Advanced Databases	None
2	Real Time Multimedia	CMP3812	16	CMP3742 Human computer Interaction and Computer Ethics	None
2	Database Programming	CMP3872	16	CMP3512 Programming Fundamentals II CMP3622 Advanced Databases	None
Total Credits			**128**		

P.2.2. COMPUTER SCIENCE MAJOR & MATHEMATICS MINOR

QUALIFICATION: Computer Science Major and Mathematics Minor 11BCMM

Students opting for a major in **Computer Science** (with minor in Mathematics) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
1	Fundamentals of Digital Electronics	CMP3521	8	Departmental Entry Test	None
1	Analytical Geometry, Complex Numbers and Matrices	MAT3531	16		None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8	University Entry Requirements	None
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
2	Computer Organization	CMP3532	16	Departmental Entry Test	None
2	Introduction to Statistics	STS3522	8	Faculty entry requirements	None
2	Pre-calculus	MAT3512	16	Faculty entry requirements	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Introduction to Database Systems	CMP3611	16	CMP3511 Programming Fundamentals I	None
1	Object Oriented Programming	CMP3631	16	CMP3511 Programming Fundamentals I	None
1	Software Engineering I	CMP3641	8	CMP3511 Programming Fundamentals I	None
1	Mathematics for Computer Science I	CMP3671	16	MAT3511 Basic Mathematics	None
1	Sets and Numbers	MAT3601	8	Any two full modules of first year mathematics	None
1	Numerical Methods	MAT3621	8	Any two full modules of first year mathematics	None
2	Advanced Databases	CMP3622	8	Co-Requisite: CMP3611 Introduction to Database Systems	None
2	Data Structures and Algorithms	CMP3612	16	Co-Requisite: CMP3631 Object Oriented Programming	None
2	Foundations of Data Communications	CMP3632	16	CMP3532 Computer Organization	None
2	Software Engineering II	CMP3652	16	Co-Requisite: CMP3641 Software Engineering I	None
2	Mathematics for Computer Science II	CMP3672	16	Co-Requisite: CMP3671 Mathematics for Computer Science I	None
2	Elementary Linear Algebra	MAT3652	16	Any two full modules of first year Mathematics	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Computer Networks	CMP3721	8	CMP3632 Foundations of Data Communications	None
1	Computer Theory	CMP3741	8	CMP3672 Mathematics for Computer Science II	None
1	Computer Architecture	CMP3761	8	CMP3532 Computer Organization CMP3521 Fundamentals of Digital Electronics	None
1	Artificial Intelligence	CMP3771	16	CMP3511 Programming Fundamentals I	None
1	Research Methodology I	CMP3701	8	STS3522 Introduction to Statistics **OR** STS3531 Descriptive Statistics	None
1	Linear Algebra I	MAT3711	16	MAT3601 Sets and Numbers MAT3652 Elementary Linear Algebra	None
2	Operating Systems	CMP3722	8	CMP3532 Computer Organization **OR** CMP3612 Data Structures and Algorithms	None
2	Human Computer Interaction and Computer Ethics	CMP3742	8	CMP3652 Software Engineering II	None
2	Computer Graphics	CMP3762	8	CMP3612 Data Structures and Algorithms	None
2	Internet Technologies and Applications	CMP3712	16	Co-Requisite: CMP3721 Computer Networks	None
2	Research Methodology II	CMP3702	8	Co-Requisite: CMP3701 Research Methodology I	None
2	Linear Algebra II	MAT3712	16	MAT3601 Sets and Numbers MAT3652 Elementary Linear Algebra	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Network Systems Security	CMP3821	8	CMP 3721 Computer Networks	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3721 Computer Networks	None
1	Software Project Management	CMP3819	16	CMP 3742 Human computer Interaction and Computer Ethics	None
1	Operations Research	CMP3831	16	CMP3672 Mathematics for Computer Science II **OR** EEM3672 Intermediate Mathematical Economics	None
1&2	Research Project	CMP3810	32	Pass all Third Year Modules	None
2	Field Attachment	CMP3802	8	Pass all Third Year Modules	None
2	Data Warehousing and Data Mining	CMP3822	8	CMP3622 Advanced Databases	None
2	Real Time Multimedia	CMP3812	16	CMP3742 Human computer Interaction and Computer Ethics	None
2	Database Programming	CMP3872	16	CMP3512 Programming Fundamentals II CMP3622 Advanced Databases	None
Total Credits			**128**		

P.2.3. COMPUTER SCIENCE MAJOR & STATISTICS MINOR

QUALIFICATION: Computer Science Major and Statistics Minor 11BCMS

Students opting for a major in **Computer Science** (with minor in Statistics) must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
1	Fundamentals of Digital Electronics	CMP3521	8	Departmental Entry Test	None
1	Descriptive Statistics	STS3531	16		None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8		None
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
2	Computer Organization	CMP3532	16	Departmental Entry Test	None
2	Pre-calculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
Total Credits			**168**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Introduction to Database Systems	CMP3611	16	CMP3511 Programming Fundamentals I	None
1	Object Oriented Programming	CMP3631	16	CMP3511 Programming Fundamentals I	None
1	Software Engineering I	CMP3641	8	CMP3511 Programming Fundamentals I	None
1	Mathematics for Computer Science I	CMP3671	16	MAT3511 Basic Mathematics	None
1	Probability Theory	STS3611	16	STS3532 Introduction to Probability MAT3512 Pre-calculus	None
2	Advanced Databases	CMP3622	8	Co-Requisite: CMP3611 Introduction to Database Systems	None
2	Data Structures and Algorithms	CMP3612	16	Co-Requisite: CMP3631 Object Oriented Programming	None
2	Foundations of Data Communications	CMP3632	16	CMP 3532 Computer Organization	None
2	Software Engineering II	CMP3652	16	Co-Requisite: CMP3641 Software Engineering I	None
2	Mathematics for Computer Science II	CMP3672	16	Co-Requisite: CMP3671 Mathematics for Computer Science I	None
2	Statistical Inferences	STS3632	16	STS 3532 Introduction to Probability	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Computer Networks	CMP3721	8	CMP 3632 Foundations of Data Communications	None
1	Computer Theory	CMP3741	8	CMP3672 Mathematics for Computer Science II	None
1	Computer Architecture	CMP3761	8	CMP3532 Computer Organization CMP3521 Fundamentals of Digital Electronics	None
1	Artificial Intelligence	CMP3771	16	CMP3511 Programming Fundamentals I	None
1	Research Methodology I	CMP3701	8	STS3522 Introduction to Statistics **OR** STS3531 Descriptive Statistics	None
1	Sampling Methods	STS3731	16	STS3531 Descriptive Statistics	None
2	Operating Systems	CMP3722	8	CMP3532 Computer Organization **OR** CMP3612 Data Structures and Algorithms	None
2	Human Computer Interaction and Computer Ethics	CMP3742	8	CMP3652 Software Engineering II	None
2	Computer Graphics	CMP3762	8	CMP3612 Data Structures and Algorithms	None
2	Internet Technologies and Applications	CMP3712	16	Co-Requisite: CMP3721 Computer Networks	None
2	Research Methodology II	CMP3702	8	Co-Requisite: CMP3701 Research Methodology I	None
2	Nonparametric and Categoral Data Analysis	STS3712	16	STS 3632 Statistical Inference	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Network Systems Security	CMP3821	8	CMP 3721 Computer Networks	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3721 Computer Networks	None
1	Software Project Management	CMP3819	16	CMP 3742 Human computer Interaction and Computer Ethics	None
1	Operations Research	CMP3831	16	CMP3672 Mathematics for Computer Science II **OR** EEM3672 Intermediate Mathematical Economics	None
1&2	Research Project	CMP3810	32	Pass all Third Year Modules	None
2	Field Attachment	CMP3802	8	Pass all Third Year Modules	None
2	Data Warehousing and Data Mining	CMP3822	8	CMP3622 Advanced Databases	None
2	Real Time Multimedia	CMP3812	16	CMP3742 Human computer Interaction and Computer Ethics	None
2	Database Programming	CMP3872	16	CMP3512 Programming Fundamentals II CMP3622 Advanced Databases	None
Total Credits			**128**		

P.2.4. COMPUTER SCIENCE CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

CMP3511 PROGRAMMING FUNDAMENTALS I

Module title:	**PROGRAMMING FUNDAMENTALS I**
Code:	**CMP3511**
NQF level:	5
Contact hours:	4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits:	16

Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)
Final Examinations **50%**
Prerequisites: Departmental Entry Test
Module description: This module introduces the students to the foundational skills for all computing disciplines. It develops the student's skills and concepts that are essential to good programming practice and problem solving. The module will cover the following topics: -PROBLEM SOLVING STRATEGIES: The role of algorithms in the problem solving process, Implementation strategies for algorithms, Debugging strategies, The concept and properties of algorithms. PROGRAM DEVELOPMENT STEPS: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. PROGRAMMING CONSTRUCTS: Primitive data types, Variables, Expressions & assignment, Strings and string processing, Arrays, Records, Files, Scope and lifetime of variables, Strategies for choosing the right data structures. CONDITIONAL AND ITERATION CONSTRUCTS: The Selection structure, Comparison operators, Logical operators, Nested selection structures, The Case selection structure, The Repetition structure, The For…Next Statement, The Do…Loop Statement. EVENT-DRIVEN PROGRAMMING CONSTRUCTS: Event-handling methods, Event propagation, Exception handling, Functions and Parameter passing, Structured Decomposition.

CMP3512 PROGRAMMING FUNDAMENTALS II

Module title:	**PROGRAMMING FUNDAMENTALS II**
Code:	**CMP3512**
NQF level:	5
Contact hours:	4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits:	16

Module Assessment Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-Requisites: CMP3511 Programming Fundamentals I
Module description: This module is a follow up on Programming Fundamentals 1 and provides the student with a rich set of tools to create advanced programs as required in today's business environment. The module will cover the following topics:
Introduction to vb.net applications: Design and Implementation of the .NET Framework, The Common Language Runtime, The .NET Framework Class Library, Creating a .NET Application. Designing windows based applications using the Visual Studio.NET IDE: Organizing a Windows based application, Using controls (e.g. Scroll Bar, groupbox, etc), Introduction to event handlers, Dynamic event handling. Creating programs using component based programming: Introduction to Component Based Programming, Controlling Visibility with Access Modifiers, Introduction to Classes, Introduction to the Object-Oriented Paradigm, Exception handling.

SECOND YEAR MODULES

CMP3611 INTRODUCTION TO DATABASE SYSTEMS

Module title: **INTRODUCTION TO DATABASE SYSTEMS**
Code: **CMP3611**
NQF level: 6
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites: CMP3511 – Programming Fundamentals I
Module Description: This module covers material necessary to provide the students with the required skills for working with a variety of database systems. The module will cover the following topics:- Types of databases; Evolution of Database technologies; Database technology versus conventional file-processing systems; The Systems Development Life Cycle (SDLC); The prototyping methodology ;The enterprise data model; Conceptual Data Modeling; Types of entities; ER diagrams; Business rules; Integrity Control Statements; Writing SQL statements; ER Diagram to relation transformation; Functional Dependencies; Normalization and Demoralization.

CMP3631 OBJECT ORIENTED PROGRAMMING

Module title: **OBJECT ORIENTED PROGRAMMING**
Code: **CMP3631**
NQF level: 6
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites: CMP3511 – Programming Fundamentals I
Module Description: This module introduces a student to the Object Oriented paradigm that is widely adopted in modern software design and implementation. The student should demonstrate an in-depth understanding of Object-Oriented concepts and apply these concepts using a selected OOP language like Java or C++ to solve simple to medium sized programming tasks. The module will cover the following topics: -
Introduction to OOP, and Java; Objects and classes, understanding class definitions; Object interaction; Grouping objects; More sophisticated behavior - libraries; Well-behaved objects - testing, maintaining, debugging; Designing classes; Well-behaved objects - testing, maintaining, debugging; Designing classes; Inheritance; Polymorphism; Threads; Further abstraction techniques: abstract classes and interfaces; Building Graphical User Interfaces; Handling errors; Designing applications; Networking and Case study.

CMP3641 SOFTWARE ENGINEERING I

Module title: **SOFTWARE ENGINEERING I**
Code: **CMP3641**
NQF level: 6
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites: CMP3511 Programming Fundamentals I
Module Description: This module is intended to introduce the need, importance and concepts of software Engineering. The module shows how software systems undergo the processes of specification, development, management and evolution. The following topics will be covered: Definition of Software Engineering; Ethical and professional issues related to Software Engineering; FAQ about Software Engineering; Software process and a software process models; Examples of software process models; Software requirements engineering; Software development; Software testing; Evolution; Software project management; Tasks of software project managers; Why project planning is essential; Graphical representations; Risk management; Fundamentals of software costing and pricing; Metrics for software productivity assessment; Estimating software costs and CHEdule; Testing techniques; Testing of component interfaces; Component testing for object oriented systems; Integration testing for object oriented systems; CASE tools; Define Software reuse; Benefits of reusing software components; Problems of reuse; Types of reusable components; Design processes for reuse; Concept of real-time systems; Concurrent processes; Design process for real-time systems; Real-time executive; Monitoring and control systems; Data acquisition systems.

CMP3671 MATHEMATICS FOR COMPUTER SCIENCE I

Module Title: **MATHEMATICS FOR COMPUTER SCIENCE I**
Code: **CMP3671**
NQF Level: 6
Contact Hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Pre-Requisites: MAT3511 Basic Mathematics
Module Description: This module provides the students with the necessary skills that are essential for the mathematical analysis of problems with emphasis on representation of the mathematical formulation of the problems for solution with the application of the computer. The module provides the beginning student with an initial but practical orientation to mathematics for computing and its basic theorems with a view to applying them to the solution of real life problems. The module will cover the following topics: Number Systems, Representation Of Numbers In The Computer, Computer Arithmetic, Errors, Computer Codes, Logical Statements And Truth Tables, Predicate Logic, Algorithms, Flowcharts, Pseudocode Programs. Set Theory, Relations, Functions or Mapping, Graphs, Algebraic Structures. Number Theory and Methods of Proof, Division Algorithm, The Fundamental Theorem of Arithmetic, Methods of Proof. Rectangular Coordinate System in the Plane,

Coordinate Geometry of a Point in the Plane, Equation of a Line, The Straight Line, Second Order Lines, Polar Coordinates, Parametric Equations of Lines, Coordinates On the Computer Screen. Numerical and Algebraic Expressions, Monomials and Polynomials, Factoring Polynomials, Algebraic Fractions and Irrational Expressions, Equations and Inequalities. Elementary Linear Algebra, Matrices and Determinants of the Second and Third Order, Matrix Multiplication, Subscripted Variables, Matrix Representation of a System of Linear Equations, Systems of Linear Equations in Two and Three Unknowns, Gauss-Jordan Elimination Procedure. Fundamental Principles of Counting, Factorial Notation, Permutations and Combinations, Binomial Theorem, Tree Diagrams, Multinomial Theorem, Elements of Probability Theory.

CMP3622 ADVANCED DATABASES

Module title: **ADVANCED DATABASES**
Code: **CMP3622**
NQF level: 6
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-requisites: CMP3611 Introduction to Database Systems
Module Description: This module is a follow up of Introduction to databases and is intended to consolidate the students design and use of databases and concentrates mainly on database Administration security and other advanced aspects in database systems. The following topics will be covered:Discretionary and mandatory Access Control; The role of the database administrator; Security in statistical databases and encryption; The concept of a transaction; Concurrent Execution of Transactions; Role of Lock-Based Concurrency control; Crash Recovery; Relational Query Optimization; System Catalog in DBMS; architectures of Parallel Databases; architectures of Distributed Databases; distributed query processing; distributed Concurrency Control; deadlock ; recovery; HTML; XML; XML DTDs; XML-QL; Indexing for Text Search; Multidimensional Data model and OLAP queries; Views ; Decision support systems; Spatial Data Management; recursive queries; warehousing ; data mining; mining for rules; Tree-structured rules; decision Trees ; Clustering.

CMP3612 DATA STRUCTURES AND ALGORITHMS

Module title: **DATA STRUCTURES AND ALGORITHMS**
Code: **CMP3612**
NQF level: 6
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-requisites: CMP3631 Object Oriented Programming
Module Description: The purpose of this module is to provide the students with solid foundations in the basic concepts of programming: data structures and algorithms. The main objective of the module is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter. This module is also about showing the correctness of algorithms and studying their computational complexities. This module offers the students a mixture of theoretical knowledge and practical experience. The study of data structures and algorithms is carried out within an object-oriented framework. When implementations are considered, the Java programming language is used. The module will cover the following topics: -Programming Strategies; Data Structures; Introduction; Programming Strategies Data Structures; Introduction; Programming Strategies; Data Structures; Analysis of algorithms; Hard or Intractable problems; Searching; Sequential Searches; Dynamic Algorithms; Dictionaries; Hash tables; Graphs; Complexity; Queues; Sorting; Searching Revisited; Eulerian or Hamiltonian Paths and Traveling Salesman's Problem.

CMP3652 SOFTWARE ENGINEERING II

Module title: **SOFTWARE ENGINEERING II**
Code: **CMP3652**
NQF level: 6
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-requisites: CMP3641 Software Engineering I
Module Description: This module is intended to teach students the in-depth of Software Engineering. It is an addition to the work covered in Software engineering I. The module will cover the following topics:Formal specifications techniques; Algebraic techniques of formal specification; Model-based formal techniques; Software design; Activities in general object-oriented design process; Models for documentation of an object oriented design; UML; UML diagrams; Comparison of CASE tools and UML; Definition of Cleanroom Philosophy; Effectiveness of cleanroom method; Legacy stems; Structure of legacy systems; Function-oriented design; Legacy system assessment; Definition of Encryption; Benefits of data encryption; Definition of PGP; How to use PGP; Human memory; Problem solving; Motivation ;Team dynamics; Selecting and Retaining staff; Software Development Legal issues.

CMP3672 MATHEMATICS FOR COMPUTER SCIENCE II

Module Title: **MATHEMATICS FOR COMPUTER SCIENCE II**
Code: **CMP3672**
Contact Hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-Requisites: CMP3671 Mathematics for Computer Science I
Module Description: This module provides the students with the necessary skills that are essential for the mathematical analysis of problems with emphasis on representation of the mathematical formulation of the problems for solution with the application of the computer. The module aims to provide the beginning student with an initial but practical orientation to

mathematics for computing and its basic theorems with a view to applying them to the solution of real life problems. The module will cover the followings: -Variables and Functions, Review of Basic Elementary Functions, Empirical Functions, Interpolation of Functions, Limits and Continuity, The Derivative of a Function, Basic Derivative Theorems, Applications of the Derivative, Differentials, Indefinite Integral, The Definite Integral, Application of the Definite Integral. Complex Numbers, Complex Function of a Real Variable, The Concept of a Function of a Complex Variable, Series. The Concept of a Function of Several Variables, Continuity, Partial Derivatives of the First-Order, The Total Differential of a Function, Application of the Differential of a Function to Approximate Computations, Partial Derivatives of Higher Order, Test for the Total Differential, The Extremum of a Function of several Variables, Constructing Empirical Formulas by the Method of Least Squares. Differential Equations of the First-Order, First-Order Equations with Variables Separable, First-Order Homogeneous Differential Equations, First-Order Linear Differential Equations, Euler's Method, Differential Equations of the Second Order, Integrating a Differential Equation with the Aid of Power Series, Second-Order Linear Homogenous Differential Equations with Constant Coefficients, Partial Differential Equations, Linear Partial Differential Equations. Line Integrals of the First Kind, The Line Integral of the Second Kind, The Physical Meaning of the Line Integral of the Second Kind, Conditions under Which the Line Integral of the Second Kind is Independent Path, The Work Performed by a Potential Force, Double Integrals, Triple Integrals

CMP3632 FOUNDATIONS OF DATA COMMUNICATIONS

Module title: **FOUNDATION OF DATA COMMUNICATIONS**
Code: **CMP3632**
NQF level: 6
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)Final Examinations 50%
Co-requisites: CMP3532 Computer Organisation
Module Description: This module covers: data communication and open system standards; data transmission; data link controls; Network architectures, layered protocols, network service interface; local networks long-haul networks; internet protocols; link protocols; addressing; routing; flow control; higher level protocols.

SECOND YEAR INFORMATION TECHNOLOGY MODULES

CME3611 TELECOMMUNICATIONS

Module Title: **TELECOMMUNICATIONS**
Code: **CME3611**
NQF Level: 6
Contact hours: 4 lecture periods/week; 3 hour practical session per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%** (1x 3 hour examination)
Pre-Requisites: CMP3521 Fundamentals of Digital Electronics
Module Description: This module covers the principles and practice of wireless communications. The module presents the concepts of frequency re-use and cellular structure and cover propagation effects, multipath fading, digital and analogue modulation, diversity and equalization, multiple access and wireless networks. The module also presents modern communication systems and standards. The module also introduces the use and application of fibre and satellite systems to telecommunication as well as packet switching, traffic and queuing theory. Application of electromagnetic wave propagation and communication theory to teleccommunication networks. The focus of the module is to combine communication at a system level and is designed as a senior elective.

CME3612 NETWORKING AND EMERGING TECHNOLOGIES

Module title: **NETWORKING AND EMERGING TECHNOLOGIES**
Code: **CME3612**
NQF Level: 6
Contact hours: 4 lecture periods/week; 3 hour practical session per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 3 hour Exam)
Pre-requisites: CME3511 Introduction to Information technology
Co-Requisites: CME3611 Telecommunications
Module description: The Networking and Emerging Technologies Program provides instruction in various network designs, computer-related equipment, network management, systems and application software. In addition, the program will introduce the student to exciting emerging technologies; such as, network security, wireless networks, Voice Over IP, and remote network management. This program offers course work designed to train the network administrator in standard networking principles as well as new and emerging technologies.

THIRD YEAR MODULES

CMP3721 Computer Networks

Module title:	**COMPUTER NETWORKS**
Code:	**CMP3721**
NQF level:	7
Contact hours:	2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits:	8

Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites: CMP3632 Foundation of Data Communications
Module description: This module introduces the problems, solutions, and limitations associated with interconnecting computers by communication networks (LAN or WAN). The seven layer ISO Open Systems Interconnection (OSI) reference model serves as a framework for the module with major emphasis on the physical layer standards, data link protocols, network and transportation layer protocols. Topics include: modems, baseband and broadband communications, HDLC, Ethernet and token ring LANs, cell and frame relay networks, bridges, routers, services of the upper layers (Session, Presentation, Application), and network security.

CMP3741 COMPUTER THEORY

Module title:	**COMPUTER THEORY**
Code:	**CMP3741**
NQF level:	7
Contact hours:	2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits:	8

Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Final Examinations**50%**
Prerequisites:CMP3672 Mathematics for Computer Science II
Module description: This module introduces the student working with mathematical proofs and the concepts, notations, and techniques of the theories of Automata, formal languages, and Turning machines; and to provide historical perspective on the creation of the computer with a profound understanding of some of its capabilities and limitations. This module is necessary in understanding of the modules on Computer design, Artificial Intelligence, the analysis of algorithms. The module also provides the basis for the development of the abilities to recognize and manipulate context-free grammars and to understand the power of the recursive interaction of parts of a procedure. The module will cover the following topics: - Functions, Relations ,Sets, Propositional Logics : Logic, graphs, trees and algebraic structures,Tautologies, contradictions and contingencies., Logical equivalence and logical implication, Argument evaluation and rules of inference. Predicate logic, Combining quantifiers, Proving mathematical theorems. Proof by induction, Recursive definitions and recurrence relations, Recurrence relations (cont) and expert systems, Program correctness. Graph and Trees: : Graphs, , Simple graphs and connectedness , Paths in graphs , Hamilton paths and Euler paths , Hamilton circuit of least possible total weight, Matrix representations of graphs, isomorphisms and planarity, Isomorphisms and planarity, Isomorphisms and trees , Rooted and binary trees, Huffman codes, Algebraic structures, Semigroups, Groups, Subgroups, Semigroups obtained from finite alphabets Error-detecting/correcting capabilities of codes, Generator matrices and codes , Characteristics of error detecting/correcting codes, Parity-check matrices, Syndromes, Syndromes, error correction and Hamming codes. Theory of Computation : Regular Languages, Finite Automata, equivalence, minimization, Myhill-Nerode Theorem, introduction to nondeterminism, Context free grammars, Pushdown automata, equivalence and applications. Turing machines, Recursive and Recursively enumerable sets, non-determinism, RAMs and equivalence, Universal Turing Machines, undecidability, Rice's theorems for RE sets, Post machines, Basics of Recursive function theory. Equivalence, Church's thesis, computational complexity, space and time complexity of Turing Machines, Relationships, Savage's theorem, Complexity classes, Complete problems, NP-completeness, Cook-Levin theorem. Automata theory: Deterministic finite Automata and Non-deterministic finite automata. Equivalence of DFAs and NFAs, Regular expressions, the pumping lemma for Regular expressions, Push-down Automata (PDAs), relations of PDAs and context-free grammars and its properties, Turning machines, sets and languages, Chomsky hierarchy, the church turning thesis, decidability, tracability.

CMP3761 COMPUTER ARCHITECTURE

Module title:	**COMPUTER ARCHITECTURE**
Code:	**CMP3761**
NQF level:	7
Contact hours:	2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits:	8

Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites CMP3532 Computer Organization **CMP3521** Fundamentals of Digital Electronics
Module description: This module refers to those attributes of a system visible to a programmer or those attributes that have a direct impact on the logical execution of a program. It introduces how a Microprocessor inside a computer can perform many different activities or tasks have been performed by the same machine controlling extra pieces of hardware attached to it (what goes on inside a computer). The module will cover the following topics: -CPU design, memory systems, bus structure, processing exceptions, language features that influence architecture, memory management, Microprogramming, Microprocessors, bit slice architecture, multiprocessor architectures, shared memory, associative processors, interconnection networks, pipelined architectures, tagged architecture, data flow architecture, special purpose architecture, performance evaluation, RAID architectures, cache memories, language for parallel/distributed computation, case studies, graphics systems, computer peripherals. It deals with Processor data path design, Input/Output organization, interrupts and DMA. Design and modelling of disks, disk caches, Redundant Arrays of Inexpensive Disks (RAID) devices, parallel I/O subsystems, parallel file systems, and Flash memory.

CMP3771 ARTIFICIAL INTELLIGENCE

Module Title: **ARTIFICIAL INTELLIGENCE**
Code: **CMP3771**
NQF Level: 7
Contact Hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Pre-Requisites:CMP3511 Programming Fundamentals I
Module Description: This module provides the framework for the development of the necessary skills that are essential for the application of Artificial Intelligence to real-life problem situations. The emphasis is on developing the necessary theory and programming skills required in building and deploying Artificial Intelligence systems. The module provides practical projects that constitute the best way of learning and developing skills in Artificial Intelligence through the use of industry strong Artificial Intelligence programming language. By integrating theory and practice, the module provides the concepts, skills, tools, and techniques required for the development of appropriate skills in Artificial Intelligence. The module will cover the following topics: -Artificial Intelligence Problems and the Underlying Assumptions; Problems, Problem Spaces, and Search; Heuristic Search Techniques; Knowledge Representation and Issues; Using Predicate Logic; Representing Knowledge Using Rules; Statistical Reasoning; Slot-and-Filter Structures; Game Playing; and Planning. Introduction to PROLOG, The PROLOG Language, PROLOG in AI, More PROLOG in AI, Expert Systems, Perception and Action. Natural Language Processing, Understanding, Parallel and Distributed Artificial Intelligence, Learning, Connectionist Models, and Common Sense.

CMP3701 Research Methodology I

Module Title: **RESEARCH METHODOLOGY I**
Code: **CMP3701**
NQF Level: 7
Contact Hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
1½-hour tutorial /week for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 2 hour exam)
Pre-Requisites: STS3522: Introduction to Statistics or STS3531 Descriptive Statistics
Module Description: This module provides the framework for the development of the necessary skills that are essential for conducting and reporting the results of a research. The emphasis is on the development of methods for doing research both for scientific contribution in the field of computer science and in the development of computing and information related projects. The module will cover the following topics: - Research Methodology, Quantitative and Qualitative Research Cycles, The Research Topic, Statement of the Research Problem, Research Design, Research Hypotheses, The Cyclic Progress of the Scientific Expansion of Knowledge. Literature Review, Literature Searches, Compiling a Literature Review, The Reference System, Reference in the Text, Language Reference. Research Design: Population and Types of Samples, The Sampling Frame, Random Sampling, Other Types of Probability Sampling, Non-probability Sampling, Sample Size ($_n$). The Research Proposal, Requirements of a Research Topic, Designing a Research Project, Sections of a Research Proposal, Evaluation Criteria for a Research Proposal, the Student-Study Supervisor Role.

CMP3722 OPERATING SYSTEMS

Module title: **OPERATING SYSTEMS**
Code: **CMP3722**
NQF level: 7
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 2 hour Exam)
Prerequisites:CMP3532 Computer Organisation or CMP3612 Data Structures and Algorithms
Module description: This module introduces the student to the concepts that underlie Operating Systems (OS).It is essential for a computer scientist to know what operating systems are,what they do and how they are designed.
The module will cover the following topics: Processes in OS, synchronization,Interprocess communication, CHEduling,deadlocks,memory management, virtual memory, secondary storage , device management and security.

CMP3742 HUMAN COMPUTER INTERFACE AND COMPUTER ETHICS

Module title: **HUMAN COMPUTER INTERFACE AND COMPUTER ETHICS**
Code: **CMP3742**
NQF level: 7
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 2 hour exam)
Prerequisites:CMP3652 Software Engineering II
Module description: This module introduces the student to Human Computer Interaction (HCI). HCI is concerned with understanding, designing, implementing and evaluating user-interfaces so that they better support users in carrying out their tasks. It also highlights the importance of IT professionals in making ethically informed decisions that are within the boundaries of relevant legal systems and professional codes of conduct. The module will cover the following topics: -User and task analysis, human factors, ergonomics, accessibility standards and cognitive psychology.
The module also examines the various ethical issues surrounding computers and expected from computer professionals including piracy, hacking, viruses, responsibility and liability for the use of software and invasion of privacy.

CMP3762 COMPUTER GRAPHICS

Module title: **COMPUTER GRAPHICS**
Code: **CMP3762**
NQF level: 7
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 2 hour exam)
Prerequisites: **CMP3612** Data Structures and Algorithms
Module description: This module introduces the student to the basic principles of graphical systems. Graphical systems have become an increasingly important area within computer science, and the purpose of this module is to investigate the principles, techniques and tools that have enabled advances in Computer graphics. Implementation is a central component of the module, but its mathematical underpinnings will also be emphasized. The module will cover the following topics: -Graphical Algorithms, Graphical user-interface design, Choosing interaction styles and interaction techniques, HCI aspects of interface design, Dynamics of color, Structuring a view for effective understanding. Raster and Vector graphics systems, Video display devices, Physical and logical input devices, Issues facing the developer of graphical systemsComputer animation and Multimedia Techniques.

CMP3712 INTERNET TECHNOLOGIES AND APPLICATIONS

Module title: **INTERNET TECHNOLOGIES AND APPLICATIONS**
Code: **CMP3712**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 3 hour exam)
Co-requisites: CMP3721 Computer Networks
Module Description: This module is intended to teach students the technologies governing the working of the Internet and its relationship with the World Wide Web (WWW).The following topics will be covered:Review of the OSI model; Internet protocols - TCP and TCP/IP; TCP/IP as the de-facto Internet protocol; HTML and XTML codes; Use HTML to create a simple web page; Use the Internet to search for other scripting languages; Client applications; Standards for Client applications; Types of security; Security Implementation; Digital certificates; Digital signatures; Secure protocols; Use of Dreamweaver application; Use My Sql, Oracle or Ms-Access to create a database; Link at least 3 tables in the database; Primary and foreign keys; ASP technology; PHP technology; Database linkage to Website; Electronic payment systems; Internet fraud; Conveniences of using credit cards; Risks of using credit cards; Culture in Electronic Commerce; Contracts; Legal issues related to usage of the Internet;

CMP3702 RESEARCH METHODOLOGY II

Module Title: **RESEARCH METHODOLOGY II**
Code: **CMP 3702**
NQF Level: 7
Contact Hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-Requisites: CMP3701 Research Methodology I
Module Description: This module provides the framework for the development of the necessary skills that are essential for conducting and reporting the results of a research. The emphasis is on the development of methods for doing research both for scientific contribution in the field of computer science and in the development of computing and information related projects. The module will cover the following topics: -

Types of Quantitative Research Designs; Quasi-Experimental Research; Non-experimental Research; Validity of Conclusions; Suitability of Research Designs; Internal Validity and Threats; External Validity and Threats. Systematic Observation and Quantitative Measurement, Measurement Theory, Construct Validity of the Dependent Variable, Reliability, Pilot Study in the Development of an Instrument, Measuring Instruments, Developing and Constructing Questionnaires, Interview CHEdules, and Attitude Items, Ethical Considerations.

Qualitative Research Design, Historical Research, The Phenomenological Approach, Qualitative Methods, Case Study Research, Participant Observation, Unstructured and In-depth Interviews and Focus Groups, Participatory Research, Action Research, Content Analysis. Statistical Validity and Techniques, Statistical Techniques and Coding, Presenting the Results, Report Writing, The Sections of a Research Report, Conventions, Grammar, and Style, Evaluation Criteria for a Research Report.

THIRD YEAR INFORMATION TECHNOLOGY MODULES

CME3731 INTRODUCTION TO NETWORK SECURITY

Module title: **INTRODUCTION TO NETWORK SECURITY**
Code: **CME3731**
NQF level: 7
Contact hours: 4 lecture periods/week; 3 hour practical session per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Exam **50%** (1x 3 hour exam)
Pre-requisites: CME3612 Networking and Emerging Technologies
Module description: The course covers theory and practice of Network security, focusing in particular on the security aspects of the web and Internet.

It prepares the student for the security issues and concerns they will face in professional environments. It starts with an overview of TCP/IP stacks, their strengths and weaknesses, followed by topics like intrusion detection, worm modeling and detection, VPNs, IPSEC, PKIs etc. It surveys cryptographic tools used to provide security, such as shared key encryption (DES, 3DES, RC-4/5/6, etc.); public key encryption, key exchange, and digital signature (Diffie-Hellmann, RSA, DSS, etc.). It then reviews how these tools are utilized in the internet protocols and applications such as Kerberos, SSL, IPSEC, TLS, PGP, S/MIME, SET, and others. System security issues, such as viruses, intrusion, firewalls, and others will also be covered. Last but not least, wireless security issues will also be discussed. Application of cryptographic protocols for secure communication across a network.

CME 3732 ADVANCED WEB PROGRAMMING

Module title: **ADVANCED WEB PROGRAMMING**
Code: **CME 3732**
NQF level: 7
Contact hours: 4 lecture periods/week; 3 hour practical session per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%** (1x 3 hour)
Prerequisites: CME 3512 Introduction to Web design **CMP 3512** Programming Fundamentals II
Module Description: This module is intended to teach the students advanced features in web programming. The following topical areas will be covered: Introduction to XML; How XML can be used; XML Syntax; XML Elements; XML Attributes; XML Validation; XML Validator; XML Browser support; Viewing XML in Browsers; Displaying XML with CSS; Displaying XML with XSL;XML embedded in HTML. Advanced features of XML: XML Namespaces; XML CDATA; XML Encoding; XML Server; XML Applications; XML HTTP Requests; XML Save Data to an XML File; Behaviors for HTML and XML;XML Technologies; XML Editor; XML Summary.

FOURTH YEAR MODULES

CMP3810 RESEARCH PROJECT

Module Title: **Research Project**
Code: **CMP3810**
NQF Level: 8
Contact Hours: Research Project Running for one year
Credits: 32
Module Assessment: Continuous Assessment: **100%** Oral Presentation of Proposal: 10%Written Research Proposal: 20%Oral Presentation of Results: 20% Written Research Report: 50%
Pre-Requisites: Pass all third year modules
Module Description: This module provides the framework for the development of the necessary research skills through the completion of a supervised research project in the context of the major. Students will be expected to develop a research proposal under the guidance of the supervisor, present the proposal in the written and oral form, collect and analyze relevant data in order to prepare a requirements document, prepare the relevant design documentation for the project, produce workable software, test the software and implement it. The student is expected to produce a report on the project according to the accepted format adopted by the Department of computer Science. The student is expected to present the final report orally and in the written form.

CMP3819 SOFTWARE PROJECT MANAGEMENT

Module Title: **SOFTWARE PROJECT MANAGEMENT**
Code: **CMP3819**
NQF Level: 8
Contact Hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment Continuous Assessment **50%** (minimum of 2 tests and 2 ssignments) 1×3 Hrs Final Examination **50%**
Pre-Requisites: CMP3742 Human Computer Interaction and Computer Ethics
Module Description: This module provides the framework for the development of the necessary skills that are essential for the management of Information Technology projects. The emphasis is on the application of the nine project management knowledge areas (project integration, scope, time, cost, quality, human resources, communication, risk, and procurement management) and the all the five process groups (initiating, planning, executing, controlling, and closing) to information technology projects.

The module provides practical lessons in project management through the use of project management software. By integrating theory and practice, the module provides the concepts, skills, tools, and techniques required for information technology project management. The module will cover the following topics: -Project Management Context and Processes, A Methodology for Information Technology Management, Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resources Management, Project Communication Management, Project Risk Management, Project Procurement Management, Using Project Management Software to assist Project Management areas. Initiating a Project, Planning a Project, Executing a Project, Controlling a Project, Closing a Project.

CMP3821 NETWORK SYSTEMS SECURITY

Module title: **NETWORK SYSTEMS SECURITY**
Code: **CMP3821**
NQF level: 8
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment Continuous Assessment **50%** (minimum of 2 tests and 2 ssignments)1×2 Hrs Final Examination **50%**
Prerequisites **CMP3721**Computer Networks
Module description: The module covers theory and practice of Network security, focusing in particular on the security aspects of the web and Internet. It prepares the student for the security issues and concerns they will face in professional environments. It starts with an overview of TCP/IP stacks, their strengths and weaknesses, followed by topics like intrusion detection, worm modeling and detection, VPNs, IPSEC, PKIs etc. It surveys cryptographic tools used to provide security, such as shared key encryption (DES, 3DES, RC-4/5/6, etc.); public key encryption, key exchange, and digital signature (Diffie-Hellmann, RSA, DSS, etc.). It then reviews how these tools are utilized in the internet protocols and applications such as Kerberos, SSL, IPSEC, TLS, PGP, S/MIME, SET, and others. System security issues, such as viruses, intrusion, firewalls, and others will also be covered. Last but not least, wireless security issues will also be discussed. Application of cryptographic protocols for secure communication across a network.

CMP3841 WIRELESS AND MOBILE COMPUTING

Module title: **WIRELESS AND MOBILE COMPUTING**
Code: **CMP3841**
NQF level: 8
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)1×2 Hrs Examination **50%**
Prerequisites CMP3721 Computer Networks
Module description: This module covers fundamental techniques in design and operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, radio propagation models, error control techniques, handoff, power control, common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc), radio resource and network management. As an example for the third generation air interfaces, WCDMA is discussed in detail since it is expected to have a large impact on future wireless networks. In addition the module covers fundamental techniques about wireless communication, wireless networks, and wireless applications. It gives a good insight in the significance that wireless systems and the user's mobility have on the construction and handling of a data or telecommunication network, and also gives an overview of present technologies. The problem approach includes the transmission and network aspects of communication systems.

CMP3831 OPERATIONS RESEARCH

Module Title: **OPERATIONS RESEARCH**
Code: **CMP3831**
NQF Level: 8
Contact Hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (minimum of 2 tests and 2 assignments) 1×3 Hrs Final Examination **50%**
Pre-Requisites CMP3672 Mathematics for Computer Science II Or **EEM 3672** Intermediate Mathematical Economics
Module Description: This module provides the students with the necessary skills that are essential for the analysis of problems with emphasis on mathematical model formulation and model building as well as the application of the computer and available software to the solution of problems using the fundamental principles of operations research. This module will cover the following topics: - Formulating and Building Linear Programming Models, Graphical Solution of Linear Programming Problems, The Simplex Algorithm and Goal Programming, Sensitivity Analysis and Duality in Linear Programming, Data Envelopment Analysis. Transportation Problems, Assignment Problems, Network Models, Integer Programming, Advanced Topics in Linear Programming. Nonlinear Programming, Introductory Concepts, Convex and Concave Functions, Solving NLPs with One Variable, Golden Section Search, Unconstrained Maximization and Minimization Problems with Several Variables, The Method of Steepest Ascent, Lagrange Multipliers, The Kuhn-Tucker Conditions, Quadratic Programming, Separable Programming, The Method of Feasible Directions, Pareto Optimality and Tradeoff Curves. Decision Making under Uncertainty, Utility Theory, Flaws in Expected Maximization of Utility: Prospect Theory and Framing Effects, Decision Trees, Baye's Rule and Decision Trees, Decision Making with Multiple Objectives, The Analytic Hierarchy Process, Game Theory. Deterministic EOQ Models, Probabilistic Inventory Models, Introduction to Stochastic Processes, Defining Markov Chains, Classification of States in a Markov Chain, Steady-State Probabilities and Mean First Passage Times, Absorbing Chains, Examples of the Application of Markov Chains. Deterministic Dynamic Programming, Examples of Application of Dynamic Programming, Formulating Dynamic Programming Recursions, The Wagner-Whitin Algorithm and the Silver-Meal Heuristic, Using Excel to Solve Dynamic Programming Problems, Probabilistic Dynamic Programming, When Current Stage Costs are Uncertain, but the Next Period's State is Certain, A Probabilistic Inventory Model, How to Maximize the Probability of a Favorable Event Occurring, Examples of Probabilistic Dynamic Programming Formulations, Markov Decision Processes. Queuing Theory and Queuing Terminology, Modeling Arrival and Service Processes, Birth-Death Processes, Queuing Systems, Finite Source Models: The Machine Repair Model, Exponential Queues in Series and in Open Networks, Queuing System with Blocked Customers Cleared, How to Tell Whether Interarrival Times and Service Time Are Exponential, Closed Queuing Networks, Priority Queuing Models, Transient Behavior of Queuing Systems. Discrete-Event Simulation, Random Numbers and Monte Carlo Simulation, Simulation with Continuous Random Variables, Statistical Analysis in Simulations, Simulation Languages, The Simulation Process, Simulation with Process Model, Simulation with the Excel Add-in @ Risk. Time Series Models, Moving Average Forecasting Methods, Simple Exponential Smoothing, Holt's Method: Exponential Smoothing with Trend, Winter's Method: Exponential Smoothing with Season, Ad Hoc Forecasting, Simple Linear Regression, Multiple Regression, Nonlinear Regression. Numerical Methods with Operations Research Packages, Simulation with SIMULA, Operations Research with Visual Basic 2005, Operations Research with Visual C# 2005, Operations Research with C++, Operations Research with Java.

CMP3802 FIELD ATTACHMENT

Module Title: **FIELD ATTACHMENT**
Code: **CMP3802**
NQF Level: 8
Contact Hours: Filed Attachment running for 8 Weeks
Credits: 8
Module Assessment: Continuous Assessment: **100%**Oral Presentation of field reportl: 20% Written Field Report: 80%
Pre-Requisites: Pass all third year modules
Module Description: This module provides the framework for the development of the necessary interpersonal and other work related communications skills through the completion of a supervised field attachment period in the context of the major. Students will be expected to prepare a filed report and present the report. The report will be assessed by the company providing the field attachment and the Department of computer Science. The student is expected to present the field report orally and in the written form.

CMP3822 DATA WAREHOUSING AND DATA MINING

Module title: **DATA WAREHOUSING AND DATA MINING**
Code: **CMP3822**
NQF level: 8
Contact hours: 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks
Credits: 8
Module Assessment: Continuous Assessment **50%** (minimum of 2 tests and 2 assignments) 1×3 Hrs Final Examination **50%**
Prerequisites: CMP3622 Advanced Databases
Module Description : This module aims to introduce the foundation of data warehousing, the theories of various data mining techniques and explore the practice of developing data mining applications. This module is one of the advanced database module series. The module is designed to be practical. As such, real-life examples of data mining issues and applications will also be used throughout the module. The following topics will be covered in the module;Data Warehouse; Data Model for Data Warehouses.; Architecture, relational OLAP, Multidimensional OLAP; Implementing Data Warehouses: data extraction, cleansing, transformation and loading, data cube computation, materialized view selection; OLAP query processing; Data Mining Fundamentals: data mining process and system architecture, relationship with data warehouse and OLAP systems; Mining Techniques and Application: association rules, mining spatial databases, mining multimedia databases, web mining, mining sequence and time-series data and text mining and Data pre-processing.

CMP3812 REALTIME MULTIMEDIA

Module title: **REALTIME MULTIMEDIA**
Code: **CMP3812**
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)1×3 Hrs Final Examination **50%**
Prerequisites CMP3742 Human Computer Interaction and Computer Ethics
Module description: The module offers a practical introduction to real-time multimedia in packet networks, and more specifically IP networks. The module will introduce transmission protocols used for the delivery of real-time multimedia as well as the protocols responsible for the setup, maintenance and release of the communication sessions. Various issues surrounding multimedia communication networks from basic signaling to service creation will also be discussed. The module will cover the following topics: -Session Initiation Protocol (Sip). Transmission Of Real-Time Multimedia In Packet Networks Using Rtp/Rtcp. Softswitche . Asterisk

CMP3872 DATABASE PROGRAMMING

Module Title: **DATABASE PROGRAMMING**
Code: **CMP3872**
NQF Level: 8
Contact Hours: 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment **50%** (minimum of 2 tests and 2 assignments) 1×3 Hrs Examination **50%**
Pre-Requisites: CMP3512 Programming Fundamentals II, CMP3622 Advanced Databases
Module Description: This module provides the framework for the development of the necessary skills that are essential for developing and deploying database applications, including remote applications that run on the Web. The emphasis is on the design and development of GUIs, server development, and middle tier implementation. The module will cover the following topic: - Fundamentals of Database programming with ADO.NET, Review of databases, Structured Query Language (SQL), Transact-SQL Programming, Overview of ADO.NET Classes, Windows Application and ADO.NET. Connecting to a Database, Executing Database Commands, Using DataReader Objects to Read Results, Using DataSet to store Data, Using DataSet Objects to Modify Data, Navigating and Modifying Related Data, Using Data View Objects. Advanced Transaction Control, Web Applications Design and Implementation, ASP.NET, Using SQL Server's XML Support, Web Services.

P.2.5. COMPUTER SCIENCE DEPARTMENT: COURSE EQUIVALENTS

OLD MODULES	NEW MODULES
CMP3521 Fundamentals of Digital Electronics	CMP3531 Introductions to Digital Electronics
CMP3532 Computer Organization	CMP3572 Computer Organization & Architecture
CME3512 Introduction to Web Design	CIT3512 Fundamentals of Information Technology II
CME3511 Introduction to Information Technology	CIT3511 Fundamentals of Information Technology I
CMP 3641 Software Engineering I	CMP3691 Object Oriented Programming I
CMP3671 Mathematics for Computer Science I	CMP3651 Mathematics for Computer Science
CMP 3611 Telecommunications	CIT3652 Telecommunications
CMP 3632 Foundations of Data Communications	CIT3612 Computer Networks II
CMP 3652 Software Engineering II	CMP3691 Object Oriented Programming II
CMP 3672 Mathematics for Computer Science II	CMP3651 Mathematics for Computer Science
CMP 3761 Computer Architecture	CIT3711 Advanced Computer Networks
CMP 3701 Research Methodology I	CMP3752 Research Methodology
CMP 3702 Research Methodology II	CMP3752 Research Methodology
CMP 3811 Numerical Methods	CMP3811 Numerical Methods and Operations Research
CMP 3831 Operations Research	CMP3811 Numerical Methods and Operations Research
CMP 3882 Network Administration	CIT3812 Cloud Computing
No exact equivalencies - new subjects offered	

Q. DEPARTMENT OF GEOLOGY

The B.Sc. Geology Single Major qualification is equivalent to an Honours degree that allows graduates to enter a professional career.
Geology is a professional career, where graduates become members of the professional organizations in the countries that they will be employed.
As such the standard of the graduands are expected to meet the high standards in industry. This requires that students participate in field trips without exception. Practical competences will be learned and sharpened in the field. The practical competences of the graduands are highly valued, and therefore we expect all our students to take a keen interest in the field trip aspect of the course. In their final year, geology students also conduct research as part of the new honours geology single major BSc degree programme. This research work develops skills in scientific writing, solving of geological problems and academic communication.

Q.1. DEPARTMENTAL REGULATIONS

To register in the B.Sc.Geology Degree, a candidate must hold a valid NSSC-O or NSSC-A certificate or equivalent with passes in at least five subjects which add up to 25 points, calculated using the UNAM specified scale. In addition to the above requirements, the candidate must have at least a 'C" symbol in English and in Mathematics on NSSC or equivalent qualification. First year students are required to pass a departmental aptitude test before admission to the single major geology programme. Mature age entrants will gain admission as per UNAM mature age entry regulations contained in the General Information & Regulations Prospectus.

Field work to various mines and places of geological interest are an integral part of the geology curriculum. The field work activity varies from 1-3 day trips to 1-4 weeks during semester breaks and at the end of the year. Students should note that field trips are physically strenuous and all students participating in the field trips are therefore required to be medically fit for outdoor activities.

Q.1.1.ADVANCEMENT AND PROGRESSION RULES:

From Year 1 to Year 2: To progress to the second (2nd) year of study, all first year students registered for the geology single major programme must pass **all the first (1st) year level modules.** In exceptional cases, students who have failed a single module may be allowed by the Department to progress to second year, depending on their overall performance which should be outstanding.

From Year 2 to Year 3: In order to advance to the third (3rd) year level of study, a student must have passed all first year modules and at least **6 second year level modules (equivalent to 96 credits)**. Furthermore, students may not register for third year level courses without the necessary pre-requisites for such courses.

Year 3 to Year 4: In order to advance to the fourth (4th) year level of study, a student must have passed all second year modules and at least **6 third year level modules (equivalent to 96 credits)**. Furthermore, students may not register for fourth year level courses without the necessary pre-requisites for such courses.

Q.1.2.GRADUATION

Students must pass **all** prescribed modules in order to graduate as a Geology Major. The Geology Department shall approve all successful candidates who should graduate with a BSc (Honours) Geology single major degree.

Q.2. GEOLOGY MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: B.Sc. (Honours) Geology Single Major (11BGLY

Students opting for a major in **Geology** single major must take all of the following modules:

YEAR 1

SEMESTER	MODULE NAME	CODE	CREDIT	PRE- REQUISITES	CO-REQUISITES
1	Computer Literacy	CLC3509	8		None
1	English Communication & Study skills	LCE3419	16	NSSC ENGLISH 'C'	None
1	Chemistry 1A	CHM3511	16		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Introduction to Physical Geology & Surface Processes	GLY3521	8	Departmental entry requirements	None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
1	Basic Mathematics	MAT3511	16	Faculty entry requirements	None
2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Earth Systems	GLY3502	8	Departmental entry requirements	None
2	Chemistry 1B	CHM3512	16		None
2	Physics for Physical Sciences II	PHY3512	16		None
2	Pre-Calculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16	NSSC ENGLISH 'C'	None
2	Introduction to Statisticsx	STS3522	8		None
Total credits			**184**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDIT	PRE- REQUISITES	CO-REQUISITES
1&2	Field Geology I	GLY3600	8	GLY3521	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Inorganic Chemistry I	CHM3611	16	CHM3511 and CHM3512	None
1	Introduction to Hydrology	GLY3621	8	MAT3512, GLY3521;	None
1	Waves & Optics	PHY3631	16	PHY3511 & PHY3512	None
1	Physical chemistry I	CHM3631	16	CHM3511, CHM3512, MAT3511 & MAT3512	None
1	Earth Resources	GLY3641	8	GLY3521	None
2	Calculus II	MAT3612	16	MAT3611	None
2	Stratigraphy & Geological Mapping	GLY3612	6	GLY3521; GLY3600	None
2	Crystallography & Mineral Chemistry	GLY3632	16	MAT3512, CHM3512	None
2	Introduction to Geochemistry	GLY3642	8	MAT3512, GLY 3521, CHM3512;	None
2	Introduction to Petrology	GLY3652	16	GLY3521; GLY3600	None
Total credits			**144**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE- REQUISITES	CO-REQUISITES
1 & 2	Field Geology II	GLY3700	8	GLY3600	None
1	Coal, Petroleum and Gas*	GLY3701 *	8	GLY3521	None
1	Inorganic Chemistry II*	CHM3701*	8	CHM3611 & MAT3512	None
1	Mineralogy	GLY3711	16	GLY3632, CHM3512	None
1	Plate Tectonics	GLY3721	8	GLY3612; GLY3600	None
1	Exploration Geochemistry and Geostatistics	GLY3749	16	GLY3642; GLY3600	None
1	Sedimentology & Palaeontology	GLY3731	16	GLY3521 & GLY3652	None
1	Regional Geology of Namibia	GLY3761	8	GLY3521	None
1	Environmental & Engineering Geology I	GLE3771	16	GLY3642 & MAT3512; GLY3600	None
2	Ordinary Differential Equations*	MAT3642 *	8	MAT3512	None
2	Field Geology II	GLY3700	8	GLY3600	None
2	Hydrogeology I	GLY3702	8	GLY3621, GLY3642	None
2	Structural Geology I	GLY3712	16	GLY3612; MAT3612; GLY3600	None
2	Igneous Petrology	GLY3729	8	GLY3652, GLY3642; GLY3600	None
2	Metamorphic Petrology	GLY3742	8	GLY3652, GLY3642; GLY3600	None
2	Exploration Geochemistry and Geostatistics	GLY 3782	8	GLY3642; GLY3600	None
2	Research Methodology	GLY3762	8	GLY3600	None
2	Igneous Petrology	GLY3722	8	GLY3652; GLY3600	None
Total credits			**184**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE- REQUISITES	CO-REQUISITES
1	Field Geology III	GLY3800	8	GLY3700; GLY3810	
1	Environmental and Engineering Geology II*	GLE3801 *	8	GLE3771	
1	Industrial Minerals and Gemstones*	GLY3801 *	8	GLY3711; GLY 3700	
1	Igneous Petrogenesis	GLY3821	8	GLY3722, GLY3711; GLY3700	
1	Economic Geology	GLY3831	16	GLY3711 & GLY3721; GLY3700	
1	Metamorphic Petrogenesis	GLY3841	8	GLY3742, GLY3711; GLY3700	
2	Hydrogeology II	GLY3812	16	GLY3702;	
2	Field Geology III	GLY3800	8	GLY3700; GLY3810	
1&2	Research Project	GLY3810	32	All third and second year modules; GLY3800	
2	Exploration Geology and Geophysics	GLY3832	16	GLY3712 & GLY3782, PHY3631; GLY3700	
2	Remote Sensing & GIS	GLY3852	16	GLY3712;	
2	Structural Geology II	GLY3862	8	GLY3712 & GLY3700	
Total credits			**152**		

***Elective course**

Q.3. GEOLOGY CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

GLY3521: INTRODUCTION TO PHYSICAL GEOLOGY AND SURFACE PROCESSES

Module title:	**INTRODUCTION TO PHYSICAL GEOLOGY AND SURFACE PROCESSES**
Code:	**GLY3521**
NQF level:	5
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module assessment:	Continuous **40%**: At least 5 practicals, 2 tests, 1 assignment. Examination **60%**: One 3 hour exam paper.
Prerequisites:	Faculty entry requirements for geology minor students; departmental entry requirements for geology major students

Module description (content): Plate Tectonics, The rock cycle, Introduction to Rocks & Minerals; Introduction to Physical Geology, Earth materials and their uses; The Environment, Natural geological hazards and mitigation measures, Geomorphology and land forms; Introduction to Aerial Photography.

GLY3502: INTRODUCTION TO EARTH SYSTEMS

Module Title:	**INTRODUCTION TO EARTH SYSTEMS**
Code:	**GLY 3502**
NQF level:	5
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module Assessment:	Continuous **40%**: At least 5 practicals; 1-test and at least one assignment. Examination **60%**: One 3 hour exam paper.
Pre-requisites:	Faculty entry requirements for geology minor students; departmental entry requirements for geology major students

Module Description: The Earth as a planet in space; orbit and rotational parameters; Effects of orbit and rotational parameters on glaciers; sediments; and the magnetic field; paleomagnetism; plate tectonics as a unifying principle in the rock cycle; sources of heat in the earth; evolution of planet earth through time; Energy Resources; coal, petroleum; gas; geothermal and solar energy; nuclear energy and other energy sources

SECOND YEAR MODULES

GLY3600: FIELD GEOLOGY I

Module Title:	**FIELD GEOLOGY I**
Code:	**GLY3600**
NQF level:	6
Contact hours:	1 week of field mapping in a suitable area of Namibia or neighbouring country.
Credits:	1
Module Assessment:	Continuous **100%**: Field note books, field reports and field trip participation.
Pre-requisites:	GLY3521 Introduction to Physical Geology & Surface Processes
Co-requisite:	All Geology Modules at level 6, i.e., the second academic year of studying geology as a single major.

Module Description: Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive.

GLY3621: INTRODUCTION TO HYDROLOGY

Module title:	**INTRODUCTION TO HYDROLOGY**
Code:	**GLY3621**
NQF level:	6
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module assessment:	Continuous **40%**: At least 5 practicals, 2 tests, 1 assignment. Examination **60%**: One 3 hour exam paper.
Prerequisites:	GLY3521 Introduction to Physical Geology & Surface Processes, MAT 3512 Precalculus

Module description (content): The hydrologic cycle: Inventory of water resources on planet earth; elements of the hydrologic cycle; rainfall run-off relationships; stream hydrograph analysis; separation of baseflow and run-off, spring flow analysis. Infiltration & percolation: Infiltration capacity of soil; methods for determining infiltration capacity; soil moisture. Hydraulic properties of geological materials: Porosity; permeability, aquifers & confining units; confined and unconfined aquifers; homogeneity & isotropy in aquifers; geology of groundwater occurrence; primary and secondary permeability in aquifers. Principles of groundwater flow: Darcy's Law, specific discharge, average linear velocity, hydraulic head concept, potentiometric surface; equipotential lines; flow lines & transmissivity. Storage properties of aquifers: Specific storage; storativity and specific yield. Natural chemical evolution of groundwater: Hydrochemical facies; graphical methods of representation of hydrochemical facies (piper diagrams, stiff diagrams & fence diagrams);closed and open system behaviour. Overview of Hydrogeological region in Namibia.

GLY3641: EARTH RESOURCES

Module title: **EARTH RESOURCES**
Code: **GLY3641**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous **40%**: At least 4 practicals; 1 test and 1 assignment
Examination **60%**: One 3 hour exam paper.
Prerequisites: GLY3521 Introduction to Physical Geology & Surface Processes

Module description: Earth resources: types, characteristic properties and industrial uses. Mineral and energy resources: the geology of renewable and non-renewable resources -energy, metallic, and nonmetallic resources; Mineral resources of Namibia: outline of the geology, mineral and energy resources of Namibia.

GLY3612: STRATIGRAPHY & GEOLOGICAL MAPPING

Module Title: **STRATIGRAPHY & GEOLOGICAL MAPPING**
Code: **GLY3612**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week.
Credits: 16
Module Assessment: Continuous **40%**: At least 6 practicals; 2 tests and 1 assignment. Examination **60%**: One 3 hourExam
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes

Module Description: Principles of stratigraphy, including Walthers's law; applications of stratigraphic principles and type examples; introduction to the geological time scale; geological history of Namibia; geological maps and structures; geological mapping techniques; structures due to deformation.

GLY3632: CRYSTALLOGRAPHY AND MINERAL CHEMISTRY

Module title: **CRYSTALLOGRAPHY & MINERAL CHEMISTRY**
Code: **GLY3632**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Module assessment: Continuous **40%**: At least 7 practicals; 2 tests and 2 assignments.
Examination **60%**: One 3 hour theory paper and one 3 hour practical paper.
Prerequisites: MAT 3512 Precalculus, CHM3512 Chemistry 1B

Module description: Crystals, lattices and Crystal symmetry; Crystal morphology: and Crystal projections; Space groups, internal order and translational symmetry; Crystal structures and Crystal chemistry. X-ray crystallography and X-ray diffraction. Mineral chemistry – minerals in the Earth's crust; chemical analytical techniques (X-ray diffraction, X-ray fluorescence, electron microprobe analysis); mineral compositions and variations; exsolutions; calculation of mineral analyses; Graphic representation of mineral composition.

GLY3642: INTRODUCTION TO GEOCHEMISTRY

Module Title: **INTRODUCTION TO GEOCHEMISTRY**
Code: **GLY3642**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous **40%**: At least 6 practicals; 2 tests and 1 assignment.
Examination **60%**: One 3 hour exam paper.
Pre-requisites: GLY3521 Itroduction to Physical Geology & Surface Processes, CHM3512 Chemistry 1B

Module Description: The compositon of the solid earth, its atmosphere, and surrounding universe. The origin and evolution of the earth as a whole, as well as its constituent parts and its structure. Thermodynamics of crystals and minerals, crystal chemistry, magmatism and igneous rocks, sedimentation and sedimentary rocks, isotope geochemistry, Eh-pH diagrams and surface environments, metamorphism as a geochemical process; geochemistry of ore deposits.

GLY3652: INTRODUCTION TO PETROLOGY

Module Title: **INTRODUCTION TO PETROLOGY**
Code: **GLY3652**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week.
Credits: 16
Module Assessment: Continuous **40%**: At least 6 practicals; 2 tests and 1 assignment.
Examination **60%**: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes

Module Description: Part A: Introduction to Igneous Rocks-their textures, classification of igneous rocks, granites; monzonites; monzodiorites; silicic volcanics; syenites, trachytes; latites; diorites; andesites; gabbros; basalts; ultramafic igneous rocks; nepheline syenites; phonolites; lamprophyres; pyroclastics.

Part B: Introduction to sedimentary rocks-sedimentary textures; argillaceous rocks; aranaceous rocks; calcareous rocks; dolomites; siliceous rocks; ferruginous rocks; carbonaceous rocks. Part C: Metamorphic rocks- metamorphism, deformation and recrystallisation; metasomatism and melting; the facies classification; progressive regional metamorphism of pelites and basic rocks.

THIRD YEAR MODULES

GLY3700: FIELD GEOLOGY II

Module Title:	**FIELD GEOLOGY II**
Code:	**GLY3700**
NQF level:	7
Contact hours:	2-3 weeks of field mapping; logging; geochemical sampling in any given area of Namibia or neighbouring country or at a mine or exploration site. At the end of the academic year, students are expected to be attached to a mining company; exploration firm; geochemical firm; hydrogeological firm; and/or environmental firm (with a bias towards metal pollution mitigation or engineering geology).
Credits:	1
Module Assessment:	Continuous **100%**: Field note books, field reports and field trip participation.
Pre-requisites:	GLY3600 Field Geology I
Co-requisite:	All Geology Modules at level 7, i.e., the second academic year of studying geology as a single major.

Module Description: Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive; complexly folded areas; excursions; mine visits; geochemical sampling.

GLY3701: COAL, PETROLEUM AND GAS

Module Title:	**COAL, PETROLEUM AND GAS**
Code:	**GLY3701**
NQF level:	7
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module assessment:	Continuous **40%**: At least 4 practicals, 1 test, 1 assignment. Exam **60%**: One 3 hour exam paper.
Prerequisites:	GLY3521 Introduction to Physical Geology and Surface Processes

Module description (content): Sedimentary basins and sequence stratigraphy; development of peat; climates associated with coal development; the preservation of coal; the coalification process; petrology of coal and its origins; types of coal and the environs in which they develop; methods of coal exploration; coal mining; Origin of petroleum and Gas; migration and accumulation of oil and gas; chemical characteristics of oil; source and reservoir rocks; reservoir fluids; reservoir traps; reservoir conditions; introduction to reservoir mechanics; subsurface and exploration for oil and gas; exercises in seiMIC stratigraphy.

GLY3711: MINERALOGY

Module title:	**MINERALOGY**
Code:	**GLY3711**
NQF level:	7
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous **40%**: At least 7 practicals; 2 tests and 2 assignments. Examination **60%**: One 3 hour theory and one 3 hour practical papers.
Prerequisites:	GLY3632 Crystallography and Mineral Chemistry, CHM3512 Chemistry 1B

Module description: Classification of minerals. Physical properties of minerals: colour, streak, lustre, diaphaneity, luminescence, form, cleavage, parting, fracture, hardness, tenacity; magnetism, electricity, radioactivity, specific gravity, thermal properties.

Optical mineralogy: optical properties of minerals: isotropic and anisotropic crystals, polarized light, the polarizing microscope. The optical indicatrix: isotropic, uniaxial and biaxial crystals; opaque minerals. Systematic mineralogy: common rock forming minerals, their occurrence and uses (nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicates and tectosilicates); Gemstones - their classification and properties; Nonsilicate minerals.

GLY3721: PLATE TECTONICS

Module Title:	**PLATE TECTONICS**
Code:	**GLY3721**
NQF level:	7
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight..
Credits:	8
Module Assessment:	Continuous **40%**: At least 4 practicals; 1-test and at least one assignment. Examination **60%**: One 3 hour exam paper.
Pre-requisites:	GLY 3612 Stratigraphy & Geological Mapping

Module Description: Concept of sea floor spreading and plate consumption and generation; the Wilson cycle; plate Motions and stress distribution in plates; geomagnetism-reversals in the Earth's magnetic field, process of rock magnetization; hot spots and plumes, Super continents-how they are recognized; SeiMIC crustal structure, Benioff zone and earthquake distribution; Plate tectonic settings and rock associations; Crustal Provinces.

GLY3731: SEDIMENTOLOGY & PALAEONTOLOGY

Module Title: **SEDIMENTOLOGY & PALAEONTOLOGY**
Code: **GLY3731**
NQF level: 7
Contact hours: 4 lecture hours per week for 14 weeks; 1-3hour practical session per week for 14 weeks.
Credits: 16
Module Assessment: Continuous **40%**: At least 6 practicals; 2-tests and 1 assignment..
Examination **60%**: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3612 Stratigraphy & Geological Mapping and GLY 3652 Introduction to Petrology.

Module Description: Sediments cover 75% of continents and most of the ocean floor. They also host most of the mineral deposits in the world. The following topics will be covered; weathering of rocks; paleoclimates; origin and transport of sedimentary materials; deposition of siliciclastic materials; physical properties of sedimentary rocks; sedimentary textures; sedimentary structures; siliciclastic sedimentary rocks; carbonate sedimentary rocks; biochemical and carbonaceous sedimentary rocks; depositional environments; continental environments; marginal marine environments; siliciclastic marine environments; carbonate and evaporate environments; lithostratigraphy; sequence stratigraphy; magnetostratigraphy; seiMIC stratigraphy; biostratigraphy; PalAeontology: taphanomy; fossils and evolution; fossils and paleoecology; fossils and paleogeography; identification & classification of fossils; common fossils in geologic time.

GLY3761: REGIONAL GEOLOGY OF NAMIBIA

Module title: **REGIONAL GEOLOGY OF NAMIBIA**
Code: **GLY3761**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous **40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination **60%**: One 3 hour exam paper.
Prerequisites: GLY3521 Introduction to Physical Geology & Surface Processes

Module description (content): Regional Geology of Southern Africa. Cratons and cratonic evolution of Southern Africa,mobile belts of Southern Africa. Geology of Namibia, from the Archaean to the Pleistocene. Mineral deposits of Southern Africa according to tectonic settings.

GLE3771: ENVIRONMENTAL & ENGINEERING GEOLOGY I

Module title: **ENVIRONMENTAL & ENGINEERING GEOLOGY I**
Code: **GLE3771**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Module assessment: Continuous **40%**: At least 7 practicals, 2 tests, 1 assignment.
Examination **60%**: One 3 hour exam paper.
Prerequisites: MAT3512 Precalculus, GLY3642 Introduction to Geochemistry

Module description (content): Environmental geochemistry; Types of contaminants in natural water resources; anthropogenic sources of Geochemistry of weathering, equilibrium constants and pollution buffering in different rock types. Groundwater pollution. Engineering properties of rocks and rock masses. Geotechnical site investigations in sedimentary, igneous and metamorphic rocks; Soil description for engineering processes; Reservoirs & Dams structures; Slope stability.

GLY3702: HYDROGEOLOGY I

Module title: **HYDROGEOLOGY I**
Code: **GLY3702**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous **40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination **60%**: One 3 hour exam paper.
Prerequisites: GLY3621 Introduction to Hydrology, GLY3642 Introduction to Geochemistry

Module description (content): Groundwater flow equations & flow net analysis; Piezometers, piezometer nests and potentiometric surface map; Regional groundwater flow systems; Ground recharge mechanisms and estimation techniques (Chloride Mass Balance Method, stable isotope method, Hydrograph analysis technique); Aquifer Hydraulics: Theis Equation; computing drawdown caused by a pumping well; determining aquifer parameters from Time-Drawdown data; slug tests, intersecting pumping cones and well interference; effect of hydrogeologic boundaries; aquifer test design; well loss; well efficiency; well specific capacity & optimum pumping rates. Solute transport in aquifers: Diffusion; advection; dispersion; retardation; sorption reactions; redox reactions; cation exchange; carbonate dissolution & precipitation reactions. The advection-dispersion equation; mass transport with reaction; first order kinetic reactions; equilibrium sorption reactions.

GLY3712: STRUCTURAL GEOLOGY I

Module Title: **STRUCTURAL GEOLOGY I**
Code: **GLY3712**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week..
Credits: 16
Module Assessment: Continuous **40%**: At least 6 practicals; 2-tests and 1 assignment.
Examination **60%**: One 3 hour theory exam; one 3 hour practical exam.
Pre-requisites: GLY3612 Stratigraphy & Geological Mapping and MAT3612 Calculus II

Module Description: The module will cover the following topics: Analysis of stress:- its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes.Analysis of Strain:- the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks.Material response to Stress:- brittle behaviour, brittle-ductile behaviour, ductile behaviour, classes of material response to stress and strain.Microstructures:- crystal defects, microstructural development at various grades, deformation mechanisms and associated textures.Primary Structures:- bedding, unconformities, sedimentary versus tectonic structuresFolds:- their description, fold systems and orientation, classification and development of folds.Foliations:- axial plane foliations, fracture cleavage, crenulation cleavage, slaty cleavage, schistosity, differential layering, orientation of foliation in response to strain, and transposed foliations. Lineations:- slickenside striae, lineations associated with folds, lineations due to intersection of foliations, mineral lineations, pebbles, boulders and ooids and the origin of lineations.Faults and JointsGeometrical analysis:- scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas.Structural associations.Tectonics.

GLY3722: IGNEOUS PETROLOGY

Module Title: **IGNEOUS PETROLOGY**
Code: **GLY3722**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight..
Credits: 8
Module Assessment: Continuous **40%**: At least 5 practicals; 1 test and 1 assignment.
Examination **60%**: One 2 hour theory exam; one 2 hour practical Exam.
Pre-requisites: GLY3652 Introduction to Petrology, GLY3642 Introduction to Geochemistry

Module Description: Nature and scope of petrology; Classification of rocks; Rocks and Earth Structures. The Igneous Rocks: Structures and textures; Chemistry, mineralogy and classification. The Phase rule and Phase diagrams. Petrogenesis, movement and modification of magmas. Common igneous rocks: basalts; rhyolites, andesites, granites, granodiorites, alkaline rocks and carbonatites.

GLY3742: METAMORPHIC PETROLOGY

Module Title: **METAMORPHIC PETROLOGY**
Code: **GLY3742**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight..
Credits: 8
Module Assessment: Continuous **40%**: At least 6 practicals; 2 tests and 1 assignment.
Examination **60%**: One 2 hour theory exam; one 2 hour practical Exam.
Pre-requisites: GLY3652 Introduction to Petrology, GLY3642 Introduction to Geochemistry

Module Description: Basics of metamorphism:- grade, metamorphic zones and facies, Pressure-Temperature depth time paths, types of metamorphism and the geothermal and geobaric gradients. Study progressive metamorphism of pelites and basic rocks for the greenschist, amphibolite, granulite and eclogite facies.Fundamental relations of thermodynamics, producing P-T paths from mineral assemblages; The use of the petrogenetic grid Calculation of AFM and ACF diagrams Calculation of Mineral formulas. Examination of the Duhem theorem and facies concept, activities and mixing, Gibbs Free Energy

GLY3782: EXPLORATION GEOCHEMISTRY AND GEOSTATISTICS

Module title: **EXPLORATION GEOCHEMISTRY AND GEOSTATISTICS**
Code: **GLY3782**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module assessment: Continuous **40%**: At least 7 practicals; 2 tests and 1 assignment.
Examination **60%**: One 3 hour exam paper.
Prerequisites: GLY3642 Introduction to Geochemistry

Module description: Exploration geochemistry: primary and secondary dispersion aureoles and anomalies; geochemical sampling, analysis and interpretation; geochemical patterns of mineral deposits. Geostatistics and geostatistical methods of ore reserve estimation. Laws of distribution for ore deposits; Kriging and error estimation. The module will only cover Linear Geostatistics at this level. Case studies of various deposit types.

GLY3762: RESEARCH METHODOLOGY

Module Title: **RESEARCH METHODOLOGY**
Code: **GLY3762**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous **100%** : 5 assessed assignments, 1 test. Examination: Not applicable
Pre-requisites: GLY3600 Field Geology I
Module Description: Overview of research. Ethics of research. The scientific method: logic and the scientific, natural observations, formulation of hypothesis, predictions. Types of hypotheses. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance, Testing hypotheses. Experimental (research stydy/project) design. Data collection, Documenting research data and other records. Presentation of data in scientific reports/theses/dissertation. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review. Report writing. Giving a good oral presentation (including use of powerpoint).

FOURTH YEAR MODULES

GLY3800: FIELD GEOLOGY III

Module Title: **Field Geology III**
Code: **GLY3800**
NQF level: 8
Contact hours: 4 weeks of field mapping; logging; geochemical sampling in any given area of Namibia or neighbouring country.
Credits: 2
Module Assessment: Continuous **100%**: Field note books, field reports and field trip participation.
Pre-requisites: GLY3700 Field Geology II
Co-requisite: GLY3810 Research Project
Module Description: Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive; complexly folded areas; excursions; mine visits; geochemical sampling. During the year, a student may be attached to mining company; exploration firm; geochemical firm; hydrogeological firm; engineering geology company and/or environmental firm with a bias towards metal pollution mitigation as part of the requirements for the Project.

GLE3801: ENVIRONMENTAL & ENGINEERING GEOLOGY II*

Module title: **ENVIRONMENTAL & ENGINEERING GEOLOGY II**
Code: **GLE3801**
NQF level: 8
Contact hours: 2 hrs lectures per week (14 weeks) & 1x3 hours practical per week for 7 weeks
Credits: 8
Module assessment: Continuous **40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination **60%**: One 3 hour exam paper.
Prerequisites: GLE 3771 Environmental & Engineering Geology I
Module description (content): Stress distribution and elastic theory; soil mechanics; analysis of rock slopes; excavation methods and design; control, maintenance and protection of rock slopes; the influence of groundwater and weathering on rock slope stability. Standard practice in Site Investigation. Engineering solutions to construction problems arising from ground conditions (soils and rocks). Earth materials in relation to engineering; ground engineering problems including ground improvement, mining settlement; foundation engineering; retaining structures; groundwater control . Assessment of contaminated land and water; risk assessment and the legal framework; reclamation and remediation of contaminated sites; the nature of contaminants; ground improvement methods and risk-based strategies for land reclamation and containment of pollutants; potential environmental effects of landfill waste disposal; Pollution associated with metalliferous deposits, acid mine drainage and its remediation, pollution associated with gold deposits, dangers and its remediation, pollution associated with industrial pollutants of petroleum origin and its remediation. Environmental Impact Assessment, including the aims and objectives of EIA, design and implementation of EIA, screening and scooping, impact prediction and mitigation.

GLY3801: INDUSTRIAL MINERALS AND GEMSTONES*

Module Title: **INDUSTRIAL MINERALS AND GEMSTONES**
Code: **GLY3801**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Module Assessment: Continuous **40%**: At least 6 practicals; 2-tests and 1 assignment. Examination **60%**: One 3 hour exam paper.
Pre-requisites: GLY3641 Earth Resources, GLY3711 Mineralogy
Module Description: The module will cover two parts; first industrial minerals, the second gemstones. Under industrial minerals the following topics will be covered: Importance of Industrial Minerals; Standard of living Index as determined by industrial minerals usage; aggregates and construction materials; cement and concrete; glass; gypsum; fluorite; clays in general; kaolinite; smectites and montmorrilonites; evaporates; graphite; sillimanite; kyanite; andalusite; limestone and dolomite; magnesite and magnesia; olivine; perlite; phosphates; asbestos; abrasives; nepheline syenite; slate; wollastonite. The second part will be gemstones: Introduction to gemstones; host rocks and processes of formation; the economics and valuing of gemstones; gem mining; megagems; precious gemstones: diamonds; sapphires; aquamarines; Semi-precious stones.

GLY3810: RESEARCH PROJECT

Module Title:	**Research Project**
Code:	**GLY3810**
NQF level:	8
Contact hours:	Independent Research and Mapping Project by the student, under close supervision from the Lecturer. The lecturer will require an average of one hour contact per week and one week supervision in the field.
Credits:	32
Module Assessment:	Continuous **100%**: Report 60%, Presentation 15%, Oral Exam 25%
Pre-requisites:	All third and second year modules
Co-requisite:	GLY3800 Field Geology III

Module Description: The module will be based on a research topic chosen by a student in the previous year. The field work will be compulsory, and one of the products in the project will normally be production of a geological map and cross-section.

GLY3821: IGNEOUS PETROGENESIS

Module title:	**IGNEOUS PETROGENESIS**
Code:	**GLY3821**
NQF level:	8
Contact hours:	2 lecture hours per week for 14 weeks; 1x3 hour practical session per fortnight for 14 weeks
Credits:	8
Module assessment:	Continuous **40%**: At least 7 practicals; 2 test and 2 assignment Examination **60%**: 2 hour theory and 2 hour practical papers.
Prerequisites:	GLY3722 Igneous Petrology, GLY3711 Mineralogy

Module description: Magmas, magmatism and global tectonic processes. Igneous rocks as petrogenetic indicators. Partial melting processes: primary magma, fractionation, fractional crystallization, convection and mixing, crustal contamination. Magmatism within plates and at plate boundaries. Palaeotectonic settings.

GLY3831: ECONOMIC GEOLOGY

Module title:	**ECONOMIC GEOLOGY**
Code:	**GLY3831**
NQF level:	8
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Module assessment:	Continuous **40%**: At least 7 practicals; 2 tests and 2 assignment. Examination **60%**: One 3 hour theory paper and one 3 hour practical paper.
Prerequisites:	GLY3711 Mineralogy and GLY3721 Plate Tectonics

Module description: Ore-forming processes and theories of ore genesis. Classification of mineral resources. Mineral economics: economic recovery of minerals; environmental impact of mineral exploitation; Ore deposit types: magmatic, volcanogenic, volcano-sedimentary, sedimentary, and metamorphic. Metals - their uses and economics: ferrous and base metals; precious and rare metals. Petroleum: origin, exploration and production. Geopolitical effects of mineral resources and petroleum. Metallogeny: mineral provinces, epochs, and plate tectonic controls.

GLY3841: METAMORPHIC PETROGENESIS

Module Title:	**METAMORPHIC PETROGENESIS**
Code:	**GLY3841**
NQF level:	8
Contact hours:	2 lecture hours per week for 14 weeks; 1-3hour practical session per fortnight for 14 weeks.
Credits:	8
Module Assessment:	Continuous **40%**: At least 6 practicals; 2-tests and 1 assignment. Examination: **60%**: One 2 hour theory exam; one 2 hour practical Exam.
Pre-requisites:	GLY3742 Metamorphic Petrology, GLY3711 Mineralogy

Module Description: Mineral chemistry and mineral sites; exchange vectors and P-T-d relationships. Chemical thermodynamics:- equilibrium in metamorphic systems, species, phases, components, kinetics, state variables and their transformation, Fundamental relations of thermodynamics.Examination of the Duhem theorem and facies concept, activities and mixing, Gibbs Free Energy, Enthalpy and Equilibrium constant. Thermogeobarometry. Metamorphic reactions:- in basic rocks, pelites and in carbonates. The facies concept, the AFM diagram, ACF diagram, the X-CO2 diagram for carbonates, μ-μ diagrams for mineral assemblages and the petrogenetic grid. Mineral chemistry and geothermobarometry.

- Upper Amphibolite facies, Eclogite facies; Granulite facies; blue schist facies and metamorphism of hydrothermally altered rocks.
- Metamorphism, tectonics and pressure-temperature-time-depth paths.
- Heat flow in the crust.

GLY3812: HYDROGEOLOGY II

Module title:	**HYDROGEOLOGY II**
Code:	**GLY3812**
NQF level:	8
Contact hours:	4 hrs lectures per week & 1x3 hours practical per week for 14 weeks
Credits:	16
Module assessment:	Continuous **40%** - At least 7 practicals, 2 tests, 1 assignment. Examination **60%** - 1x 3 hrs theory paper, 1 x 3hrs practical paper
Prerequisites:	GLY3702 Hydrogeology I

Module description (content): Groundwater flow modelling: Types of groundwater flow models; governing equations, numerical & analytical techniques, conceptual model design, boundary conditions; initial conditions; steady state & transient simulations; model calibration; sensitivity analysis; predictive modelling; finite difference & finite element models, different types of computer codes; Introduction to modelling with MODFLOW. Groundwater age dating: Carbon-14 method; tritium method; chlorine-36 method; Chlorofluorocarbons; oxygen-18 and deuterium. Contaminant hydrogeology: contaminant plumes; field tracer tests; multiphase fluid systems. Groundwater and ore deposits: Roll-front uranium deposits, lead-zinc deposits, saline soils & evaporates. Groundwater Exploration, development & management: Groundwater resource evaluation, groundwater budgets, conjunctive use groundwater & surface water. Groundwater pollution processes.

GLY3832: EXPLORATION GEOLOGY AND GEOPHYSICS

Module title:	**EXPLORATION GEOLOGY AND GEOPHYSICS**
Code:	**GLY3832**
NQF level:	8
Contact hours:	4 lecture hours per week for 14 weeks; 1x3 hour practical session per week for 14 weeks
Credits:	16
Module assessment:	Continuous **40%**: At least 7 practicals; 2 test and 2 assignment Examination **60%**: One 3 hour theory exam; one 3 hour practical exam.
Prerequisites:	GLY3712 Structural Geology I, GLY3782 Exploration geochemistry and geostatistics, PHY3631 Waves & Optics

Module description: Exploration techniques: Geological mapping and prospecting. Application of photogeology and remote sensing in mineral exploration. Deep sampling methods: pitting and trenching, auger drilling, hand-held percussion drills, Wagon and Banka drilling; .Mineral resource evaluation and ore reserve estimation using conventional methods. Exploration geophysics: principles and applications of seiMIC, magnetic, gravity, resistivity, electromagnetic induced polarization and radiometric techniques.

GLY3852: REMOTE SENSING AND GIS

Module Title:	**REMOTE SENSING AND GIS**
Code:	**GLY 3852**
NQF level:	8
Contact hours:	4 lecture hours per week; 3 practical hours per week.
Credits:	16
Module Assessment:	Continuous Assessment **40%**: At least 6 practicals; 2-tests and 1 assignment. Examination **60%**: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites:	GLY3712 Structural Geology I

Module Description: This module will cover the following themes: The Electromagnetic spectrum .Remote sensing systems, how they function and life times. .Data acquisition and storage on Remote Sensing Systems. Interpretation of Remote Sensing Images . Image Processing and filtering.Photogeology-interpretation and analysis. Applications of Remote Sensing in Earth and Atmospheric sciences .GIS platforms. Digital mapping techniques. Image analysis using GIS and modeling with GIS.

GLY3862: STRUCTURAL GEOLOGY II

Module Title:	**STRUCTURAL GEOLOGY II**
Code:	**GLY 3862**
NQF level:	8
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Module Assessment:	Continuous **40%**: At least 6 practicals; 1 test and 1 assignment. Examination **60%**: One 3 hour exam paper.
Pre-requisites:	GLY3712 Structural Geology I, GLY3700 Field Geology II

Module Description: The module will cover the following topics: Microstructures and microtectonics: Advanced analysis of stress:- its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes.Further topics in Strain analysis:- the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Cross-section balancing for regions and smaller areas.Construction of block diagrams; depth to detachment and regional shortening calculations; uplift rates, continents and super continents, cycles of the Earths' magnetic field . Advanced geometrical analysis and stereographic projections for boreholes: scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas.
Heat flow in the earths' interior. Geochronology as applied to deformation and crustal evolution

Q.4. GEOLOGY DEPARTMENT: COURSE EQUIVALENTS

OLD CURRICULUM MODULES FAILED	NEW CURRICULUM MODULES TO BE TAKEN
GLY3211 Physical Geology	GLY3521 Physical Geology and Surface Processes
GLY3202 Crystallography	GLY3632 Crystallography & Mineral Chemistry
GLY3212 Stratigraphy & Geological Mapping	GLY3612 Stratigraphy & Geological Mapping
GLY3200 Field Geology I	GLY3600 Field Geology I
GLY3301 Mineralogy	GLY3711 Mineralogy
GLY3331 Sedimentology and Paleontology	GLY3731 Sedimentology and Paleontology
GLY3341 Principles of Geochemistry	GLY3642 Introduction to Geochemistry
GLY3302 Petrology	GLY3652 Introduction to Petrology
GLY3322 Plate Tectonics	GLY3721 Plate Tectonics
GLY3332 Structural Geology	GLY3712 Structural Geology I
GLY3300 Field Geology II	GLY3700 Field Geology II
GLY3411 Igneous & Metamorphic Petrogenesis	GLY3722 Igneous Petrology & GLY 3742 Metamorphic Petrology
GLY3431 Economic Geology	GLY3831 Economic Geology
GLY3432 Exploration Geology & Geophysics	GLY3832 Exploration Geology & Geophysics
GLY3422 Hydrogeology	GLY3702 Hydrogeology I
GLY3402 Remote Sensing & GIS	GLY3852 Remote Sensing and GIS
GLY3400 Field Geology III	GLY3800 Field Geology III

R. DEPARTMENT OF MATHEMATICS

Here are our Departmental Regulations:

- All students must have a Scientific Calculator. Any non-programmable Scientific Calculator may be used.
- In addition to the Unam regulations on Examination qualification, students must attend at least 80% of the tutorial session to qualify for the Examination of that particular module.
- The contribution of the CA mark and the Examination mark toward the final mark is **50:50.**

R.1. MATHEMATICS MAJOR

R.1.1. MATHEMATICS MAJOR & MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: B.Sc. (Honours) Mathematics Major and Statistics Minor 11BMAS

Students opting for a major in **Mathematics** (with Statistics minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
	Statistics Minor:				
1	Descriptive Statistics	STS3531	16		None
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
1	Fundamentals of Digital Electronics	CMP3531	16	Departmental Entry Test	None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
	Statistics Minor:				
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
Total Credits			**176**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 and MAT3512] or [MAT3531 and MAT3512]	None
1	Sets and Numbers	MAT3601	8	Any two following modules: MAT3511, MAT3531, MAT3512	None
1	Numerical Methods	MAT3621	8	Any two following modules: MAT3511 , MAT3531, MAT3512	None
	Statistics Minor:				
1	Probability Theory	STS3611	16	STS 3532 and MAT3512	None
1	Statistical Estimation	STS3631	16	STS3532	None
1	Software Engineering I	CMP3641	8	CMP3511	None
2	Calculus II	MAT3612	16	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two following modules: MAT3511, MAT3531, MAT3512	None
	Statistics Minor:				
2	Statistical Inference	STS3632	16	STS3532	
2	Introduction to Statistical Computing	STS3612	16	STS3531	
Total Credits			**144**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	[MAT3611 or MAT3612] and MAT3601	
1	Linear Algebra I	MAT3711	16	MAT3601 and MAT3652	
1	Numerical Analysis I	MAT3701	8	[MAT3611 and MAT3621] or [MAT3612 and MAT 3621]	
1	Set Theory	MAT3721	8	MAT3601	
1	Partial Differential Equations	MAT3741	8	[MAT3611 or MAT3612], MAT3621 and MAT 3642	
	Statistic Minor:				
1	Sampling Techniques	STS3731	16	STS3531	
1	Distribution Theory	STS3721	8	STS3611, MAT3611 and MAT3612	
2	Real Analysis II	MAT3732	16	[MAT3611 or MAT3612] and MAT3601	
2	Linear Algebra II	MAT3712	16	MAT3601 and MAT3652	
2	Vector Analysis	MAT3622	8	[MAT3611 or MAT3612] and MAT3601	
2	Number Theory	MAT3722	8	MAT3601	
		Statistics Minor:			
2	Nonparametric and Categorical Data Analysis	STS3712	16	STS3632	
Total Credits			**144**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	General Topology	MAT3811	16	MAT3731 or MAT3732	
1	Algebra	MAT3831	16	MAT3711 or MAT3712	
1	Complex Analysis I	MAT3851		MAT3731 or MAT3732	
2	Research Project	MAT3810	16	All Mathematics modules up to third year	
2	Normed Vector Spaces	MAT3822	8	[MAT3731 or MAT3712] and [MAT3711 or MAT 3712]	
2	Category Theory	MAT3802	8	All Mathematics modules up to third year	
2	Numerical Analysis II	MAT3832	16	MAT3611, MAT3612 and MAT3701	
2	Complex Analysis II	MAT3852	16	MAT3731 or MAT3732	
Total Credits			**96**		

QUALIFICATION: B.Sc. (Honours) Mathematics Major and Computer Science Minor Minor 11BMAC

Students opting for a major in **Mathematics** (with Computer Science minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
	Computer Science Minor:				
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
1	Fundamentals of Digital Electronics	CMP3531	16	Departmental Entry Test	None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8	University Entry Requirements	None
2	Precalculus	MAT3512	16	Faculty Entry Requirements	None
2	Introduction to Probability	STS3532	16	Faculty entry requirements	None
	Computer Science Minor:				
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
2	Computer Organization	CMP3532	16	Departmental Entry Test	None
Total Credits			**176**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
1	Sets and Numbers	MAT3601	8	Any two following modules: MAT3511, MAT3531, MAT3512	None
1	Numerical Methods	MAT3621	8	Any two following modules: MAT3511 , MAT3531, MAT3512	None
	Computer Science Minor:				
1	Introduction to Database Systems	CMP3611	16	CMP3532 and CMP 3511	None
1	Object Oriented Programming	CMP3631	16	CMP 3511	None
1	Software Engineering I	CMP3641	8	CMP 3511	None
2	Calculus II	MAT3612	16	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two following modules: MAT3511, MAT3531, MAT3512	None
	Computer Science Minor:				
2	Data Structure and Algorithms	CMP3612	16	CMP3631	None
2	Foundations of Data Communications	CMP3632	16	CMP 3532 Computer Organization	None
Total Credits			**144**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	[MAT 3611 or MAT 3612] and MAT 3601	None
1	Linear Algebra I	MAT3711	16	MAT 3601 and MAT 3652	None
1	Numerical Analysis I	MAT3701	8	[MAT 3611 and MAT 3621] or [MAT 3612 and MAT 3621]	None
1	Set Theory	MAT3721	8	MAT 3601	None
1	Partial Differential Equations	MAT3741	8	[MAT 3611 or MAT 3612], MAT 3621 and MAT 3642	None
	Computer Science Minor:				
1	Artificial Intelligence	CMP3771	16	CMP 3511 Programming Fundamentals I	None
2	Real Analysis II	MAT3732	16	[MAT 3611 or MAT 3612] and MAT 3601	None
2	Linear Algebra II	MAT3712	16	MAT 3601 and MAT 3652	None
2	Vector Analysis	MAT3622	8	[MAT 3611 or MAT 3612] and MAT 3601	None
2	Number Theory	MAT3722	8	MAT 3601	None
	Computer Science Minor:				
2	Operating Systems	CMP3722	8	CMP 3532 or CMP 3612	None
2	Advanced Databases	CMP3622	8	CMP3611	None
Total Credits			**136**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	General Topology	MAT3811	16	MAT 3731 or MAT 3732	None
1	Algebra	MAT3831	16	MAT 3711 or MAT 3712	None
1	Complex Analysis I	MAT3851	16	MAT 3731 or MAT 3732	None
1&2	Research Project	MAT3810	32	All Mathematics modules up to third year	None
2	Normed Vector Spaces	MAT3822	8	[MAT3731 or MAT3712] and [MAT3711 or MAT 3712]	None
2	Category Theory	MAT3802	8	All Mathematics modules up to third year	None
2	Numerical Analysis II	MAT3832	16	MAT3611, MAT3612 and MAT3701	None
2	Complex Analysis II	MAT3852	16	MAT3731 or MAT3732	None
Total Credits			**144**		

QUALIFICATION: B.Sc. (Honours) Mathematics Major and Physics Minor 11BMAP

Students opting for a major in **Mathematics** with (Physics minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16		None
1	Computer Literacy	CLC 3509	8		None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
1	Descriptive Statistics	STS3531	16		None
	Physics Minor:				
1	Physics for Physical Sciences I	PHY3511	16	Departmental Entry Test	None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8	University Entry Requirements	None
2	Precalculus	MAT3512	16	Faculty Entry Requirements	None
2	Introduction to Probability	STS3532	16	Faculty entry requirements	None
	Physics Minor:				
2	Physics for Physical Science II	PHY3512	16	Departmental Entry Test	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
1	Sets and Numbers	MAT3601	8	Any two following modules: MAT3511, MAT3531, MAT3512	None
1	Numerical Methods	MAT3621	8	Any two following modules: MAT3511 , MAT3531, MAT3512	None
1	Probability Theory	STS3611	16	STS3532 and MAT3512	None
	Physics Minor:				
1	Waves and Optics	PHY3631	16	PHY3511 and PHY3512	None
1	Classical Mechanics	PHY3611	16	MAT3512, PHY3511 and MAT3511	None
2	Calculus II	MAT3622	8	[MAT3511 and MAT3512] or [MAT3531 and MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two following modules: MAT3511, MAT3531, MAT3512	None
	Physics Minor:				
2	Electromagnetism	PHY3612	16	MAT3511, MAT3512 and PHY3512	None
2	Modern Physics I	PHY3602	8	MAT3511, MAT3512, PHY3511 and PHY3512	None
Total Credits			**136**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	[MAT3611 or MAT3612] and MAT3601	None
1	Linear Algebra I	MAT3711	16	MAT3601 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	[MAT3611 and MAT3621] or [MAT3612 and MAT 3621]	None
1	Set Theory	MAT3721	8	MAT3601	None
1	Partial Differential Equations	MAT3741	8	[MAT3611 or MAT3612], MAT3621 and MAT 3642	None
	Physics Minor:				
1	Electrodynamics	PHY3711	16	MAT3612 and PHY3612	None
2	Real Analysis II	MAT3732	16	[MAT3611 or MAT3612] and MAT3601	None
2	Linear Algebra II	MAT3712	16	MAT3601 and MAT3652	None
2	Vector Analysis	MAT3622	8	[MAT3611 or MAT3612] and MAT3601	None
2	Number Theory	MAT3722	8	MAT3601	None
	Physics Minor:				
2	Theoretical Mechanics	PHY3712	16	PHY3611, MAT3621, MAT3642 and MAT3652	None
2	Electronics I	PHY3702	8	PHY3512	None
Total Credits			**144**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-/COREQUISITES	CO-REQUISITES
1	General Topology	MAT3811	16	MAT3731 or MAT3732	None
1	Algebra	MAT3831	16	MAT3711 or MAT3712	None
1	Complex Analysis I	MAT3851	16	MAT3731 or MAT3732	None
1&2	Research Project	MAT3810	32	All Mathematics modules up to third year	None
2	Normed Vector Spaces	MAT3822	8	[MAT3731 or MAT3712] and [MAT3711 or MAT 3712]	None
2	Category Theory	MAT3802	8	All Mathematics modules up to third year	None
2	Numerical Analysis II	MAT3832	16	MAT3611, MAT3612 and MAT3701	None
2	Complex Analysis II	MAT3852	16	MAT3731 or MAT3732	None
Total Credits			**128**		

H.1.2. MATHEMATICS CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES:

MAT3511: BASIC MATHEMATICS

Module name: **BASIC MATHEMATICS**
Code: **MAT3511**
NQF level: 5
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Faculty Entry Requirements
Module description: Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement. Algebraic expressions: simplification, expansion, polynomials, remainder and factor theorem, partial fractions. Trigonometry: trigonometric functions, basic trigonometric identities. The absolute value, linear equations, linear inequalities, quadratic equations, quadratic inequalities. Functions: domain, codomain, image, preimage, even function, odd function. Sequences: the geometric sequence, the arithmetic sequence. The Binomial Theorem.

MAT3531: ANALYTIC GEOMETRY, COMPLEX NUMBERS AND MATRICES

Module name: **ANALYTIC GEOMETRY, COMPLEX NUMBERS AND MATRICES**
Code: **MAT3531**
NQF level: 5
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Faculty Entry Requirements
Module description: Points and lines in a plane: the distance formula, the triangle inequality, parallel and perpendicular lines, circles and tangent lines. Conic sections: ellipse, parabola, hyperbola. Vectors in two and three dimensions: addition of vectors, multiplication by a scalar, magnitude, dot product, cross product. Matrices: addition, multiplication, scalar multiplication and transpose (for up to 3×3 dimension), determinant and inverse (with emphasis on 2×2), solutions of systems of linear equations by Cramer's rule (for 2×2), and by Gaussian elimination method (for up to 3×3 matrices). Complex numbers: operations on complex numbers, the complex conjugate, Argand diagram, modulus-argument form, de Moivre's formula, fundamental theorem of algebra.

MAT3512: PRECALCULUS

Module name: **PRECALCULUS**
Code: **MAT3512**
NQF level: 5
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Faculty Entry Requirements
Module description: Functions: one-to-one and onto functions, horizontal line test, composition of functions, inverse of a function. Introduction to exponential and logarithmic functions. Limit of a function: definition, left and right limits, improper limits, continuity in terms of limits. Differentiation: rate of change, derivative of a function, rules of differentiation, increasing and decreasing functions and graph sketching. Integration: antiderivatives, the definite integral, area under a graph. Trigonometry: area of a sector and segment of a circle, further trigonometric identities, trigonometric equations, derivatives and integrals of trigonometric functions.

SECOND YEAR MODULES

MAT3601: SETS AND NUMBERS

Module name: **SETS AND NUMBERS**
Code: **MAT3601**
NQF level: 6
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: Any two of the following three modules: Basic Mathematics (**MAT3511**), Analytic Geometry, Complex Numbers and Matrices (**MAT 3531**), Precalculus (**MAT 3512**).

Module description: Basic logic: propositions and predicates conjunction, disjunction, negation, implication, contrapositive, equivalence. Methods of proof: direct, contrapositive, contradiction, induction. Sets: symmetric difference of two sets, de Morgan's laws, power set, partition, cartesian product, definition of a binary relation, functions as binary relations, preorder. Real numbers: natural numbers, integers, positional number systems, induction.

MAT3611: CALCULUS I

Module name: **CALCULUS I**
Code: **MAT3611**
NQF level: 6
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: [**MAT3511**(Basic Mathematics) and **MAT3512** (Precalculus)] OR [**MAT3531**(Analytic Geometry, Complex Numbers and Matrices)

Module description: Limits and continuity of functions: limit at a point, improper limit, continuity. Derivatives: definition, rules of differentiation, chain rule, derivatives of higher order, derivative of the inverse function, Arc functions (inverse trigonometric functions), hyperbolic functions, area functions (inverse hyperbolic functions). Exponential and logarithmic functions. Some applications of the exponential functions: growth and decay, Rolle's Theorem, Mean Value theorem. Applications of the derivative: l'Hˆospital's rule, related rates, concavity. Integration: antiderivatives, integration by substitution, the fundamental theorem of calculus, area of a region bounded by graphs.

MAT3652: ELEMENTARY LINEAR ALGEBRA

Module name: **ELEMENTARY LINEAR ALGEBRA**
Code: **MAT3652**
NQF level: 6
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

Prerequisite: Any two of the following three modules: Basic Mathematics (**MAT3511**), Analytic Geometry, Complex Numbers and Matrices **(MAT3531),** Precalculus (**MAT3512).**

Module description: Matrices: determinant, inverse and Cramer's rule (for up to 3 × 3 dimension), eigenvalues and eigenvectors, adjoint, symmetric and skew-symmetric matrices, orthogonal matrices. Linear algebra in R^2, R^3 and R^n: subspace, linear combination, linearly independent and linearly dependent vectors, span, basis, dimension. Points, lines, planes and hyperplanes in R^2, R^3 and R^n. orthogonality, angle.

MAT3612 CALCULUS II

Module name: **CALCULUS II**
Code: **MAT3612**
NQF level: 6
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16

Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

Prerequisite: [MAT3511(Basic Mathematics) and **MAT3512** (Precalculus)] or **[MAT3531**(Analytic Geometry, Complex Numbers and Matrices) and **MAT3512** (Precalculus)]

Module description: Integration: Riemann sums, approximations of the Riemann integral using the trapezoidal rule and Simpson's rule. Integration techniques: integration by parts, integration of rational functions. Improper integrals, Applications of the Riemann integral: volume of a solid of revolution, arc length, surface of revolution. Partial differentiation, chain rule, directional derivative. Classification of critical points for two-variable functions, Sequences and series of numbers: the limit of a sequence, absolutely convergent series, tests of convergence. Power series: radius of convergence, interval of convergence, Taylor series, binomial theorem. Double integration, iteration, use of polar coordinates, application of double integration to finding area and volume.

MAT3621 NUMERICAL METHODS

Module name: **NUMERICAL METHODS**
Code: **MAT3621**
NQF level: 6
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: Any two of the following three modules: **MAT3511** (Basic Mathematics), **MAT3531**(Analytic Geometry, Complex Numbers and Matrices), **MAT3512** (Precalculus)
Module description: Basics Of MATLAB: arithmetic, decision, functions, graphs (2-3) dimension. Vector (Array) and Matrix Operations: arithmetic, inverse, determinant, Leslie. Limit of Function: limit, sequence, recurrence relation. Processes: discrete, continuous, and stochastic. Differentiation: Euler, difference methods (linear first and second order). Integration: trapezium, midpoint and Simpson.

MAT 3642 ORDINARY DIFFERENTIAL EQUATIONS

Module name: **ORDINARY DIFFERENTIAL EQUATIONS**
Code: **MAT 3642**
NQF level: 6
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: [MAT3511 (Basic Mathematics) and **MAT3512** (Precalculus)] OR **[MAT3531** (Analytic Geometry, Complex Numbers and Matrices) and **MAT3512** (Precalculus)]
Module description First order equations: initial value problems, separable, exact, homogeneous linear equations: integrating factor. Second order equations: linear homogeneous with constant coefficients: distinct, complex and repeated roots of the characteristic equation; nonhomogeneous equations; method of undetermined coefficients and variation of parameters. Series solution of second order linear equations. Bessel's equation. The Laplace transform: solution of initial value problems, inverse Laplace transform. System of first order linear equations, homogeneous linear system with constant coefficients, nonhomogeneous linear systems.

THIRD YEAR MODULES

MAT3741 PARTIAL DIFFERENTIAL EQUATIONS

Module name: **PARTIAL DIFFERENTIAL EQUATIONS**
Code: **MAT3741**
NQF level: 7
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: MAT3621 (Numerical Methods), MAT3642 (Ordinary Differential Equations) and at least one of the following modules [MAT3611 (Calculus I) or MAT3612 (Calculus II)]
Module description: First order equations: basic properties of the linear equations, solutions of linear equations, the general first order nonlinear equation, applications. Linear second order equations in two independent variables: classification of linear second order equations into parabolic, hyperbolic and elliptic equations. Separation of variables. Examples: the one–dimensional wave equation, the vibrating string, boundary conditions associated with the wave equation.

MAT3731: REAL ANALYSIS I

Module name: **REAL ANALYSIS I**
Code: **MAT3731**
NQF level: 7
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Calculus I (**MAT3611**) and Sets and numbers (**MAT3601**)] or [Calculus II (**MAT3612**), and Sets and numbers (**MAT3601)]**
Module description: The real numbers: upper and lower bounds of a set, supremum and infimum, completeness property of R, Archimedean property of R, intervals. Sequences and series of real numbers: bounded sequences, monotonic sequences, the limit of a sequence, limit rules, subsequences, theorem of Bolzano–Weierstrass, Cauchy sequences, completeness of R, convergent and absolutely convergent series, convergence tests. The limit of a function at a point, limit rules, continuous functions, intermediate value theorem, maximum–minimum theorem, uniform continuity. Differentiation: definition of differentiability, rules of differentiation, mean value theorem, theorem of Taylor.

MAT3701 NUMERICAL ANALYSIS I

Module name: **NUMERICAL ANALYSIS I**
Code: **MAT3701**
NQF level:
Contact hours: 2 lectures per week for 14 weeks1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination 50% (2 hours examination paper).
Prerequisite: [**MAT3611** (Calculus I) and **MAT3621** (Numerical Methods)] or [**MAT3612** (Calculus II) and MAT 3621 (Numerical Methods)]
Module description: Computer arithmetic: binary numbers, floating–point arithmetic, the various kinds of errors, propagation of errors. Solving of non- linear equations. Systems of linear equations: Gauss and Gauss–Jordan algorithm, LU decomposition, the condition of a matrix and error estimation. Iterative methods for non - linear systems: Jacobi iteration, Convergence Near Fixed Points, Seidel iteration, error analysis. Interpolation and curve fitting.

MAT3721: SET THEORY

Module name: **SET THEORY**
Code: **MAT3721**
NQF level: 7
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: Sets and Numbers (MAT3601)
Module description: Ordered pairs and the product of two sets. Functions: definition of a function as a set of ordered pairs, images and preimages, injective, surjective and bijective functions, families of sets, Axiom of Choice. Binary relations: equivalence relations, equivalence classes, transversals, order relations, upper and lower bounds, greatest and least elements, maximal and minimal elements, Zorn's Lemma. Equipotent sets: countable sets, product of two countable sets, countability of Q, uncountability of R.

MAT3711: LINEAR ALGEBRA I

Module name: **LINEAR ALGEBRA I**
Code: **MAT3711**
NQF level: 7
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Sets and Numbers (MAT3601), Elementary Linear Algebra (MAT3652)
Module description: Vector spaces: definition and examples, subspaces, operations on subspaces, span of a set of vectors, complement of a subspace, Dedekind's law, linearly independent set of vectors, basis and dimension, dimension formula for subspaces. Linear mappings: image and preimage of a subspace, kernel, image, rank and defect, isomorphism, coset, factor space, homomorphism theorem, dimension formula for linear mappings, linear form, the dual.

MAT3732: REAL ANALYSIS II

Module name: **REAL ANALYSIS II**
Code: **MAT3732**
NQF level: 7
Contact hours: 4 lectures per week for 14 weeks2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Sets and Numbers (MAT3601) and at least one of the modules Calculus I (MAT3611) and Calculus II (MAT3612).
Module description: The Riemann integral: upper and lower Darbaux sums, Riemann integrability, rules of integration, the fundamental theorem of calculus, Lebesque's theorem on Riemann integrability. The Euclidean metric of R^n. neighborhoods, open and closed subsets, limit of a sequence, theorem of Bolzano–Weierstrass, completeness of R^n.The limit of a function at a point, limit rules, continuous functions. Partial differentiation: gradient, divergence, curl, partial derivatives of higher order. Differentiability of vector-valued functions of several variables: Jacobi matrix, C^1 – functions, chain rule.

MAT3622: VECTOR ANALYSIS

Module name: **VECTOR ANALYSIS**
Code: **MAT3622**
NQF level: 6
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: Sets and Numbers (MAT3601) and at least one of the modules Calculus I (MAT3611) and Calculus II (MAT3612)
Module description: Vector fields, Line, surface and volume integrals, parametric representation of surfaces, Green's theorem, Stokes theorem, Divergence theorem, applications.

MAT3722: NUMBER THEORY

Module name: **NUMBER THEORY**
Code: **MAT3722**
NQF level: 7
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: Sets and Numbers (MAT3601)
Module description: Divisibility of integers, Euclidean division, greatest common divisor and least common multiple of a set of integers, Euclid's algorithm, primes numbers, p–exponents, the Fundamental Theorem of Arithmetic.

MAT3712: LINEAR ALGEBRA II

Module name: **LINEAR ALGEBRA II**
Code: **MAT3712**
NQF level: 7
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Sets and Numbers (MAT3601), Elementary Linear Algebra (MAT3652)
Module description: Endomorphisms: involution, projection, eigenvalue, eigenvector, eigenspace. Matrix theory: representation of a linear mapping by a matrix, change of basis, similar matrices. Euclidean vector spaces: scalar product, norm of a vector, Cauchy–Schwarz inequality, orthogonal basis, orthonormal basis, orthogonal mappings. Determinatal forms, determinant of an endomorphism, characteristic polynomial.

FOURTH YEAR MODULES

MAT3811: GENERAL TOPOLOGY

Module name: **GENERAL TOPOLOGY**
Code: **MAT3811**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Real Analysis I (MAT3731) or Real Analysis II (MAT3732)
Module description: Topological spaces: topologies on a set, topological space, open set, closed set, boundary, neighbourhood, neighbourhood filter, accumulation point, derived set, dense set, nowhere dense set, cluster points and limits of a sequence, separation axioms, continuous function, connected subset, connected subsets of the real line, quasicompact space, compact space, theorem of Heine–Borel. Metric spaces: metric on a set, metric space, topology induced by a metric, distance between a point and a subset, Cauchy sequence, completeness.

MAT3831: ALGEBRA

Module name: **ALGEBRA**
Code: **MAT3831**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: Linear Algebra I (MAT3711) or Linear Algebra II (MAT3712)
Module description: Binary operations: properties of binary operations, powers, semigroup, monoid. Groups: definition and examples, subgroup, subgroup generated by a subset, cyclic group, finitely generated group, homomorphism, normal subgroup, factor group, isomorphism, automorphism, homomorphism theorem, conjugacy classes of an element, conjugacy class of a subgroup. Rings: definition and examples, endomorphism ring of an abelian group, characteristic, subring, homomorphism, ideal, isomomorphism, homomorphism theorem, principal ideal domain, polynomial ring.

MAT3851: COMPLEX ANALYSIS I

Module name: **COMPLEX ANALYSIS I**
Code: **MAT3851**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAT3731 or MAT3732
Module description: The field C of the complex numbers: construction of C, absolute value, modulus–argument form, roots of unity, non–orderability of C, complex number plane. Sequences and series: bounded sequence, convergent sequence, theorem of Bolzano–Weierstrass, completeness of C, convergent series, absolutely convergent series, rearrangement of a series, product of two series, Cauchy product.

MAT3822: NORMED VECTOR SPACES

Module name: **NORMED VECTOR SPACES**
Code: **MAT3822**
NQF level: 8
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: (MAT3731 or MAT3732) and (MAT3711 or MAT3712)
Module description: Definition of a normed vector space and examples, closed subspaces, continuity of linear mappings, Banach spaces, Hilbert spaces, the dual of a normed vector space, theorem of Hahn–Banach.

MAT3832: NUMERICAL ANALYSIS II

Module name: **NUMERICAL ANALYSIS II**
Code: **MAT3832**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAT3611 (Calculus I), MAT3612 (Calculus II) and MAT3701 (Numerical Analysis I)
Module description: Approximation: linear and nonlinear approximations, uniform approximation, Legendre and Chebychev polynomials, splines, discrete least-squares and the QR−factorizations, Norms and the analysis of errors. Optimization: first and second order Taylor approximations, the steepest descent method, zeroing the gradient and the conjugate gradient method. Numerical integration: Newton–Cotes formulae, Romberg method, Gaussian quadrature. Ordinary Differential Equations: Euler method, Runge–Kutta method, Numerical Methods for Boundary Value Problems: shooting method and finite difference method.

MAT3852: COMPLEX ANALYSIS II

Module name: **COMPLEX ANALYSIS II**
Code: **MAT3852**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks2 tutorials per week for 14 weeks
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAT3731 or MAT3732
Module description: Differentiation: definition, rules of differentiation, Cauchy–Riemann equations. Holomorphic functions: definition, mean value inequality. Power series: set of convergence, radius of convergence, Abel's Lemma, differentiability of the sum of a power series, exponential function, circular functions, Euler's formula. Integral of a continuous complex–valued function, rules of integration, standard estimate, fundamental theorem, path, operation on paths, rectifiable path, piecewise C1–path, path integral, Goursat's Lemma, star–shaped region, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, analyticity of holomorphic functions, Liouville's theorem, fundamental theorem of algebra, isolated singularities, Laurent series, residue, residue theorem.

MAT3802: CATEGORY THEORY

Module name: **CATEGORY THEORY**
Code: **MAT3802**
NQF level: 8
Contact hours: 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: All mathematics modules up to third year.
Module description: Definition and examples of categories, sections, retractions, monic and epic morphisms, functors, natural transformations, products and coproducts, representable functors, Yoneda's lemma.

MAT3810: RESEARCH PROJECT

Module name: **RESEARCH PROJECT**
Code: **MAT3810**
NQF level: 8
Contact hours: 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks
Credits: 32
Assessment: Continuous assessment **100%** 30% (Assignments)
Examination 70% (oral presentation of written project 20%, written project 80%)
Prerequisite: All modules of mathematics up to third year level.
Module description: The student will be requested to study a specific problem in mathematics. Although, depending on the magnitude of the problem, the student might not be able to solve the problem, he is expected to find out how much is known about that problem. In the process the student will learn some mathematics required to understand and to solve the problem.

H.1.3 MATHEMATICS: COURSE EQUIVALENTS

OLD MODULES	NEW MODULES (STARTED 2008)
MTS3101: Mathematics 1A	MAT3511: Basic Mathematics
MTS3121: Analytic Geometry & Complex Numbers	MAT3531: Analytic Geometry, Complex numbers and Matrices
MTS3132: Foundation Mathematics	MAT3512: Precalculus
MTS3112: Mathematics 1B	*None*
MTS3211: Calculus I	MAT3611: Calculus I
MTS3232: Calculus II	MAT3612: Calculus II
MTS3201: Sets and Numbers	MAT3601: Sets and Numbers
MTS3222: Elementary Linear Algebra	MAT3652: Elementary Linear Algebra
None	MAT3621: Numerical Methods
MTS3321: Linear Algebra I	MAT3711: Linear Algebra I
MTS3312: Linear algebra II	MAT3712: Linear algebra II
MTS3311: Real Analysis I	MAT3731: Real Analysis I
MTS3322: Real Analysis II	MAT3732: Real Analysis II
MTS3381: Ordinary Differential Equations	MAT3642: Ordinary Differential Equations
MTS3362: Numerical Analysis I	MAT3701: Numerical Analysis I
None	MAT3622: Vector Analysis
None	MAT3722: Number Theory
None	MAT3721 Set Theory
MTS3411: Algebra	MAT3831: Algebra
MTS3431: General Topology	MAT3811: General Topology
MTS3432: Complex Analysis	MAT3851: Complex Analysis I
None	MAT3852: Complex Analysis II
MTS3412: Numerical Analysis II	MAT3832: Numerical Analysis II
MTS3422: Partial Differential Equations	MAT3741: Partial Differential Equations
None	MAT3822: Normed Vector Spaces
None	MAT3802: Category Theory
None	MAT3810: Research Project

S. DEPARTMENT OF PHYSICS

S.1. PHYSICS MAJOR & MINORS, CURRICULUM & PREREQUISITES

Four subject combinations are recommended. These are **Physics** and Mathematics, **Physics** and Chemistry, **Physics** and Computer Science, and **Physics** and Geology.

QUALIFICATION: B.Sc. Honours Physics Major and Mathematics_Minor 11BPHM

Students opting for a major in **Physics** (with minor in Mathematics) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16	University entry requirements	None
1	Computer Literacy	CLC3509	8	University entry requirements	None
1	Physics for Physical Sciences I	PHY3511	16	NSSC/IGCSE Physical Science **and** Mathematics (**C-symbols**)	None
	MINOR MODULES				
1	Basic Mathematics	MAT3511	16	Faculty entry requirements	None
1	Analytic Geometry, Matrices & Complex Numbers	MAT3531	16	Faculty entry requirements	None
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8	University Entry Requirements	None
2	Physics for Physical Sciences II	PHY3512	16	NSSC/IGCSE Physical Science **and** Mathematics (**C-symbols**)	None
	MINOR MODULES				
2	Precalculus	MAT3512	16	NSSC/IGCSE Mathematics	None
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Classical Mechanics	PHY3611	16	PHY3511, MAT3511, MAT3512	None
1	Waves & Optics	PHY3631	16	PHY3511, PHY3512	None
	Minor modules				
1	Sets & Numbers	MAT3601	8	Any **two** from following: MAT3511, MAT3512, MAT3531	None
1	Calculus I	MAT3611	16	Either [MAT3511 & MAT3512] **or** [MAT3512 & MAT3531]	None
1	Numerical Methods	MAT3621	8	Any **two** from following: MAT3511, MAT3512, MAT3531	None
1	Object Oriented Programming	CMP3631	16	CMP3511	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	Electromagnetism	PHY3612	16	PHY3512, MAT3511, MAT3512	None
2	Modern Physics I	PHY3602	8	PHY3511, PHY3512, MAT3511, MAT3512	None
	Minor modules				
2	Calculus II	MAT3612	16	Either [MAT3511 & MAT3512] **or** [MAT3512 & MAT3531]	None
2	Ordinary Differential Equations	MAT3642	8	Either [MAT3511 & MAT3512] **or** [MAT3512 & MAT3531]	None
2	Elementary Linear Algebra	MAT3652	16	Any **two** from following: MAT3511, MAT3512, MAT3531	None
2	Data Structures & Algorithms	CMP3612	16	CMP3631	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	None
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3611, MAT3612	None
1	Computational Physics with C++	PHY3721	8	MAT3612	None
	Minor modules				
1	Real Analysis I	MAT3731	16	[MAT3611 **or** MAT3612] **and** MAT3601	None
1	Linear Algebra I	MAT3711	16	MAT3601, MAT3652	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	Theoretical Mechanics	PHY3712	16	PHY3611, MAT3612, MAT3642, MAT3652	None
2	Modern Physics II	PHY3732	16	PHY3602	None
2	Electronics I	PHY3702	8	PHY3512	None
2	Research Methodology	PHY3722	8	PHY3612	None
	Minor modules				
2	**Vector Analysis**	MAT3622	8		None
2	**Number Theory**	MAT3722	8		None
2	Real Analysis II	MAT3732	16	[MAT3611 **or** MAT3612] **and** MAT3601	None
Total Credits			**144**		

A student may replace the full module MAT3732 (Real Analysis II) with the combination of two half modules (MAT3622) Vector Analysis and MAT3722 (Number Theory).

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3712, PHY3732	None
1	Statistical Mechanics	PHY3831	16	PHY3611, PHY3701	None
1	Research Project	PHY3810	16	PHY3711, PHY3712	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Plasma Physics	PHY3821	8	PHY3711	None
1	*Energy Physics	*PHY3861	16	*PHY3701 (This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.)	None
2	Solid State Physics	PHY3812	16	PHY3701, PHY3732	None
2	Research Project	PHY3810	32	PHY3711, PHY3712	None
2	Nuclear Physics	PHY3802	8	PHY3732	None
2	Optics and Laser Physics	PHY3822	8	PHY3631, PHY3711	None
2	Astrophysics	PHY3842	8	PHY3732	None
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	None
2	*Electronics II	*PHY3829	8	PHY3702	None None
Total Credits			**168**		

***(This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.)**

QUALIFICATION: B.Sc. Honours Physics Major and Geology Minor 11BPHG

Students opting for a major in **Physics** (with Geology minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16	NSSC/IGCSE Mathematics	None
1	Computer Literacy	CLC3509	8	University entry requirements	None
1	Physics for Physical Science I	PHY3511	16	NSSC/IGCSE Physical Science **and** Mathematics **(C-symbols)**	None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16	NSSC/IGCSE Mathematics	None
	Geology Minor:				
1	Introduction to Physical Geology and surface processes	GLY3521	8	NSSC/IGCSE Maths **(C-symbol)**	None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8		None
2	Pre-calculus	MAT3512	16	NSSC/IGCSE Mathematics	None
2	Physics for Physical Science II	PHY3512	16	NSSC/IGCSE Physical Science **and** Mathematics (**C-symbols)**	None
2	Introduction to Probability	STS3532	16	NSSC/IGCSE Maths **(C-symbol)**	None
	Geology Minor:				
2	Introduction to Earth systems	GLY3502	8	NSSC/IGCSE Maths **(C-symbol)**	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Classical Mechanics	PHY3611	16	PHY3511; MAT3511; MAT3512	None
1	Waves and Optics	PHY3631	16	PHY3211; PHY3512	None
1	Calculus I	MAT3611	16	[MAT3511 & MAT3512] **or** [MAT3531 & MAT3512]	None
1	Sets and Numbers	MAT3601	8	any two of the following modules: MAT3511; MAT3531; MAT3512	None
1	Numerical Methods	MAT3621	8	Any two of the following modules: MAT3511; MAT3531; MAT3512	None
	Geology Minor:				
1	Introduction to Hydrology	GLY3621	8	GLY3521 & MAT3512	None
1	Earth Resources	GLY3641	8	GLY3521	None
2	Electromagnetism	PHY3612	16	PHY3512; MAT3511; MAT3512	None
2	Modern Physics I	PHY3602	8	PHY3511; PHY3512; MAT3511; MAT3512	None
2	Calculus II	MAT3612	16	[MAT3511 & MAT3512] **or** [MAT3531 & MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two of the following modules: MAT3511; MAT3531; MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 & MAT 3512] **or** [MAT3531 & MAT3512]	None
	Geology Minor:				
2	Geological Mapping and Stratigraphy	GLY3612	16	GLY3521	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Electrodynamics	PHY3711	16	PHY3612; MAT3612	None
1	Thermodynamics and Kinetic Theory	PHY3701	8	PHY3611; MAT3612	None
1	Computational Physics with C++	PHY3721	8	MAT3612	None
1	Real Analysis I	MAT3731	16	MAT3611 or MAT3612 MAT3601	None
	Geology Minor:				
1	Coal, Petroleum and Gas	GLY3701	8	GLY352	None
1	Plate Tectonics	GLY3721	8	GLY3612	None
2	Theoretical Mechanics	PHY3712	16	PHY3611; MAT3612; MAT3642; MAT3652	None
2	Modern Physics II	PHY3732	16	PHY3602	None
2	Electronics I	PHY3702	8	PHY3512	None
2	Research Methodology	PHY3722	8	PHY3722	None
	Geology Minor:				
2	Structural Geology I	*GLY3712*	16	GLY3612 & MAT3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3712; PHY3732	None
1	Statistical Mechanics	PHY3831	16	PHY3611; PHY3701	None
1	Advanced Electrodynamics	PHY3809	8	PH 3711	None
	Electives: Choose Any One Modules (Subject to Dept Approval)				
1	Plasma Physics	PHY3821	8	PHY3711	None
1	*Energy Physics	*PHY3861	8	PHY3701	None
2	Solid State Physics	PHY3812	16	PHY3701; PHY3732	None
2	Research Project	PHY3810	32	PHY3711; PHY3712	None
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	None
	Electives: Choose Any Three Modules (Subject to Dept Approval)				
2	Nuclear Physics	PHY3802	8	PHY3732	None
2	Optics and Laser Physics	PHY3822	8	PHY3631; PHY3711	None
2	Astrophysics	PHY3842	8	PHY3732	None
2	*Electronics II	*PHY3829	8	PHY3702	None
Total Credits			**144**		

***This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.**

QUALIFICATION: B.Sc. Honours Physics Major and Computer Science Minor 11BPHC

Students opting for a major in **Physics** (with Computer Science minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Physics for Physical Sciences I	PHY3511	16	NSSC/IGCSE Physical Science **and** Mathematics (**C-symbols**)	None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry, Matrices & Complex Numbers	MAT3531	16		None
	Minor modules				
1	Programming Fundamentals I	CMP3511	16	Departmental Entry Test	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8		None
2	Physics for Physical Sciences II	PHY3512	16	NSSC/IGCSE Physical Science **and** Mathematics (**C-symbols**)	None
2	Precalculus	MAT3512	16	NSSC/IGCSE Mathematics	None
	Minor modules				
2	Programming Fundamentals II	CMP3512	16	CMP3511 Programming Fundamentals I	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Classical Mechanics	PHY3611	16	PHY3511, MAT3511, MAT3512	None
1	Waves & Optics	PHY3631	16	PHY3511, PHY3512	None
1	Sets & Numbers	MAT3601	8	Any **two** from following: MAT3511, MAT3512, MAT3531	None
1	Calculus I	MAT3611	16	Either [MAT3511 & MAT3512] **or** [MAT3512 & MAT3531]	None
1	Numerical Methods	MAT3621	8	Any **two** from following: MAT3511, MAT3512, MAT3531	None
	Minor modules				
1	Object Oriented Programming	CMP3631	16	CMP3511	
SEMESTER	**MODULE**	**CODE**		**PRE-REQUISITES**	**CO-REQUISITES**
2	Electromagnetism	PHY3612	16	PHY3512, MAT3511, MAT3512	None
2	Modern Physics I	PHY3602	8	PHY3511, PHY3512, MAT3511, MAT3512	None
2	Calculus II	MAT3612	16	Either [MAT3511 & MAT3512] **or** [MAT3512 & MAT3531]	None
2	Ordinary Differential Equations	MAT3642	8	Either [MAT3511 & MAT3512] **or** [MAT3512 & MAT3531]	None
2	Elementary Linear Algebra	MAT3652	16	Any **two** from following: MAT3511, MAT3512, MAT3531	None
	Minor modules				
2	Data Structures & Algorithms	CMP3612	16	CMP3631	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE -REQUISITES	CO-REQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	None
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3611, MAT3612	None
1	Computational Physics with C++	PHY3721	8	MAT3612	None
1	Real Analysis I	MAT3731	16	[MAT3611 **or** MAT3612] **and** MAT3601	None
	Minor modules				
1	Artificial Intelligence	CMP3771	16	CMP3511	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE -REQUISITES**	**CO-REQUISITES**
2	Theoretical Mechanics	PHY3712	16	PHY3611, MAT3612, MAT3642, MAT3652	None
2	Modern Physics II	PHY3732	16	PHY3602	None
2	Electronics I	PHY3702	8	PHY3512	None
2	Research Methodology	PHY3722	8	PHY3612	None
2	**Real Analysis II**	**MAT3732**	16		None
2	**Vector Analysis**	MAT3622	8		None
2	**Number Theory**	MAT3722	8		None
	Minor modules				
2	Operating Systems	CMP3722	8	CMP3532 **or** CMP3612	None
2	Computer Graphics	CMP3762	8	CMP3612	None
Total Credits			**144**		

A student may replace the full module MAT3732 (Real Analysis II) with the combination of two half modules (MAT3622) Vector Analysis and MAT3722 (Number Theory).

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3712, PHY3732	None
1	Statistical Mechanics	PHY3831	16	PHY3611, PHY3701	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Plasma Physics	PHY3821	8	PHY3711	None
1	*Energy Physics	*PHY3861	8	*PHY3701 (This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.)	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	Solid State Physics	PHY3812	16	PHY3701, PHY3732	None
1&2	Research Project	PHY3810	32	PHY3711, PHY3712	None
2	Nuclear Physics	PHY3802	8	PHY3732	None
2	Optics and Laser Physics	PHY3822	8	PHY3631, PHY3711	None
2	Astrophysics	PHY3842	8	PHY3732	None
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	None
2	*Electronics II	*PHY3829	8	PHY3702 (This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.)	None
Total Credits			**144**		

QUALIFICATION: **B.Sc. Honours Physics Major and Chemistry Minor 11BPHH**

Students opting for a major in **Physics** (with Chemistry minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Basic Mathematics	MAT3511	16	NSSC/IGCSE Mathematics	None
1	Computer Literacy	CLC 3509	8		None
1	Physics for Physical Science I	PHY3511	16	NSSC/IGCSE Physical Science **and** Mathematics **(C-symbols)**	None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16	NSSC/IGCSE Mathematics	None
	Chemistry Minor:				
1	Chemistry 1A	CHM3511	16		None
2	English for Academic Purposes	LEA3519	16	Co-requisite: LCE3419	None
2	Contemporary Social Issues	CSI3580	8		None
2	Pre-calculus	MAT3512	16	NSSC/IGCSE Mathematics	None
2	Physics for Physical Science II	PHY3512	16	NSSC/IGCSE Physical Science **and** Mathematics **(C-symbols)**	None
	Chemistry Minor:				
2	Chemistry 1B	CHM3512	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Classical Mechanics	PHY3611	16	PHY 3511; MAT 3511; MAT 3512	None
1	Waves and Optics	PHY3631	16	PHY 3211; PHY 3512	None
1	Calculus I	MAT3611	16	[MAT3511 & MAT 3512] **or** [MAT3531 & MAT3512]	None
1	Sets and Numbers	MAT3601	8	any two of following modules: MAT3511; MAT3531; MAT3512	None
1	Numerical Methods	MAT3621	8	Any two of the following modules: MAT3511; MAT3531; MAT3512	None
	Chemistry Minor:				
1	Physical Chemistry I	CHM3631	16	CHM 3511, CHM3512,, MAT3511 and MAT3512	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	Electromagnetism	PHY3612	8	PHY 3512; MAT 3511; MAT 3512	None
2	Modern Physics I	PHY3602	8	PHY 3511; PHY 3512; MAT 3511; MAT 3512	None
2	Calculus II	MAT3612	16	[MAT3511 & MAT 3512] **or** [MAT3531 & MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two of the following modules: MAT3511; MAT3531; MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 & MAT 3512] **or** [MAT3531 & MAT3512]	None
	Chemistry Minor:				
2	Organic Chemistry I	CHM3612	16	CHM3511 and CHM3512	None
	Total Credits		**152**		

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Electrodynamics	PHY3711	16	PHY3612; MAT3612	None
1	Thermodynamics and Kinetic Theory	PHY3701	8	PHY3611; MAT3612	None
1	Computational Physics with C++	PHY3721	8	MAT3612	None
1	Real Analysis I	MAT3731	16	**1.**MAT3611jj**or** MAT3612 MT3612 **2.** MAT3601	None
	Chemistry *Minor:*				
1	Organic Chemistry II	CHM3711	16	CHM3612	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	Theoretical Mechanics	PHY3712	16	PHY3611; MAT3612; MAT3642; MAT3652	None
2	Modern Physics II	PHY3732	16	PHY3602	None
2	Electronics I	PHY3702	8	PHY3512	None
2	Research Methodology	PHY 3722	8	PHY3722	None
	Chemistry *Minor:*				
2	Physical Chemistry II	CHM3712	16	CHM3631,MAT3611 and MAT3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3712; PHY3732	None
1	Statistical Mechanics	PHY3831	16	PHY3611; PHY3701	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
	Electives: Choose Any One Modules (Subject to Dept Approval)				
1	Plasma Physics	PHY3821	8	PHY3711	None
1	*Energy Physics	*PHY3861	8	PHY3701	None
SEMESTER	**MODULE**	**CODE**	**CREDIT**	**PRE-REQUISITES**	**CO-REQUISITES**
2	Solid State Physics	PHY3812	16	PHY3701; PHY3732	None
1&2	Research Project	PHY3810	32	PHY3711; PHY3712	None
	Electives: Choose Any Four Modules (Subject to Dept Approval)				
2	Nuclear Physics	PHY3802	8	PHY3732	None
2	Optics and Laser Physics	PHY3822	8	PHY3631; PHY3711	None
2	Astrophysics	PHY3842	8	PHY3732	None
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	None
2	*Electronics II	*PHY3829	8	PHY3702	None
Total Credits			**144**		

***This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.**

S.2. PHYSICS SERVICE COURSES

SEMESTER	MODULE	CODE	PRE-/COREQUISITES
I	Physics for Life Sciences I	PHY3501	NSSC Physical Science
II	Physics for Radiographers	PHY3402	-
II	Physics for Life Sciences II	PHY3532	NSSC Physical Science, PHY3501
II	Electricity and Magnetism	SPHE3642	PHY3512, MAT3511, MAT3512
I	Modern Physics for Educators	SPHE3751	PHY3511, PHY3512, MAT3511, MAT3512

S.3. PHYSICS CURRICULUM MODULE DESCRIPTIONS

FIRST YEAR MODULES

PHY3511: PHYSICS FOR PHYSICAL SCIENCES I

Module title: **PHYSICS FOR PHYSICAL SCIENCES I**
Code: **PHY3511**
NQF level: 5
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of class tests, tutorial tests/assignments and practical reports.
Pre-requisites: NSSC Physical Science and Mathematics (C-symbols)
Module description (content): Units, significant figures & scientific notation; vectors: properties, components, unit vectors, products; average & instantaneous speed, velocity and acceleration; one dimensional motion with constant acceleration; falling bodies; two dimensional motion with constant acceleration; projectile motion; uniform circular motion; circular motion; relative velocity and acceleration; Newton's laws; inertial frames; weight; friction; applications; work and kinetic energy; power; conservative and non-conservative forces; gravitational potential energy; conservation theorem; work-energy theorem; linear momentum & impulse; conservation of linear momentum - 2 particle system; collisions; equilibrium; centre of gravity; applications; Newtonian gravitation; gravitational constant; weight & gravitational force; Kepler's laws; pressure; Archimedes' principle; laminar flow; Bernoulli's equation; temperature & temperature scales; thermal expansion; ideal gas; heat; heat capacity; latent heat; heat transfer.

PHY3501: PHYSICS FOR LIFE SCIENCES I

Module title: **PHYSICS FOR LIFE SCIENCES I**
Code: **PHY3501**
NQF level: 5
Contact hours: 28 Lectures and 14 Practical Sessions/Tutorials
Credits: 8
Module assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of class tests, tutorial tests/assignments and practical reports.
Pre-requisites: IGCSE Physical Science
Module description (content): This module is to introduce Life science students to physics concepts and applications that will be useful to them in their undergraduate studies and carrier. The module is not for physical science students as it is not equivalent to PHY3511. The course will cover the following topics:
Units and significant figures; Motion in one dimension, average velocity, acceleration, freely falling bodies; Vectors and scalars, addition and subtraction of vectors in one and two dimensions, multiplication of vectors, component method of vector addition; Projectiles; Force and weight, Newton's laws and applications, free-body diagrams, friction, motion on inclined planes; Uniform circular motion, period and frequency of motion, centripetal force, banking of curves; Newton's law of Universal gravitation, gravity near the Earth's surface, satellites; Kepler's laws; Work done by a constant force, kinetic energy, work-energy theorem, potential energy, conservation of Mechanical energy, power; Momentum, impulse, conservation of energy and momentum in collisions, elastic and inelastic collisions in one dimension.

PHY3512: PHYSICS FOR PHYSICAL SCIENCES II

Module Title: **PHYSICS FOR PHYSICAL SCIENCES II**
Code: **PHY3512**
NQF Level: 5
Contact Hours: 4 Lectures per week for 14 weeks, Practical Time: 14 sessions (42 hours)
Credits: 16
Module assessment: Continuous assessment (**50%**, Minimum 2 tests, 4 assignments and practical reports) Examination (**50%**, 1 x 3- hour paper)
Pre-requisites: IGCSE Physical Science and Mathematics (C-symbols)
Module description (contents): This module introduces the phenomena associated with electrostatics (charges at rest) and magnetostatics (the magnetic effects associated with steady currents). It also introduces and develops the use of the electric and magnetic field vectors and relates them by considering electromagnetic induction at a classical level. The connection between these fields and conventional circuit parameters R, C and L is developed, together with the techniques to deal with elementary transient phenomena. Sound, basic geometrical optics and radioactivity and its detection are also covered. The contents of this course include: Electric charge; insulators and conductors; Electric force and coulomb's law, Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Basic geometrical optics; Radioactivity and its detection; Sound.

PHY3532: PHYSICS FOR LIFE SCIENCES II

Module Title: **PHYSICS FOR LIFE SCIENCES II**
Code: **PHY3532**
NQF Level: 5
Contact Hours: 4 Lectures per week for 14 weeks, Practical Time: 14 sessions (42 hours)
Credits: 16
Module assessment: Continuous assessment (**50%**, Minimum 2 tests, 4 assignments and practical reports) and Examination (**50%**,1 x 3-hour paper)
Pre-requisites: IGCSE Physical Science
Co-requisites: Physics for Life Sciences I
Module description (contents): This module introduces life science students to concepts of physics and their application to real life situations, new topics that were not dealt with in PHY 3501 are introduced (i.e., on electricity, magnetism and radioactivity). The module is not for physical science students as it is not equivalent to PHY3512. The content of this course is good enough to help the life science students throughout their undergraduate work and careers. The following topics will also be covered: Electric charge; insulators and conductors; Electric force and coulomb's law , Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Temperature, gas and thermal expansion; Basic geometrical optics; Radioactivity and its detection.

PHY3402: PHYSICS FOR RADIOGRAPHERS

Module Title: **PHYSICS FOR RADIOGRAPHERS**
Code: **PHY3402**
NQF Level: 4
Contact Hours: 28
Credits: 8
Module assessment: Continuous assessment **50%**, one 2 hour exam **50%**. Continuous assessment is based on class tests, assignments and minimum 7 practical sessions
Pre-requisites: none
Module Description: Electromagnetic radiation; elementary quantum theory ; atomic structure; atomic nucleus; radioactive decay - half-life, law of radioactive decay, activity of a radioactive sample; detectors of radioactive particles; X- and Gamma-rays and their interactions with matter – photo-absorption, Compton scattering, pair-production; homogeneous and heterogeneous beams, x-ray spectra; intensity of x- and gamma-radiation as a function of distance to the source and as a function of the thickness of the absorber; attenuation coefficients; half-value layer; filters; effects of the different absorption modes on the clarity and quality of a radiographic image; dosimetry - absorbed dose; exposure; dosimetric devices; maximum permissible doses.

SECOND YEAR MODULES

PHY3611: CLASSICAL MECHANICS

Module title: **CLASSICAL MECHANICS**
Code: **PHY3611**
NQF level: 6
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous Assessment **(50%)** and one 3-hour Exam Paper (**50%**).Continuous assessment will consist of class tests, assignments and practical reports.
Pre-requisites: PHY3511: Physics for Physical Sciences I, MAT3511: Basic Mathematics and MAT3512: Precalculus
Module description (content): Vectors, vector operations & the calculus of vectors; straight line and general motion particles; polar co-ordinates; rigid bodies: rotating about a fixed axis & planar motion; reference frames; inertial frames and the law of inertia; Laws of: mutual interaction, multiple interactions, universal gravitation; mass distributions; principle of equivalence; rectilinear motion in a force field; constrained rectilinear motion; resisting media; projectiles; circular motion; classical SHM: damped & forced; coupled oscillations and normal modes; energy principle; rectilinear motion; conservative fields; orbits in a central field: orbital motion, path equation, Homann transfer orbits, attractive & repulsive inverse square fields; Rutherford scattering; non-linear oscillations and phase space; phase plane in dynamics; limit cycles; driven non-linear oscillations; degrees of freedom; rigid bodies; linear momentum; rocket motion; collision theory; zero-momentum frame; 2-body problem; scattering; integrable mechanical systems; moment of a force; angular momentum; planar rigid body motion; Rigid body statics;

PHY3631: WAVES AND OPTICS

Module Title: **WAVES AND OPTICS**
Code: **PHY3631**
NQF Level: 6
Contact Hours: 4 Lectures per week for 14 weeks, Practical Time: 14 sessions (42 hours)
Credits: 16
Module Assessment: Continuous [**50%**], Minimum 2 tests and 2 assignments. Exam [**50%**], 1 x 3-hour paper
Pre-requisites: PHY3511: Physics for physical sciences I and PHY3512: Physics for physical sciences II
Module description (contents): This course will provide opportunity to students to understand how waves behave in nature. They will know various phenomenons involving rectilinear propagation of light and wave nature of light.
The course contents are as follows: Mathematical description of wave motion; Fourier analysis of wave motion; Differential equation of wave motion; Elastic waves in solid rod; Waves in string and liquid; Electromagnetic wave and interaction with matter.
Huygen's principle; Malu's theorem; Fermat's principle; Reflection and refraction of plane waves; Wave geometry; Reflection and refraction at spherical surfaces; Lens, prisms, dispersion and chromatic aberrations; Interference, diffraction and polarization.

PHY3612: ELECTROMAGNETISM

Module Title: **ELECTROMAGNETISM**
Code: **PHY3612**
NQF Level: 6
Credits: 16
Contact Time: 56 hours. Practical Time: 14 sessions (42 hours)
Assessment: Continuous [**50%**] Minimum 2 tests and 2 assignments Exam [**50%**] 1 x 3-hour paper
Pre-requisites: PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus,
Model description (contents): This module will provide students how the charges at rest and at motion behave. This course will be calculus based and students will develop the skill to obtain different equations and solve related problems. The contents of the course are: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohms law; Resistance, Joule effect and emf; Magnetic interaction; Lorentz force; Electromagnetic field of a moving charge; Electric flux of a moving charge; Magnetic field and electric current; Magnetostatics; Ampere's law; Time dependent electric field; Maxwell's equations.

PHY3602: MODERN PHYSICS I

Module title: **MODERN PHYSICS I**
Code: **PHY3602**
NQF Level: 6
Contact hours: 28 Lectures and 7 Practical Sessions
Credits: 8
Module assessment: Continuous assessment (class tests, assignments and practical reports) **50%**, two-hour exam **50%**
Pre-requisites:PHY3511: Physics for Physical sciences I, PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus
Module description (content): Particles and waves in classical physics; introduction to special relativity; blackbody radiation; Planck's quantization; Photoelectric effect; Compton effect; atomic structure; spectral lines of Hydrogen; the nuclear atom; Bohr's theory; correspondence principle; Franck-Hertz experiment; Characteristic x-rays; de Broglie wavelengths; particle-wave duality; Heisenberg uncertainty relation; Schrödinger equation for a free particle; the potential Step.

PHE3642: ELECTRICITY AND MAGNETISM

Module title:	**ELECTRICITY AND MAGNETISM**
Code:	**PHE3642**
NQF Level:	**6**
Contact Time:	28 Lectures and 7 Practical sessions (21 hours)
Credits:	8
Module Assessment:	Continuous assessment (class tests, assignments and practical reports) **50%**, two-hour exam **50%**
Pre-requisites:	PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus.

Module description (content): The content of the module will cover the following: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohms law; DC circuits; Magnetic field and flux, Lorentz force; Ampere's law; Electromagnetic induction and ac circuits.

THIRD YEAR MODULES

PHY3711: ELECTRODYNAMICS

Module title: **ELECTRODYNAMICS**
Code: **PHY3711**
NQF Level: 7
Contact hours: 4 lectures per week for 14 weeks, supplemented by 14 practical/tutorial sessions (minimum 3 hour per session) and extra classes
Credits: 16 NQF credits
Module assessment: Continuous assessment (minimum of 4 class tests, 4 assignments and practical reports) **50%**, three hour written exam **50%**
Pre-requisites: PHY3612: Electromagnetism and MAT3612: Calculus II
Module description (content): The following topics are covered in Electrodynamics: Vector analysis, with emphasis on the 'del' operator , integral calculus, curvilinear coordinate systems; The electrostatic field E and its divergence and curl, Gauss's law; The electric potential, Poisson's equation and Laplace's equation; Work and energy in electrostatics, induced charges on conductors and capacitors; Uniqueness theorems and method of images as special techniques for solving some problems; The electric field of a dipole; Electric field in matter – polarization, linear dielectrics, electric displacement; Magnetostatics field B – Lorentz force law, Biot-Savart law, divergence and curl of B, Ampère's law, magnetic vector potential; Magnetic fields in matter – magnetization and the auxiliary field H; Electrodynamics – Ohm's law, Faraday's law, Maxwell's equations in vacuum and in matter, conservation laws, Poynting's theorem.

PHY3701: THERMODYNAMICS AND KINETIC THEORY

Module title: **THERMODYNAMICS AND KINETIC THEORY**
Code: **PHY3701**
NQF Level: 7
Contact hours: 28
Credits: 8
Module assessment: Continuous assessment (**50%** weight), one 2 hour exam (**50%** weight) Continuous assessment is based on class tests, assignments and minimum 7 practical sessions
Pre-requisites: PHY3611: Classical Mechanics and MAT3612: Calculus II
Module Description: Fundamental concepts - zeroth law, temperature, equilibrium; equations of state - ideal gases, real gases; First Law of Thermodynamics - internal energy, heat, reversible quasi-static processes, work, heat capacity, heat engines; Second Law of Thermodynamics - Caratheodory theorem, absolute temperature, entropy, entropy changes, Clapeyron inequality; Carnot theorem, heat engines; thermodynamic potentials and Maxwell relations - internal energy, enthalpy, Helmholz and Gibbs functions; phase transitions; kinetic theory - Maxwell's velocity distribution, Boltzmann distribution; applications.

PHY3721: COMPUTATIONAL PHYSICS WITH C++

Module title: **COMPUTATIONAL PHYSICS WITH C++**
Code: **PHY3721**
NQF level: 7
Contact hours: 28 Lectures and 7 Practical Sessions
Credits: 8
Module assessment: Continuous Assessment (**50%**) and one 3-hour Exam Paper. (**50%**) Continuous assessment will consist of class tests and computational assignments.
Pre-requisites: MAT3612: Calculus II
Module description (content): Introduction to C++; statements; expressions; variables: local and global; constants: literal and symbolic; data-types; basic stream I/O: iostream; operators; program flow: for, while, if, switch, etc.; functions; arrays; pointers & references; stream I/O: iosteam, fstream and strstream; C/C++ standard libraries; OOP basics: C++ classes; constructors & destructors; operator overloading; simple inheritance; Computational Physics techniques: iteration, recursion, dynamic creation of arrays; coding the : Thomas Algorithm, Euler and Runge-Kutta methods, Crank-Nicolson, ADI and LOD finite difference methods; random numbers and pseudo-random number generators; random-walk methods and Monte-Carlo basics applied to diffusion problems; analysis and visualisation of data.

SPHE3751: MODERN PHYSICS FOR EDUCATORS

Module title: **MODERN PHYSICS FOR EDUCATORS**
Code: **PHE3751**
NQF Level: 7
Contact hours: 4 Lectures per week and 1 (3h) Practical Sessions per week
Credits: 16
Module assessment: Continuous assessment (class tests, assignments and practical reports) **50%**, Three-hour exam **50%**
Pre-requisites:PHY3511: Physics for Physical sciences I, PHY3512: Physics for Physical sciences II, PHY3611: Classical Mechanics, MAT3511: Basic Mathematics and MAT3512: Precalculus.
Module description (content) : Blackbody radiation; Planck's quantization; Photoelectric effect; Compton effect; atomic structure; spectral lines of Hydrogen; the nuclear atom; Bohr's theory; correspondence principle; Franck-Hertz experiment; x-rays; de Broglie wavelengths; particle-wave duality; Heisenberg uncertainty relation; Special relativity; departure from Newtonian dynamics; Einstein and Lorentz transformations; Lorentz contraction and time dilation; wave mechanics, Schrödinger equation for a free particle; the potential Step. particles in a box ; particle in a finite potential well; Electrons in metals, Nearly free electron model, energy bands; Semiconductors, band gaps, intrinsic carrier concentration, impurity conductivity, donor and acceptor states.

PHY3712: THEORETICAL MECHANICS

Module title: **THEORETICAL MECHANICS**
Code: **PHY3712**
NQF level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Module assessment: Continuous Assessment (**50%**) and one 3-hour Exam Paper (**50%**). Continuous assessment will consist of class tests, assignments and practical reports.

Pre-requisites:PHY3611: Classical Mechanics, MAT3612 Calculus II: Numerical Methods, MAT3642: Ordinary Differential Equations and MAT3652: Elementary Linear Algebra.

Module description (content): Lagrangian methods; constraints; generalised coordinates; D'Alembert's principle; Lagrange's equations; moving constraints; Lagrangian; generalised momenta; symmetry and conservation principles; The calculus of variations; minimisation problems; Euler-Lagrange equation; variational & Hamilton's principles; Hamilton's equations; phase space; systems of first order ODEs; Legendre transforms; Hamilton's equations; Hamiltonian phase space; Liouville's theorem and recurrence; general theory of small oscillations; Stable equilibrium and small oscillations; general theory of normal modes; existence; normal mode problems; orthogonality; general small oscillations; normal coordinates; Rigid body kinematics; rotation about a fixed axis & general rigid body kinematics; rotating reference frames; single & multi-particle system in a non-inertial frame; Tensor algebra and the inertia tensor: orthogonal transformations; coordinate transformations; tensors & tensor algebra; inertia tensor; symmetric tensor; rigid body dynamics; bodies with axial symmetry; Lagrangian dynamics of rigid bodies; Euler's equation; unsymmetrical rigid bodies.

PHY3732 MODERN PHYSICS II

Module title: **MODERN PHYSICS II**
Code: **PHY3732**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions
Credits: 16
Module assessment: Continuous assessment (class tests, assignments) **50%**, three hours written exam **50%**

Pre-requisites: PHY3602: Modern Physics I

Module description (content): Special relativity; departure from Newtonian dynamics; Einstein and Lorentz transformations; Minkowski diagram; Lorentz contraction and time dilation; relativistic kinematics and relativistic dynamics; four vectors; wave mechanics, particles and potential; particles in a box ; Schrödinger equation; particle in a finite potential well; barrier penetration; spin and Pauli exclusion principle; L-S coupling; Zeeman effect; stimulated emission.

PHY3702: ELECTRONICS I

Module Title: **ELECTRONICS I**
Code: **PHY3702**
NQF Level: 7
Contact hours: 28 hours theory: 2 Lectures/Week
1x3 hours Practical session per week
Credits: 8
Module Assessment: Continuous: **50%**, Examination: **50%** (1 x 2 hour exam)

Pre-requisites: PHY3512: Physics for Physical Sciences II

Module description: This module introduces the basic concepts of analogue electronics and illustrates its applications through examples using such as diodes, BJT's and FET and operational amplifiers. Introduction to semi-conductor theory, intrinsic, p & n type doping, extrinsic semiconductors, conduction processes; Semiconductors diodes and diodes applications, devices transistors, biasing of transistors, load line and the Q-point and its stability; Small signal equivalent circuits and frequency response; p-n-p-n devices, thyristors, diacs and triacs, IC's, logic operation of integrated circuits; Operational amplifier characteristics, Op-amps practical applications, electronic control circuits and feedback concept; Digital circuits, analogy circuits, hybrid (digital plus analogue) circuits; Standard logic functions and gates - AND, OR, NOT, NAND, NOR, XOR, XNOR; truth tables; Boolean theorems; laws and rules; truth table; Boolean algebra and simplification of basic logic networks circuits; Basic combinational logic circuits, flip-flops and their applications.

PHY3722: RESEARCH METHODOLOGY

Module title: **RESEARCH METHODOLOGY**
Code: **PHY3722**
NQF Level: 7
NPSC: Not applicable
Contact hours: 2 lectures per week for 14 weeks
Credits: 8 NQF credits
Module assessment: 100% modulework (assignments & a typed report on literature review on some physic topic)

Pre-requisites: PHY3612: Electromagnetism

Module description (content): Although the actual topics will be adapted to the students research area the following topics will be "generally" covered in this module: various philosophies of Science; Research Proposals (Guidance to writing good project proposals); Basic research skills (e.g. library research, literature review, article analysis etc.); Research Strategy: Planning, Designing and Implementing; Data collection and interpretation methods; Data Reduction, Error analysis (error propagation); Data analysis; Report writing; Communication, skills required to communicate research findings to a broader audience, presentations (oral & written), peer reviewing, refereed journals; Ethics and Legal Issues (e.g. plagiarism); Basics of Quantitative Research (concerned with the tabulation or numeric relevance of various kinds of behaviour (¨measuring¨); Basics of Qualitative Research (concerned with understanding the processes, which underlie various behavioural patterns (Answering the question ¨why? ¨).

FOURTH YEAR MODULES

PHY3811: QUANTUM MECHANICS

Module title: **QUANTUM MECHANICS**
Code: **PHY3811**
NQF Level: 8
Contact hours: 4 lecture periods per week for 14 weeks and 14 Practical/Tutorial sessions
Credits: 16
Module assessment: Continuous assessment (**50%**) and one 3-hour Examination (**50%**). Continuous assessment consists of a minimum of 4 assignments, 2 tests and practical reports.
Pre-requisites: PHY3712: Thoretical Mechanics and PHY3732: Modern Physics II.
Module description: This course is to have students learn the fundamentals of quantum mechanics. Students will be introduced to many new concepts and techniques in the course. The course will cover the following topics: Mathematical primer; Historical review; The postulates of quantum mechanics, state functions and expectation values, time development of state functions; Dirac notation, eigenvalues and eigenfunctions; Hermitian operators and applications; Commutator relations and compatible observables; Time development of expectation values, Ehrenfest's principle and applications, constants of motion, conservation of energy, momentum and parity; The harmonic oscillator, creation and annihilation operators; Angular momentum, commutation properties of the components of angular momentum, simultaneous eigenfunctions; Total angular momentum, commutation relations for the components of total angular momentum, ladder operators; Elements of matrix mechanics, Pauli spin matrices, spin wave functions; The Slater determinant; Time-independent Perturbation theory, degenerate perturbation theory, the Stark effect; Variational method; Scattering.

PHY3831: STATISTICAL MECHANICS

Module title: **STATISTICAL MECHANICS**
Code: **PHY3831**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions
Credits: 16
Module assessment: Continuous assessment (class tests, assignments) **50%**, three hours written exam **50%**
Pre-requisites: PHY3611: Classical Mechanics and PHY3701: Thermodynamics and Kinetic Theory
Module description (content): Macroscopic and microscopic view point of systems, classical and statistical probability; statistics and distribution function, significance of Lagrangian multipliers; the Bose-Einstein statistics, the Fermi-Dirac statistics, the Maxwell-Boltzmann statistics; the Bose-Einstein distribution function, the Fermi-Dirac distribution function, the Maxwell-Boltzmann distribution function; thermodynamic properties of a system; applications of statistics to gases, monatomic ideal gas; the distribution of molecular velocities, Maxwell-Boltzmann speed distribution, ideal gas in gravitational fields; the principle of equipartition of energy, specific heat capacity of a diatomic gas; applications of quantum statistics to other systems; the Einstein theory of the specific heat capacity of a solid; the Debye theory of the specific heat capacity of a solid; Blackbody radiation, paramagnetism, negative temperatures; the electron gas.

PHY3810: RESEARCH PROJECT

Module title: **RESEARCH PROJECT**
Code: **PHY3810**
NQF Level: 8
Contact hours: Frequent meetings (as determined by the Department) with supervisor(s) amounting to a minimum of 112 hours.
Credits: 32
Module assessment: **100%** A written (typed) report of the research in the form of a dissertation or thesis must be submitted by the student. This will be evaluated by qualified staff within the field. During the course of the project, the student will also be expected to present the progress of his work in the form of two seminars (colloquiums).
Pre-requisites: PHY3711: Electrodynamics and PHY3712: Theoretical Mechanics
Module description (content): This one-year module constitutes the research and report writing for an available project within the various fields of physics. The actual content of the module will depend on the topic of research selected by the student, from the available specialized fields within the department. The student will submit a written dissertation (or thesis) of the project upon completion of the research activities.

PHY3809: ADVANCED ELECTRODYNAMICS

Module title: **ADVANCED ELECTRODYNAMICS**
Code: **PHY3809**
NQF Level: 8
Contact hours: 2 lectures per week for 14 weeks, and 7 practical sessions of 3 hours each.
Credits: 8 NQF credits
Module assessment: Continuous assessment (minimum of 2 tests, 2 assignments and practical reports) **50%**, written examination **50%**
Pre-requisites: PHY3711: Electrodynamics
Module description (content): This module is a follow-up on the module Electrodynamics and constitute the following topics: Conservation laws in electrodynamics; Vector and scalar potential formulation; Coulomb and Lorentz transformations; Retarded potentials and Jefimenko's equations; Liènard-Wiechert potentials; Electric and magnetic dipole radiation, power radiated; Linear Antennas; Electrodynamics and relativity – relativistic magnetism, field transformation, field tensor.

PHY3821: PLASMA PHYSICS

Module title: **PLASMA PHYSICS**
Code: **PHY3821**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions
Credits: 8
Module assessment: Continuous Assessment (**50%**) and 1 2-hour Exam Paper **(50%)** Continuous Assessment will consist of class tests, assignments and practical reports.
Pre-requisites: PHY3711: Electrodynamics
Module description (content): Plasmas: definitions, Debye shielding, plasma parameter, criteria; Single-particle motion: uniform, non-uniform and time-varying **E-** and **B**-fields; guiding-centre drifts; adiabatic invariants; plasmas as fluids; fluid equation of motion; fluid drifts perpendicular and parallel to B; plasma approximation; Waves in plasmas: plasma oscillations; electron plasma waves; sound waves; ion waves; comparisons; electrostatic electron and ion oscillations perpendicular to B; lower hybrid frequency; cut-offs and resonances; hydromagnetic waves; magnetosonic waves; CMA diagram; Diffusion in weakly ionised gases and fully ionised plasmas; decay of a plasma by diffusion; steady state solutions; recombination; Collisions in fully ionised plasmas; single-fluid MHD equations; Böhm- & neoclassical diffusion; hydromagnetic equilibrium; diffusion of magnetic field into a plasma; Classification of instabilities; Kinetic theory and its equations: Boltzmann-, Vlasov-, & Fokker-Planck equations.

PHY3861: ENERGY PHYSICS

Module title: **ENERGY PHYSICS**
Code: **PHY3861**
NQF Level: 8
Contact hours: 2 lecture periods per week for 14 weeks and 7 Practical/Tutorial sessions
Credits: 8
Module assessment: Continuous assessment (**50%**) and one 2-hour Examination (**50%**). Continuous assessment consists of a minimum of 3 assignments, 2 tests and practical reports.
Pre-requisites: PHY3701: Thermodynamics and Kinetic Theory
Module description: This course is to make students learn about different energy sources. The topics to be covered in the course are:Solar Energy: Radiation laws, the Sun, attenuation of solar radiation by the atmosphere; direct, diffuse and global radiation; solar radiation horizontal and inclined surfaces, measurement of solar radiation; fundamentals of heat transfer, optics of collectors, reflection and refraction at dielectric interfaces, transmittance and reflectance of glazings, selective absorber coatings, concentrators, solar heating panels and conversion of solar energy to electricity.Wind power: Wind resources, measurement of wind speed, types of turbine, momentum theory and dynamic matching.Hydro power: Types of turbines, the Pelton wheel, calculation of efficiency, shape factor and generation of electricity.Geothermal energy: Thermal and hyperthermal fields, heat flow in the earth, harnessing geothermal energy.Biofuels: biomass production, wood, combustion and stoves, secondary fuels such as charcoals, ethanol, biogas, producer gas and vegetable oils.Ocean Power Systems: Wave energy, tidal power, ocean thermal energy conversion Nuclear Power: Fission and fusion, introduction to reactor physics, nuclear power plants, radioactive waste and radiation protection.

PHY3812: SOLID STATE PHYSICS

Module title: **SOLID STATE PHYSICS**
Code: **PHY3812**
NQF Level: 8
Contact hours: 4 lecture periods per week for 14 weeks and 14 Practical/Tutorial sessions
Credits: 16
Module assessment: Continuous assessment (**50%**) and one 3-hour Examination (**50%**). Continuous assessment consists of a minimum of 4 assignments, 2 tests and practical reports.
Pre-requisites: PHY3701: Thermodynamics and Kinetic Theory and PHY3732: Modern Physics II.
Module description: This course is to have students learn about the properties of solids such as simple crystals, semiconductors and superconductors. The course will cover the following topics: Crystal structure; Fundamental types of lattices, crystal planes; Diffraction of waves by crystals, Bragg law, reciprocal lattice vectors, diffraction conditions, Laue equations, structure factor; Forces between atoms and molecules, forces due to the ionic and covalent bonds, van der Waals forces, dipole-dipole forces; Elastic properties of solids, Young's modulus in terms of inter-atomic force constant, Bulk modulus of an ionic solid, generalized relation between bulk modulus and lattice energy; Lattice dynamics, vibrations of crystals with monatomic basis and with two atoms per primitive basis; Thermal properties, phonon heat capacity, density of states, Einstein model, Debye model, Umklapp processes; Electrons in metals, the free electron Fermi gas, electrical conductivity, Ohm's law, Hall effect; Nearly free electron model, energy bands, Bloch functions, Kronig-penney model; Semiconductors, band gaps, Intrinsic carrier concentration, impurity conductivity, donor and acceptor states; Superconductivity, destruction of superconductivity, Meissner effect, type I and type II superconductors, London equation, the BCS theory.

PHY3802: NUCLEAR PHYSICS

Module title: **NUCLEAR PHYSICS**
Code: **PHY3802**
NQF Level: 8
Contact hours: 2 lecture periods per week for 14 weeks and 7 Practical/Tutorial sessions
Credits: 8

Module assessment: Continuous assessment (**50%**) and one 2-hour Examination **(50%)**. Continuous assessment consists of a minimum of 3assignments, 2 tests and practical reports.

Pre-requisites: PHY3732: Modern Physics II

Module description : Nuclear Structure, nuclear radius, nomenclature; Decay of the nucleus, alpha decay, beta decay, gamma decay, spontaneous fission; Radioactivity, radioactive growth and decay, transient equilibrium, secular equilibrium, radioactive decay series, carbon dating; Chart of Nuclides; Nuclear reactions, elastic scattering, inelastic scattering, reaction of transmutation, radiative capture, photodisintegration, induced fission; Interaction of radiation with matter, photoelectric effect, pair production, Compton scattering, calculation of energy transferred in Compton scattering using relativistic equations; The liquid drop model, variation of binding energy per nucleon with mass number; Weizsacher's semi-empirical mass formula; The shell model; Nuclear energy, nuclear reactors, introductory reactor physics, nuclear power plants; Nuclear instrumentation, radiation detectors, accelerators; Two body systems and nuclear force: properties of nuclear forces, the deuteron, qualitative treatment of n-p and p-p scattering at low energies; Elementary particle.

PHY3822: OPTICS AND LASER PHYSICS

Module Title: **OPTICS AND LASER PHYSICS**
Code: **PHY3822**
NQF Level: 8
Contact Hours: 2 Lectures per week for 14 weeks, Practical Time: 7 sessions (21 hours)
Credits: 8

Module Assessment: Continuous [**50%**], Minimum 1 test and 1 assignment Exam [**50%**], 1 x 2-hour paper

Pre-requisites:PHY3631: Waves and Optics and PHY3711: Electrodynamics

Module Description (contents): This module will give opportunity to students to have mastery on various phenomenon based on the wave nature of light and that light is a transverse wave. The main contents of this course will be: Interference: Division of amplitude, Division of wavefronts, Thin films, Interferometers, Multiple reflections and Refractions; Diffraction: Fresnel's diffraction, Fraunhoffer diffraction, Kirchhoff's diffraction theory, Single slit, Double slit and gratings, and Monochromatic aberrations; Polarization: Plane polarized light, Circularly polarized light, Elliptically polarized light, Double refraction, Quarter wave plate, Babinet compensator, Polarimeters, Specific rotation; Introduction to lasers: Basics of lasers, He-Ne laser, N_2 laser and CO_2 laser; Applications.

PHY3842: ASTROPHYSICS

Module title: **ASTROPHYSICS**
Code: **PHY3842**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions
Credits: 8
Module assessment: Continuous Assessment **(50%)** and 1 2-hour Exam Paper **(50%)**

Continuous Assessment will consist of class tests, assignments and practical reports.

Pre-requisites: PHY3732: Modern Physics II

Module description (content): Origins; parallax, magnitudes & luminosity; stellar spectra; classification and the H-R (Herzsprung-Russel) diagram; stellar equilibrium: equations of state, hydrostatic equilibrium, radiation pressure; virial theorem; stellar timescales; Energy production mechanisms and Radiative Transport: P-P chain, CNO-cycle, triple-□ process, other processes; shell burning; nucleosynthesis; Radiative transport; convective envelopes and cnvective cores; Stellar and planetary formation; Stellar Evolution: mass-luminosity relations; main sequence; stellar clusters; low mass, solar/intermediate mass and high mass stars; Stellar "graveyards": degenerate matter; white dwarfs; type Ia & II supernovae; neutron stars; pulsars and pulsar nebulae; SNRs; Stellar black holes; Pulsars, accreting binaries and AGNs; Practical astronomy: time; calendars; conversions; spherical geometry; coordinates & coordinate transformations; angular separation; rising & setting; compensations: precession, nutation, aberration, atmospheric refraction, barycentric motion;

PHY3862: ADVANCED POTENTIAL FIELDS

Module Title: **ADVANCED POTENTIAL FIELDS**
Code: **PHY3862**
NQF Level: 8
National Professional: None
Contact Hours: 2 Lectures per week for 14 weeks, Practical Time: 7 sessions (21 hours)
Credits: 8
Module assessment: Continuous assessment (**50%**, Minimum 2 tests and 2 or more practical assignments) Examination **(50%**1 x 3-hour paper)
Pre-requisites: PHY3711: Electrodynamics
Module description: The following topics will be covered; Potential field theory: 2D and 3D gravitational and magnetic potentials, equipotential surfaces, forces of attraction–gravityand magnetic, improper integrals, Gauss's (divergence) theorem, Laplace's equation, Poisson's equation, Harmonic functions, Gauss's integral formula, excess mass, transformations of potential fields (derivatives, Poisson's relation, pseudo-gravity, reduction-to-pole, continuation, frequency filtering), ambiguity. Gravity: Measurement of G and gravitational acceleration, units, figure of the earth, rock and mineral densities, reduction to gravity observations, gravity anomalies (Bouguer, Free air, Isostatic), isostasy, interpretation of anomalies (regional/residual separation, forward and inverse modelling). Geomagnetism: Analysis of the earth's internal and external fields, units, basic physics, magnetic properties of rocks and minerals (paramagnetism, diamagnetism, ferromagnetism, anti-ferromagnetism, susceptibility, coercivity, magnetic mineralogy, effect of grain size, curie temperature, induced and remanent magnetization), time variations of the earth's field, palaeomagnetism, magnetometers (Fluxgate, proton precession, optically pumped, Overhauser), interpretation (rules of thumb, forward and inverse modelling, magnetic fields of simple geometry, depth inversion), design of ground and airborne magnetic surveys, image processing (applicable also to gravity data).

PHY3829: ELECTRONICS II

Module Title: **ELECTRONICS II**
Code: **PHY3829**
NQF Level: 8
Contact hours: 2 Lectures/Week for 14 weeks: 7 Practical /Tutorial ssessions (21 hours)
Credits: 8
Module Assessment: Continuous: **50%,** Examination: **50%** (1 x 2 hour exam)
Pre-requisites: PHY3702: Electronics I
Module description: This course is to give students an insight into the analysis and design of electronic circuits. The detailed course content is as follows: Diodes and diode applications, diode testing, zener diodes and applications; Design of single stage CE amplifier, feedback, multistage amplifiers; Special electronic devices, optoelectronic devices, photoconductive cells, photodiodes, phototransistors, solar cells, light emitting diodes (LED), optocouplers, liquid-crystal displays (LCDs); BJT & FET differential pair, Ideal op-amp, inverting op-amp, non-inverting op-amp, frequency response, stability, gain-bandwidth, slew rate, offset currents and voltages, specifications, op-amp applications; Power BJT, power dissipation, power rating, thermal calculations, derating factor, heat sink, amplifiers classes and efficiency (class A, B, C), push-pull amplifier principle, push-pull drivers, harmonic distortion and feedback, distortions in push-pull amplifiers, class AB operation, biasing CAD design of analogue circuits.

S.4. PHYSICS COURSE EQUIVALENTS

OLD COURSE	EQUIVALENT NEW COURSE
PHC3101	*PHY3501 or PHY3511
PHC3112	*PHY3512 or PHY3512
PHC3192	(To be offered again)
PHC2102	PHY3402
PHC3211	PHY3511
PHC3201	PHY3631
PHC3291	(To be offered again)
PHC3212	PHY3512
PHC3202	PHY3602
PHC3292	(To be offered again)
PHC3311	PHY3611
PHC3331	PHY3702
PHC3391	(To be offered again)
PHC3312	PHY3712
PHC3332	PHY3711
PHC3392	(To be offered again)
PHC3411	PHY3811
PHC3431	PHY3831
PHC3491	(To be offered again)
PHC3412	PHY3812
PHC3492	(To be offered again)
PHC3402	PHY3802 and PHY3822
PHC3422	PHY3842 and PHY3862

- For Life Sciences students only.

T. DEPARTMENT OF STATISTICS AND POPULATION STUDIES

QUALIFICATION: B.Sc. (Honours) Statistics Major and Computer Science Minor 11BSTC

Students opting for a major in **Statistics** (with Computer Science minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CREDIT	CODE	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		University entry requirements
1	Descriptive Statistics	16	STS3531		C in Gr. 12 Mathematics
1	Computer Literacy	8	CLC3509		None
1	Basic Mathematics	16	MAT3511		C in Gr. 12 Mathematics
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		C in Gr. 12 Mathematics
	Computer Science Minor				
1	Programming Fundamentals I	16	CMP3511	Departmental Entry Test	
2	English for academic Purpose	16	LEA3519		
2	Contemporary Social Issues	8	CSI3580		
2	Precalculus	16	MAT3512		C in Gr. 12 Mathematics
2	Introduction to Probability	16	STS3532		C in Gr. 12 Mathematics
	Computer Science Minor				
2	Programming Fundamentals II	16	CMP3512	CMP3511Programming Fundamentals I	
Total Credit		**160**			

YEAR 2

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	16	STS3611	STS3532, MAT3512	None
1	Statistical Estimation	16	STS3631	STS3532	None
1	Calculus I	16	MAT3611	None	None
1	Sets and Numbers	8	MAT3601	None	None
	Computer Science Minor				
1	Introduction to Database Systems	16	CMP3611	CMP3511 Programming Fundamentals I	None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Calculus II	16	MAT3612	MAT3512	None
2	Statistical Inference	16	STS3632	STS3532	None
	Computer Science Minor				
2	Advanced Databases	8	CMP3622	CMP3611 Introduction to Database Systems	None
Total Credit		**128**			

YEAR 3

SEMESTER	MODULE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	Linear Models	16	STS3711	STS3611, STS3632	None
1	Distribution Theory	8	STS3721	MAT3611, MAT3632, STS3611	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Research and Survey Methods	8	STS3701	None	None
	Computer Science Minor				
1	Artificial Intelligence	16	CMP3771	CMP3511 Programming Fundamentals I	None
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3636	None
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
	Computer Science Minor				
2	Database Programming	16	CMP3872	CMP3511 Programming Fundamentals I; CMP3622 Advanced Databases	None
Total Credit		**128**			

YEAR 4

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Time Series Analysis	8	STS3801	STS3711	None
1	Statistical Computer Programming	16	STS3811	STS3732	None
1	Research Project	32	STS3810		None
1	Decision Analysis	8	STS3821	STS3711	None
1	Stochastic Processes	16	STS3831	STS3721	None
2	Multivariate Distribution Theory	16	STS3812	STS3721	None
2	Research Project	32	STS3810		None
2	Forecasting Methods and Application	16	STS3852		None
2	Statistical Quality Control	16	STS3832	STS3721	None
Total Credit		**128**			

QUALIFICATION: B.Sc. (Honours) Statistics Major and Population Studies Minor 11BSTP

Students opting for a major in **Statistics** (with Population Studies minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419	University entry requirements	None
1	Descriptive Statistics	16	STS3531	C in Gr. 12 Mathematics	None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511	C in Gr. 12 Mathematics	None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531	C in Gr. 12 Mathematics	None
	Population Studies Minor:				
1	Foundation of Sociology	16	SOG3511		None
2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI3580		None
2	Precalculus	16	MAT3512	C in Gr. 12 Mathematics	None
2	Introduction to Probability	16	STS3532	C in Gr. 12 Mathematics	None
	Population Studies Minor:				
2	Basics of Sociology	16	SOG3532		None
Total Credit		**160**			

YEAR 2

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	16	STS3611	STS3532, MAT3512	None
1	Statistical Estimation	16	STS3631	STS3532	None
1	Calculus I	16	MAT3611	None	None
1	Sets and Numbers	8	MAT3601	None	None
	Population Studies Minor				
1	Official statistics and National Statistical systems	16	POP3631	None	None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Calculus II	16	MAT3612	MAT3512	None
2	Statistical Inference	16	STS3632	STS3532	None
	Population Studies Minor				
2	Social Demography	16	SOG3652		None
Total Credit		**136**			

YEAR 3

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Linear Models	16	STS3711	STS3611, STS3632	None
1	Distribution Theory	8	STS3721	MAT3611, MAT3632, STS3611	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Research and Survey Methods	8	STS3701	None	None
	Population Studies Minor				
1	Demographic Methods I	16	POP3711		None
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3636	None
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
	Population Studies Minor				
2	Demographic Methods II	16	POP3732	POP3711, POP3611	None
Total Credit		**128**			

YEAR 4

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Time Series Analysis	8	STS3801	STS3711	None
1	Statistical Computer Programming	16	STS3811	STS3732	None
1&2	Research Project	32	STS3810		None
1	Decision Analysis	8	STS3821	STS3711	None
1	Stochastic Processes	16	STS3831	STS3721	None
2	Multivariate Distribution Theory	16	STS3812	STS3721	None
2	Forecasting Methods and Application	16	STS3852		None
2	Statistical Quality Control	16	STS3832	STS3721	None
Total Credit		**128**			

QUALIFICATION: B.Sc. (Honours) Statistics Major and Mathematics Minor 11BSTM

Students opting for a major in **Statistics** (with Mathematics minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		None
1	Descriptive Statistics	16	STS3531	C in Gr. 12 Mathematics	None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511	C in Gr. 12 Mathematics	None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531	C in Gr. 12 Mathematics	None
	Mathematics Minor				
1	Programming Fundamentals I	16	CMP3511	Departmental Entry Test	None

2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI 3529		None
2	Precalculus	16	MAT3512	C in Gr. 12 Mathematics	None
2	Introduction to Probability	16	STS3532	C in Gr. 12 Mathematics	None
	Mathematics Minor				
2	Programming Fundamentals II	16	CMP3512	CMP3511Programming Fundamentals I	None
Total Credit		**160**			

YEAR 2

SEMESTER	MODULE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	16	STS3611	STS3532, MAT3512	None
1	Statistical Estimation	16	STS3631	STS3532	None
1	Calculus I	16	MAT3611	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
1	Sets and Numbers	8	MAT3601	any two following modules: MAT3511 MAT3531,MAT3512	None
	Mathematics Minor				
1	Numerical Methods	8	MAT3621		None

2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Calculus II	16	MAT3612	[MAT3511 and MAT 3512] or [MAT3531 and MAT3512]	None
2	Statistical Inference	16	STS3632	STS3532	None
	Mathematics Minor				
2	Elementary Linear Algebra	16	MAT3652	Any two following modules: MAT3511 MAT3531,MAT3512	None
Total Credit		**128**			

YEAR 3

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Linear Models	16	STS3711	STS3611, STS3632	None
1	Distribution Theory	8	STS3721	MAT3611, MAT3632, STS3611	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Research and Survey Methods	8	STS3701	None	None
	Mathematics Minor				
1	Linear Algebra I	16	MAT3711	MAT3601 MAT3652	
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3636	None
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
	Mathematics Minor				
2	Linear Algebra II	16	MAT3712	MAT3601 MAT3652	None
Total Credit		**128**			

YEAR 4

SEMESTER	MODULE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	Time Series Analysis	8	STS3801	STS3711	None
1	Statistical Computer Programming	16	STS3811	STS3732	None
1	Decision Analysis	8	STS3821	STS3711	None
1	Stochastic Processes	16	STS3831	STS3721	None
2	Multivariate Distribution Theory	16	STS3812	STS3721	None
1&2	Research Project	32	STS3810		None
2	Forecasting Methods and Application	16	STS3852		None
2	Statistical Quality Control	16	STS3832	STS3721	None
Total Credit		**128**			

QUALIFICATION: **B.Sc. (Honours) Statistics Major and Economics Minor 11BSTE**

Students opting for a major in **Statistics** (with Economics minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419	University entry requirements	None
1	Descriptive Statistics	16	STS3531	C in Gr. 12 Mathematics	None
1	Computer Literacy	8	CLC3509		None
1	Basic Mathematics	16	MAT3511	C in Gr. 12 Mathematics	None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531	C in Gr. 12 Mathematics	None
	Economics Minor				
1	Basic Microeconomics	16	EMI3571		None
2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI 3529		None
2	Precalculus	16	MAT3512	C in Gr. 12 Mathematics	None
2	Introduction to Probability	16	STS3532	C in Gr. 12 Mathematics	None
	Economics Minor				
2	Basic Macroeconomics	16	EMA3572		None
Total Credit		**160**			

YEAR 2

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	16	STS3611	STS3532, MAT3512	None
1	Statistical Estimation	16	STS3631	STS3532	None
1	Calculus I	16	MAT3611	None	None
1	Sets and Numbers	8	MAT3601	None	None
	Economics Minor				
1	Intermediate Microeconomics I	16	EMI3671		None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Calculus II	16	MAT3612	MAT3512	None
2	Statistical Inference	16	STS3632	STS3532	None
	Economics Minor				
2	Intermediate Microeconomics II	16	EMI3672		None
Total Credit		**136**			

YEAR 3

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Linear Models	16	STS3711	STS3611, STS3632	None
1	Distribution Theory	8	STS3721	MAT3611, MAT3632, STS3611	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Research and Survey Methods	8	STS3701	None	None
	Economics Minor				
1	Econometrics I	16	ETM3771		None
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3636	None
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
	Economics Minor				
2	Econometrics II	16	ETM3772		None
Total Credit		**128**			

YEAR 4

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Time Series Analysis	8	STS3801	STS3711	None
1	Statistical Computer Programming	16	STS3811	STS3732	None
1	Decision Analysis	8	STS3821	STS3711	None
1	Stochastic Processes	16	STS3831	STS3721	None
2	Multivariate Distribution Theory	16	STS3812	STS3721	None
1&2	Research Project	32	STS3810		None
2	Forecasting Methods and Application	16	STS3852		None
2	Statistical Quality Control	16	STS3832	STS3721	None
Total Credit		**128**			

QUALIFICATION: B.Sc. Population Studies (Honours) **Population Studies** Major and Geography Minor **11BPGE**

Students opting for a major in **Population Studies** (with Geography) minor must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CODES	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication and Study Skills	LCE3419	16	C in Gr.12 English	None
1	Computer Literacy	CLC3509	8	None	None
1	Basic Mathematics	MAT3511	16	C in Gr.12 Mathematics	None
1	Fundamentals of Physical Geography	GHE3581	8		None
1	Descriptive statistics	STS3531	16	C in Gr.12 Mathematics	None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16	C in Gr. 12 Mathematics	None
2	English for academic Purpose	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8	None	None
2	Precalculus	MAT3512	16	C in Gr.12 Mathematics	None
2	Fundamentals of Human Geography	GHE3582	8		None
2	Introduction to Probability	STS3532	16	C in Gr.12 Mathematics	None
Total Credit			**136**		

YEAR 2

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Settlement Geography	8	GHE3641		None
1	Climatology	8	GHE3621		None
1	Economic Geography	8	GHE3661		None
1	Geomorphology	8	GHE3601		None
1	Community Health	16	NCH3630	None	None
1	Sets and Numbers	8	MAT3601	any two following modules: MAT3511 MAT3531,MAT3512	None
1	Introduction to Demography	16	POP3611	None	None
1	Official Statistics and National Statistical Systems	16	POP3631	None	None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Social Demography	16	SOG3652		None
2	Community Health	16	NCH3630		None
2	Statistical Inference	16	STS3632	STS3532	None
2	Biogeography	8	GHE3642		None
Total Credit		**144**			

YEAR 3

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Health Service Planning	16	NHM3711		None
1	Fundamentals of Data processing	16	POP3731	STS3612	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Demographic Methods I	16	POP3711		None
1	Geographic Analysis and Techniques	16	HGIS3711		None
2	Health service Management	16	NHM3712		None
2	Geographic Information Systems	16	HGIS3732		None
2	Demographic Methods II	16	POP3732	Co: POP3711,Pre: POP3611	None
2	Regional Geography	16	GHE3752		None
Total Credit		**144**			

YEAR 4

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Epidemiological Methods	16	POP3811		None
1	Environmental Management and Governance	8	GSP3800		None
1	Spatial Planning	8	GSP3820		None
1	Remote Sensing	8	GHR3801		None
2	Population Migration	16	POP3832		None
2	Population Projections	8	POP3822		None
1&2	Research Project	32	POP3810		None
2	Environmental Management and Governance	8	GSP3800		None
2	Spatial Planning	8	GSP3820		None
2	Applied Spatial Analysis	8	GHR3822		None
2	Forecasting Methods and Application	16	STS3852		None
Total Credit		**136**			

QUALIFICATION: B.Sc. Population Studies (Honours) Population Studies Major and Statistics Minor 11BPST

Students opting for a major in **Population Studies** (with Statistics minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419	University entry requirements	None
1	Descriptive Statistics	16	STS3531	C in Gr. 12 Mathematics	None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511	C in Gr. 12 Mathematics	None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531	C in Gr. 12 Mathematics	None
1	Foundation of Sociology	16	SOG3511		None
2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI3580		None
2	Precalculus	16	MAT3512	C in Gr. 12 Mathematics	None
2	Introduction to Probability	16	STS3532	C in Gr. 12 Mathematics	None
2	Basics of Sociology	16	SOG3532		None
Total Credit		**160**			

YEAR 2

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	16	STS3611	STS3532, MAT3512	None
1	Statistical Estimation	16	STS3631	STS3532	None
1	Community Health	16	NCH3630	None	None
1	Introduction to Demography	16	POP3611	None	None
1	Sets and Numbers	8	MAT3601		None
1	Official Statistics and National Statistical Systems	16	POP3631	None	None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Social Demography	16	SOG3652		None
2	Community Health	16	NCH3630		None
2	Statistical Inference	16	STS3632	STS3532	None
Total Credit		**152**			

YEAR 3

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Health Service Planning	16	NHM3711		None
1	Fundamentals of Data processing	16	POP3731	STS3612	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Demographic Methods I	16	POP3711		None
1	Research and Survey Methods	8	STS3701		None
2	Health service Management	16	NHM3712		None
2	Social Research Methods	16	SOG3732		None
2	Demographic Methods II	16	POP3732	Co: POP3711,Pre: POP3611	None
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
Total Credit		**136**			

YEAR 4

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Epidemiological Methods	16	POP3811		None
1	Advanced Sociology of Namibian Society	8	SOS3840		None
1	Sociology of Gender and Sexuality	8	SOS3860		None
1	Sociology of Health	8	SOZ3820		None
2	Population Migration	16	POP3832		None
2	Population Projections	8	POP3822		None
1&2	Research Project	32	POP3810		None
2	Advanced Sociology of Namibian Society	8	SOS3840		None
2	Sociology of Gender and Sexuality	8	SOS3860		None
2	Sociology of Health	8	SOZ3820		None
2	Forecasting Methods and Application	16	STS3852		None
Total Credit		**136**			

QUALIFICATION: B.Sc. Population Studies (Honours) Population Studies Major and Sociology Minor 11BPSO

Students opting for a major in **Population Studies** (with Sociology minor) must take all of the following modules:

YEAR 1

SEMESTER	MODULE	CREDIT	CODES	PRE/CO-REQUISITES	CO-REQUISITES
1	English Communication and Study Skills	16	LCE3419	C in Gr.12 English	None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511	C in Gr.12 Mathematics	None
1	Foundation of Sociology	16	SOG3511		None
1	Descriptive statistics	16	STS3531	C in Gr.12 Mathematics	None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531	C in Gr.12 Mathematics	None
2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI3580	None	None
2	Precalculus	16	MAT3512	C in Gr.12 Mathematics	None
2	Basics of Sociology	16	SOG3532		None
2	Introduction to Probability	16	STS3532	C in Gr.12 Mathematics	None
Total Credit		**160**			

YEAR 2

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Social problems: learning to conceptualize and implement social research	16	SOG3671		None
1	Community Health	16	NCH3630	None	None
1	Sets and Numbers	8	MAT3601	any two following modules: MAT3511 MAT3531,MAT3512	None
1	Introduction to Demography	16	POP3611	None	None
1	Official Statistics and National Statistical Systems	16	POP3631	None	None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Social Demography	16	SOG3652		None
2	Community Health	16	NCH3630		None
2	Statistical Inference	16	STS3632	STS3532	None
2	Classical sociological Theory	16	SOG3612		None
Total Credit		**152**			

YEAR 3

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Health Service Planning	16	NHM3711		None
1	Fundamentals of Data processing	16	POP3731	STS3612	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Demographic Methods I	16	POP3711		None
1	Research and Survey Methods	8	STS3701		None
2	Health service Management	16	NHM3712		None
2	Social Research Methods	16	SOG3732		None
2	Demographic Methods II	16	POP3732	Co:POP3711,Pre: POP3611	None
2	Sociology of Namibian society	16	SOG3772		None
Total Credit		**136**			

YEAR 4

SEMESTER	MODULE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Epidemiological Methods	16	POP3811		None
1	Advanced Sociology of Namibian Society	8	SOS3840		None
1	Sociology of Gender and Sexuality	8	SOS3860		None
1	Sociology of Health	8	SOZ3820		None
2	Population Migration	16	POP3832		None
2	Population Projections	8	POP3822		None
2	Research Project	32	POP3810		None
2	Advanced Sociology of Namibian Society	8	SOS3840		None
2	Sociology of Gender and Sexuality	8	SOS3860		None
2	Sociology of Health	8	SOZ3820		None
2	Forecasting Methods and Application	16	STS3852		None
Total Credit		**136**			

T.1. STATISTICS AND POPULATION STUDIES MODULE DESCRIPTIONS

FIRST YEAR MODULES

STS531 DESCRIPTIVE STATISTICS 4L/ Week

Module Title: **DESCRIPTIVE STATISTICS**
Code: **STS3531**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks, 1 hour tutorial per week/14 weeks
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignment) **40%**; examination **60%** (1x3 hour examination paper).
Pre- requisite: C Grade 12 Mathematics
Module description: Collection and Presentation of Data; Data Sources: primary versus secondary. Data types: categorical versus discrete and continuous numerical data. Types of measurements: nominal, ordinal, interval, ratio scales. Measures of Central Tendency: mean, mode, median. Measures of dispersion: Skewness and Kurtosis, quartiles, standard deviation, variance, range, inter- quartile range. Presentation of data: tabular forms, frequency tables, cross – tabulations (two variable), graphical methods, histograms, pie charts, bar charts, frequency polygons, stem and leaf plots, box and whiskers plot, identifying outliers; ogives.

STS3532 INTRODUCTION TO PROBABILITY 4L/ Week

Module Title: **INTRODUCTION TO PROBABILITY**
Code: **STS3532**
NQF Level: 5
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; examination **60%** (1x3 hour examination paper).
Pre-requisite: C Grade 12 Mathematics
Module description: Counting techniques: permutation and combination, Set theory; relative frequency and probability, properties, Identification of events, Addition rule, mutually exclusive events, conditional probability, calculation of total probability, Bayes Theorem and independence; Random experiments and Sample space; The axioms of probability; random variables, expectations, random vectors, functions of random variables; and probability density in discrete and continuous case; Bernoulli trials, Binomial; Poisson, Geometric; Uniform and Normal; Binomial and Normal tables.

SOG3581: FOUNDATIONS OF SOCIOLOGY

Module Title: **FOUNDATIONS OF SOCIOLOGY**
Code: **SOG3581**
NQF level: 5
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **60%,** consisting of 1 written assignment, minimum of two tests, examination **40%**.
Prerequisites: None
Module description: The course serves as a guide to the foundations of the discipline. While introducing the student to the basic concepts, theories, fields and applications of international sociology, it focuses on Namibian society. Sociology is shown with its different faces – its history of origins, the classical and contemporary interpretations of social action, social structure and social change. As well, the course reflects on the principal social institutions, such as family, state, economy, education and religion. It emphasizes the analysis and the impact of social inequality, such as class, race, and gender.

SOG3582: BASICS OF SOCIOLOGY: PARADIGMS AND METHODS (4L/Week)

Module title: **BASICS OF SOCIOLOGY: PARADIGMS AND METHODS**
Code: **SOG3582**
NQF level: 5
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **60%**, consisting of 1written assignment, minimum of two tests, examination **40%**
Module description: The introductory course emphasizes the link between the theoretical body of sociology and its methodological implementation. It acquaints the student with the basic paradigms of the discipline. At the same time, it familiarizes the student with the basic knowledge and instruments of social research. With this first out of four methodological courses, the new sociology curriculum intends to strengthen the student's research abilities. Such faculties are increasingly on request on the Namibian labour market, reflecting the broad developmental efforts of post-independence Namibian society. Themes covered: sociological sub-disciplines; main paradigms: functionalism, interactionism, marxism; post-structuralism; race, class, gender and ethnicity; social institutions: family, education and media. Social research: sources of knowledge; criteria for judging good research; purpose of social research, research goals; types of social research; key concepts; research ethics; instruments: measurement, sampling; sources of data; the research process; research proposal.

GHE3581: FUNDAMENTALS OF PHYSICAL GEOGRAPHY

Module title: **FUNDAMENTALS OF PHYSICAL GEOGRAPHY**
Code: **GHE3581**
NQF Level: 5
Contact hours: 2 lectures / week for 14 weeks
Credits: 8
Module assessment: Continuous **60%** (minimum 03 assessments, practical work). Examination **40%** (01 x 02 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): Students acquaint themselves with the essential foundations of Physical Geography, including common links to auxiliary disciplines and fields of study. The module presents structures, functions, processes and distributional patterns inherent in phenomena of 'natural' environments, relating to climate, geomorphology, hydrology, soils and vegetation. The content focuses on the interrelationship of geo-ecosystems, including the human factor. With particular reference to Namibian conditions, the module offers fundamental applications of concepts inherent in the functioning of the atmo-, litho-, sphere, hydro- and biosphere.

GHE3582 FUNDAMENTALS OF HUMAN GEOGRAPHY

Module title: **FUNDAMENTALS OF HUMAN GEOGRAPHY**
Code: **GHE3582**
NQF Level: 5
Contact hours: 2 periods / week for 14 weeks
Credits: 8
Module assessment: Continuous **60 %** (minimum 03 assessments, practical work). Examination **40 %** (1 x 2 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): Students acquaint themselves with foundations and concepts of Human Geography, including the subject's links to auxiliary disciplines. The module presents structures, functions, processes and distributional patterns inherent in phenomena of human environments. The content focuses on demographic features of population, rural and urban settlements and economic activities including tourism, land-use and infrastructure, regional diversity / similarity as well as politico-geographical perspectives relating to spatial development. Local to international references cover Namibia, the African continent and selected regions of the world. The module structure implies practical exercises / assignments, aiming at fostering application of knowledge, reflective thinking and practical skills.

SECOND YEAR MODULES

STS3611 PROBABILITY THEORY

Module Title: **PROBABILITY THEORY**
Code: **STS3611**
NQF Level: 6
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; exam **60%** (1x3 hour examination paper).
Pre-requisite: STS3532: Introduction to Probability; MAT3512: Precalculus
Module description: Convergence in probability, Law of large number, Sums and Products, convergence of distribution, Central Limit Theorem, Negative Binomial, Hypergeometric, Exponential ; Normal Approximation to Binomial and Poisson. Bivariate and multivariate probability distributions; Marginal and Conditional probability distributions; Independent random variables; Expected value of a function of random variables; Covariance of two random variables; the expected value and variance of linear functions of random variables. Mathematical expectations.

STS3631 STATISTICAL ESTIMATION

Module Title: **STATISTICAL ESTIMATION**
Code: **STS3631**
NQF Level: 6
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks
Credits: 16
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**; examination **60%** (1x3 hour examination paper).
Pre-requisite: STS3532: Introduction to Probability
Module description: Sample statistics and sampling distributions: Sampling distributions related to the Normal distribution; the Central Limit Theorem. Estimation of parameters: the bias and mean square error of point estimators; Some common unbiased point estimator; Confidence intervals; Properties of point estimators and Methods of Estimation: relative efficiency; consistency; sufficiency; the Rao-Blackwell theorem and Minimum Variance Unbiased Estimators; the Method of Moments; the Method of maximum Likelihood.

STS3612 INTRODUCTION TO STATISTICAL COMPUTING

Module Title: **INTRODUCTION TO STATISTICAL COMPUTING**
Code: **STS3612**
NQF Level: 6
Contact hours: 4 lab- based lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** - 3 hour Laboratory based
Pre-requisite: STS3531: Descriptive Statistics
Module description: Introduction to a statistical package (SPSS, Excel for analysis; Minitab, Statistica); Data acquisition and management; Create datasets, variable definition, variable labels, data entry, data cleaning, selecting cases, split files, Descriptive statistics; Graphical representation-editing, cross tabulation, Import/copying files, tables from excel, SPSS to word, estimation and hypothesis testing using a statistical package.

STS3632 STATISTICAL INFERENCE

Module Title: **STATISTICAL INFERENCE**
Code: **STS3632**
NQF Level: 6
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper)
Pre-requisite: STS3532: Introduction to Probability
Module description: Hypothesis testing: Test of significance for means; proportions and variance: in small and large samples (dependent and independent samples); Chi-square tests; Calculating Type II Error probabilities and finding the sample size for the Z test; relationships between hypothesis testing procedure and confidence intervals; Significance levels and p-values as ways of reporting results of a statistical test; Testing hypotheses concerning variances; power of tests and the Neyman-Pearson Lemma; Likelihood Ratio Tests. Linear models and estimation by least squares: an introduction; measures of association between variables

POP3611 INTRODUCTION TO DEMOGRAPHY

Module Title: **INTRODUCTION TO DEMOGRAPHY**
Code: **POP3611**
NQA level: 6
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module Assessment: Continuous assessment **40%** (at least two tests and two assignments); Examination **60%**
Pre-requisite: none

Module description: Nature and scope of Demography;The development of population theories: Malthusian and Neo-Malthusian theories, Socialist and Marxist views, Neo- Marxian views, demographic transition theory. Population size and composition, Population change; Components of population change; Key concepts in fertility; Sources of data for fertility analysis; Levels, trends and differentials of fertility; Major macro level fertility theories and models; Transition; responses; Micro level perspectives of fertility; economic, psychological; socio-cultural. Recent changes in fertility patterns in developing countries; Fertility policies and programmes. Key concepts in mortality; Sources of data for mortality analysis; Levels and trends of mortality; Differentials and Determinants; Recent changes in mortality levels and patterns in developing countries; Mortality policies and programmes in developing countries; Emerging and re-emerging diseases and their effects on mortality patterns. Population trends (Namibian context); Population Conferences; Impact of HIV.

POP3631 OFFICIAL STATISTICS AND NATIONAL STATISTICAL SYSTEMS

Module Title: **OFFICIAL STATISTICS AND NATIONAL STATISTICAL SYSTEMS**
Code: **POP3631**
NQA level: 6
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (at least two tests and two assignments); Examination **60%**
Pre-requisite: None

Module description: Purpose and scope of official statistics, structure and work of the National Statistical System, Organization, methods and practices of data collection and dissemination. Social Statistics: Define educational levels, purpose, principles and procedures with respect to education statistical data collection, Understand and appreciate data requirement for educational development purposes, Understand and appreciate various rate and ratios required for analysis of statistics on teacher and pupils, Understand definition and scope of health related statistical issues, Understand statistics on medical facilities and uses of hospital records, Comprehend basic ideas of epidemiological issues and indicators of health, Understand and define scope of housing statistics, Understand the importance of statistics related to: definition of a dwelling unit, housing condition, housing needs requirements. Understand labour and employment statistics: Explain how the following statistics are defined and calculated: labour force, economically active and inactive population, employment rates etc.; Understand the importance of statistics on wages, labour income, social security, underemployment etc. System of national accounts (SNA): Explain the importance of compiling national accounts; Explain the uses of national accounts in socio-economic planning. Trade statistics; migration statistics; (understand statistics from various line ministries), civil registration statistics, economic statistics.

SOG3671 SOCIAL PROBLEMS- LEARNING TO CONCEPTUALIZE AND IMPLEMENT

Module title: **SOCIAL PROBLEMS- LEARNING TO CONCEPTUALIZE AND IMPLEMENT**
Code: **SOG3671**
NQF Level: 6
Contanct Hours: 4 Lectures per week/14 weeks
Credits: 16
Module Assessment: Continuous assessment **60%**, consisting of 2 written assignments, 1 presentation and a minimum of 2 tests. Examination **40%**.
Prerequisites: None

Module Description: The course mostly utilizes lecture and tutorial format. It resumes the methodological training introduced into the sociology curriculum with the 1st year module "Basics of Sociology". It familiarizes the student with the use of social problems (class, poverty and inequality, gender inequality, crime and violence, alcohol and substance abuse; HIV/AIDS and other health issues; environmental problems etc.). At lower intermediate level, the course is the second in a sequence of three modules aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation. Practical acquaintance with the field, however, will be reserved for a further course at upper intermediate level, in the following years of studies.

SOG3612 CLASSICAL SOCIOLOGICAL THEORY

Module title: **CLASSICAL SOCIOLOGICAL THEORY**
Code: **SOG3612**
NQF level: 6
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **60%**, consisting of 2 written assignments, minimum 1 test; examination **40%**
Prerequisites: None
Module description: This module will survey and analyse the main classical sociological theories and their philosophical predecessors (1750-1950) that are central to the emergence and development of the sociological tradition. Enlightenment philosophy will be examined (Rousseau, Adam Smith); also German idealism (Hegel and Kant) and British socialist thought and utilitarianism (Owen, Bentham). The influence of these on the emergence of classical sociology will be explained. Extensive analysis of the major founders of sociology such as Comte, Marx, Durkheim and Weber will be at the heart of this module discussing themes such as religion, rise of modern society, class and social division, methods of social analysis. In addition students will study: Spencer, Morgan and Darwinian social evolution; Mauss on social order and social construction of the person; Toennies on community; Simmel and Lukacs on industrial culture; Schuetz and Husserl on the life-world; Mead's symbolic interactionism; Adorno and the Frankfurt School; Parsons and structural functionalism.

SOG3652 SOCIAL DEMOGRAPHY

Module title: **SOCIAL DEMOGRAPHY**
Code: **SOG3652**
NQF Level: 6
Contact hours: 4 lectures per week / 14 weeks
Total credits: 16
Module assessment: Students' work will be assessed through continuous assessment (**60%**) and an examination paper of three hours duration (**40%**). Continuous assessment grades is based on a minimum of two (2) in-class tests and one (1) individual assignment of approximately 5 pages (plus a reference list). Test and assignment dates will be discussed and agreed upon in class. Periodically, class will be divided into groups for the purpose of discussing questions provided by the lecturer. Students are graded upon their participation & presentation in groups. The final examination will evaluate factual information and understanding.
Prerequisites: None
Module description: Demography, the science of human population, deals with changes and differences in the size and structure of human populations. Demography is concerned with virtually everything that influences, or can be influenced by, population size, distribution, processes, structure or characteristics. This module pays particular attention to population concepts, population dynamics (processes), theories, causes and demographic data and their usage. The emphasis of the module is on substantive rather than technical issues.

GHE3611 CLIMATOLOGY

Module title: **CLIMATOLOGY**
Code: **GHE3621**
NQF Level: 6
Contact hours: 2 lectures / week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **60%** (minimum 03 assessments, practical work). Examination **40%** (01 x 03 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): The module investigates components, patterns, processes and functioning relating to phenomena of climatology such as air temperature; atmospheric moisture and precipitation; and on atmospheric pressure, motion and circulation.

GHE3601GEOMORPHOLOGY

Module title: **GEOMORPHOLOGY**
Code: **GHE3601**
NQF Level: 6
Contact hours: 2 lectures / week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **60%** (minimum 03 assessments, practical work). Examination **40%** (01 x 03 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): The content focuses on processes such as weathering and mass wasting; and the creation of structural terrestrial, marine and aeolic landforms. Landscapes from Namibia and southern Africa exemplify the relevant types of landforms.

GHE3641 SETTLEMENT GEOGRAPHY

Module title: **SETTLEMENT GEOGRAPHY**
Code: **GHE3641**
NQF Level: 6
Contact hours: 2 lectures / week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **60%** (minimum 03 assessments, practical work).
Examination **40%** (01 x 03 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): The module builds students' in depth comprehension and skills in fields of Settlement Geography including tourism settlemt(s). The content familiarises students with structures, patterns, processes, trends and developments relating to urbanisation, settlement development and planning. Regional examples collected from Namibia and internationally present varying spatial scales and timeframes. The content demonstrates the application of recognised models and theories in the analysis of settlements. Case studies strengthen the reflective comprehension of distinct phenomena and problem formations emerging from human settlement over time.
Practicals: Closely related to the content taught in Settlement Geography, exercises in Practical 2 aim at nurturing the reflective ability of students through knowledge and application skills.

GHE3661 ECONOMIC GEOGRAPHY

Module title: **ECONOMIC GEOGRAPHY**
Code: **GHE3661**
NQF Level: 6
Contact hours: 2 lectures / week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **60%** (minimum 03 assessments, practical work).
Examination **40%** (01 x 03 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): The content builds students' in depth comprehension and skills in fields of Economic Geography, including economic aspects of tourism. The content familiarises students with structures, patterns, processes, trends and developments relating to economic growth and development. Regional examples collected from Namibia and internationally, present varying spatial scales and timeframes. The content demonstrates the application of recognised models and theories in the analysis of geographic economic development in main sectors of the Namibian economy. Case studies strengthen the reflective comprehension of distinct phenomena and problem formations emerging from economic endeavour.
Practicals: Closely related to the content taught in Climatology, exercises in Practical 2 aim to develop the reflective ability of students through knowledge and application skills.

GHE3642 BIOGEOGRAPHY

Module title: **BIOGEOGRAPHY**
Code: **GHE3642**
NQF Level: 6
Contact hours: 2 lectures / week for 14 weeks
Credits: 8
Module assessment: Continuous assessment **60%** (minimum 03 assessments, practical work). Exam **40%** (1 x 2 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): This module introduces students to the components, functions, processes, patterns and phenomena of Biogeography. Biogeography includes a broad range of topics including evolution, ecology, history of biogeography, biogeographical system, population ecology, distribution of single species and communities, dispersal and extinction, continental biogeography, conservation biogeography and biodiversity.

NCH3630 COMMUNITY HEALTH NURSING SCIENCE I

Module title: **COMMUNITY HEALTH NURSING SCIENCE**
Code: **NCH3630**
NQF Level: 6
Contact hours: 2 periods per week x 28 weeks
Credits: 32
Prerequisite: None
Module assessment: Continuous assessment **50%:** A minimum of four tests/assignments Examination **50%**: 1 x 2 hr paper
Module Description: This module aims and introduce knowledge and appropriate skills to students to improve the quality of health status of the individual, family and community in Namibia. Module Requirement and Expectations Compulsory attendance - 80%: active class participation : make appointments with lecturer for tutorials.

THIRD YEAR MODULES

STS3711 LINEAR MODELS

Module Title: **LINEAR MODELS**
Code: **STS3711**
NQF Level: 7
Contact hours: 4 lectures per week / 14 weeks, 3 hour practical per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%**
Pre-requisite: STS3611: Probability Theory; STS3632 Statistical Inference
Module description: This module is expected to introduce students to linear models, and their application in predicting future occurrences based on models built from available information.Linear models and estimation; fitting a simple linear model; multiple regression; statistical inference of linear models; polynomial and nonlinear regression; residual analysis; multicollinearity and its effects; Diagnostics and remedial measures; model building – stepwise procedure

STS3721 DISTRIBUTION THEORY

Module Title: **DISTRIBUTION THEORY**
Code: **STS 3721**
NQF Level: 7
Contact hours: 2 lectures per week / 14 weeks, 1 hour tutorial per week
Credits: 8
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%**
Pre-requisite: MATS3611 Calculus I; MATS3632 Calculus II; STS3611: Probability Theory
Module description: Moments of Binomial, Poisson, Uniform, Normal, Geometric, Hypergeometric and Exponential distributions; Bivariate Normal, Gamma, Beta, Chi- square, F and t distributions. moment generating functions; Finding the Probability distribution of a Function of random variables: sums, products and quotients: The Method of Distribution functions, the method of Transformation, the Method of moment generating functions; Order Statistics and their functions.

STS3731 SAMPLING TECHNIQUES

Module Title: **SAMPLING TECHNIQUES**
Code: **STS3731**
NQF Level: 7
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1X3 hour)
Pre-requisite: STS3531: Descriptive Statistics
Module description: The overall aim of this module is to equip the student with the planning of data collection process, estimation of required sample size and estimation of population mean, total, proportion as well as variance. Data collection methods: probability and non-probability methods. Response and non-response errors. Estimation of population mean, population total, population proportion and population variance. Sample size allocation in: simple random sampling (with and without replacement), stratified random sampling, systematic sampling, cluster sampling (two-stage), quota sampling, judgemental sampling, and snowball sampling. Calculation of sampling and Non-sampling errors. Confidence interval. Weighting.

STS3701 RESEARCH AND SURVEY METHODS

Module Title: **RESEARCH AND SURVEY METHODS**
Code: **STS 3701**
NQF Level: 7
Contact hours: 2 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks
Credits: 8
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper).
Pre-requisite: None
Module description: Design and use of questionnaires (formulating research problem, research questions, research hypotheses), methods of collecting data, errors in surveys, ethical issues, pilot studies and revising questionnaire, types of research (desk studies, types of surveys): advantages and disadvantages, report writing, dealing with non-response, coding, scientific language, sampling frame.

STS3732 DATA PROCESSING

Module Title: **DATA PROCESSING**
Code: **STS3732**
NQF Level: 7
Contact hours: 4 Lab- based lectures per week / 14 weeks; 3 hour practical per week/14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%**
(1x3 hour Laboratory Based – examination).
Pre-requisite: STS3632 Statistical Inference; STS3612: Introduction to Statistical Computing
Module description: Applications of inferences concerning means and proportions to data – Parametric tests: t- test, Chi-Square Goodness of Fit and Independence tests, ANOVA tests and Post- hoc tests. Testing for Assumptions: Kolmogorov-Smirnov test for Normality, Levene's tests for Equality and Homogeneity of Variance. Nonparametric tests: Binomial test, Sign Test, Wilcoxon Signed- Ranks test, Mann- Whitney test, Kruskal – Wallis test, Friedman's test, Spearman Rank Correlation test. Application of Simple Linear Regression (modelling) to data. Mini project.

STS3712 NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS

Module Title: **NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS**
Code: **STS3712**
NQF Level: 7
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper)
Pre-requisite: STS 3632: Statistical Inference
Module description: Goodness of fit tests; Chi- square test, Kolmogorov – Smirnov test. Nonparametric statistics, nonparametric tests: Median tests, Sign test, Wilcoxon Signed Rank test, Mann – Whitney U test, Kruskal – Wallis H test, Friedma's test, spearman Rank Correlation test. Contingency tables; inferences for two way contingency tables; Chi- square test of Independence. Dummy variables, models for binary response variable: logistic regression and log linear models.

STS3752 EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE

Module Title: **EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE**
Code: **STS3752**
NQF Level: 7
Contact hours: 4 lectures per week / 14 weeks, 3 hour practical per week/14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments)**40%**; Examination **60%** (1x3 hour examination paper).
Pre-requisite: STS3632: Statistical Inference; Co- requisite – STS3711 Linear Models
Module description: Students who do this module will be equipped sufficiently with the basic understanding of how to design researches and analyse the data collected. Experiments; Experimental design; one-way ANOVA; Two-way ANOVA; Latin and Greco-Latin squares design; Multiple comparison; Factorial design. Analysis involving incomplete tables and missing values; estimation of missing values; multiple comparison methods.

POP3711 DEMOGRAPHIC METHODS I

Module title: **DEMOGRAPHIC METHODS I**
Code: **POP3711**
NQA level: 7
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (at least two tests and two assignments); Examination **60%**
Pre-requisite: None
Module description: Sources and types of demographic data. Uses and limitations of demographic data: Population census, sample surveys, vital registration, population register, non-traditional sources (parish register, administrative records), international sources, availability of population data in sub-Saharan Africa. Evaluation of demographic data; Errors in demographic data and techniques of detecting these errors; Data adjustment techniques. Techniques of estimating population size and composition, some basic demographic methods: the balancing equation, rates and ratios: dependency ratio: age and economic dependency ratios and their implications. Population composition: analysis of sex structure, analysis of age structure, age-sex pyramid. Estimation and measurements of basic demographic parameters: fertility, mortality and migration.

POP3732 DEMOGRAPHIC METHODS II

Module title: **DEMOGRAPHIC METHODS II**
Code: **POP3732**
NQA level: 7
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (at least two tests and two assignments); Examination **60%**
Pre-requisite: None
Module description: Direct and indirect methods of estimation of fertility and mortality. Measurements of Mortality: CDR, ASDR, (q-type and m-type mortality rates), the Lexis chart; Standardization (standardized death rate, standardized mortality ratio), Infant mortality rate. Frameworks and models for mortality analysis, Measurements of fertility: CBR, ASFR, standardization applied to fertility rates, TFR, Period and Cohort analysis of fertility; Parity progression, The determinants of fertility, Frameworks and models for fertility analysis, The Life table: the theory of the life table, abridged life tables, multiple decrement life tables, Population growth: fertility and population growth, Geometric and exponential growth, the annual rate of growth and the net reproductive rate.

POP3731 FUNDAMENTALS OF DATA PROCESSING

Module title: **FUNDAMENTALS OF DATA PROCESSING**
Code: **POP3731**
NQA level: 7
Contact hours: 4 lectures per week / 14 weeks; 3 hours practical per week
Credits: 16
Module assessment: Continuous assessment **40%**; Examination **60%**
Pre-requisite: STS 3612 Introduction to Statistical Computing
Module description: Introduce students to parametric and non-parametric tests. Introduction to regression analysis: Linear regression and Correlation; Explaining the relationship between variables using a Scatter plot; Fitting a simple linear regression model and test of hypothesis for regression coefficient; Testing the association between variables using the correlation analysis. Introducing multiple linear regression analysis: model selection techniques: forward, backward, stepwise; categorical variables in regression; Generalized Linear models: parameter estimation, interpretation; Logistic regression analysis: parameter estimation; interpretation of odds ratio; estimated probabilities.

NHM3711 HEALTH SERVICE PLANNING

Module title: **HEALTH SERVICE PLANNING**
Code: **NHM3711**
NQF level: 7
Contact hours: 4 periods per week × 14 weeks
Credits: 16
Module assessment: Continuous assessment **50%** (minimum 2 tests; 1 assignment). Examination **50%** (1 × 2 hour examination paper)
Module description: This module aims at introducing students to aspects of health service planning which will enable them to develop health service programmes for the socio-economic development of communities

NHM3712 HEALTH SERVICE MANAGEMENT

Module title: **HEALTH SERVICE MANAGEMENT**
Code: **NHM3712**
NQF level: 7
Contact hours: 4 periods per week × 14 weeks
Credits: 16
Prerequisites: None
Module assessment: Continuous assessment **50%** (minimum 2 tests; 1 assignment). Examination **50%** (1 × 2 hour examination paper)
Module description: This module aims at introducing students to aspects of health service management that will enable them to plan, implement and evaluate health service programmes, as well as human resources management.

SOG3732 SOCIAL RESEARCH METHODS

Module Title: **SOCIAL RESEARCH METHODS**
Code: **SOG3732**
NQF level: 7
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **60%**, consisting of 2 written assignments, 1 presentation, and a minimum of 2 tests. Examination equals **40%**.
Prerequisites: None
Module description: The course mostly utilizes lecture and tutorial format. It examines the different methodological and theoretical debates that underpin different research traditions. Topics include measurement, reliability and validity, index and scale construction, sampling, methods of data collection, data analysis.At upper intermediate level, the course is the third in a sequence of modules aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation.

SOG3772 SOCIOLOGY OF NAMIBIAN SOCIETY

Module title: **SOCIOLOGY OF NAMIBIAN SOCIETY**
Code: **SOG3772**
NQF level: 7
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **60%**, consisting of 2 assignments and minimum 1 test, examination **40%**
Prerequisites: None
Module description: Modern Namibian society will be examined using a cultural sociology approach. This will distinguish the course from the 4th year double module 'Advanced sociology of Namibian society'. It explores how Namibia and its socio-cultural structures and processes were historically shaped: prior to colonialism; during German and South African colonialism; currently in independent Namibia. Discourse and identity theory (Foucault, Giddens, Hall etc.) will structure the historical and modern analysis in the following topics: ethnic and national identity past and present; colonial and capitalist work culture (with emphasis on contract labour and migration); identity imposition and the state of the San peoples; sexual cultures in Namibia & HIV; the impact of the new mass media; youth cultures; tourism and culture; poverty and deprivation; consumption, class and the new materialism in modern Namibia; religious culture and Namibian society.

GIS3711 GEOGRAPHICAL ANALYSIS AND TECHNIQUES

Module title: **GEOGRAPHICAL ANALYSIS AND TECHNIQUES**
Code: **GIS3711**
NQF Level: 7
Contact hours: 4 periods /week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **60 %** (minimum 02 tests, 03 assignments; practical work). Examination **40 %** (01 x 03 hours paper)
Prerequisite: University, Faculty and Department Rules and Regulations apply
Module description (content): The module offers application-orientated insights into scientific methods and techniques, comprising the formulation of hypotheses and assumptions; collection and compilation of data; research design and management; field survey and reconnaissance; as well as the formulation of findings. Exposure to map production; fundamental geodesy; map and aerial photography analysis and interpretation complements this module, enhancing essential skills in geographic analysis techniques. The content familiarises students with the nature of statistical methods applied to quantitative geographic problem analysis, together with the employ of techniques in collecting and analysing qualitative data. Relevant computer-assisted GIS software supports practical components of the module work, seeking to ensure that all participants share a working knowledge of spreadsheet capabilities.

GIS3732 GEOGRAPHICAL INFORMATION SYSTEMS

Module title: **GEOGRAPHICAL INFORMATION SYSTEMS**
Code: **GIS3732**
NQF Level: 7
Contact hours: 4 periods / week for 14 weeks
Credits: 16
Module assessment: Continuous assessment **60 %** (minimum 02 tests, 03 assignments, practical work). Examination **40 %** (01 x 03 hours paper)
Prerequisites: University, Faculty and Department Rules and Regulations apply
Module description (content): The module introduces students to computer-assisted spatial data processing; development, implementation and functions of geographic information systems; data models and structures; as well as analytical procedures. The content focuses on foundations of mapping, database management and information science, including concepts that are essential to any GIS package. Project work based on the application of GIS to a variety of environmental problem formations complement skill-orientated exercises, offered in the Laboratory for Spatial Analysis, DGHES. Hands-on experiences provide students with advanced skills. They should enable students to master software packages such as ArcView 3.x, ArcInfo 8.x. and IDRISI/ILWIS in order to facilitate the creating of maps of geographical locations and their attributes; the performing of spatial analyses using spatial and attributed data; and the display of results in the form of maps and tables.

GHE3752 REGIONAL GEOGRAPHY

Module title: **REGIONAL GEOGRAPHY**
Code: **GHE3752**
NQF Level: 7
Contact hours: 4 Lectures per week/14 weeks
Credits: 16
Module Assessment : Continuous assessment **60%** : Examination **40%** (1 x 3 hour examination paper)
Prerequisite: None
Content: The module familiarises students with concepts of and approaches to Regional Geography and furthers students' comprehension of the complexity of the system "region", comprising regional structures and functions (politico-economic, socio-cultural). It reflects data in distinct regions, emphasising the interaction of local and external factors, forces and processes over distance and time in Namibia, Africa and other continents. The module incorporates aspects of regional disparity and explains regional development against the background of different paradigms and concepts of regional development.

SOG3732 SOCIAL RESEARCH METHODS

Module Title: **SOCIAL RESEARCH METHODS**
Code: **SOG3732**
NQF level: 7
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **60%**, consisting of 2 written assignments, 1 presentation, and a minimum of 2 tests. Examination equals **40%**.
Prerequisites: None
Module description: The course mostly utilizes lecture and tutorial format. It examines the different methodological and theoretical debates that underpin different research traditions. Topics include measurement, reliability and validity, index and scale construction, sampling, methods of data collection, data analysis.At upper intermediate level, the course is the third in a sequence of modules aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation.

FOURTH YEAR MODULES

STS3852 FORECASTING METHODS AND APPLICATIONS

Module Title: **FORECASTING METHODS AND APPLICATIONS**
Code: **STS3852**
NQF Level: 8
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper).
Co- requisite: STS3801: Time Series Analysis
Module description: The Forecasting Context; Basic Forecasting Tools; Time Series Decomposition; Exponential Smoothing Methods; Simple Regression
Multiple Regression; The Box-Jenkins Methodology for ARIMA Models; Advanced Forecasting Models; Regression with ARIMA Errors; Dynamic Regression Models; Intervention Analysis; State Space Models; Neural Networks; Forecasting the Long-term; Mega trends; Analogies; Scenarios; Judgmental Forecasting and Adjustments; Accuracy of Judgmental Forecasts; Judgmental Biases and their Limitations; Combining Statistical and Judgmental Forecasts; Using Forecasting Methods in Practice; Implementing Forecasting: uses, advantages, and Limitations

STS3812 MULTIVARIATE DISTRIBUTION THEORY

Module Title: **MULTIVARIATE DISTRIBUTION THEORY**
Code: **STS3812**
NQF Level: 8
Contact hours: 4 lectures per week / 14 weeks, 1 hour tutorial per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper)
Pre-requisite: STS3721: Distribution Theory
Module description: The multivariate normal distribution: definition, moment generating function, conditional distributions. Estimation of the mean vector; covariance matrix and distribution of the estimates. The Hotellings T2 Distribution; Chi-square distribution. Inference about the mean vectors: one or two sample cases. Test of independence.

STS3832 STATISTICAL QUALITY CONTROL

Module Title: **STATISTICAL QUALITY CONTROL**
Code: **STS3832**
NQF Level: 8
Contact hours: 4 lectures per week / 14 weeks, 3 hour practical per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper).
Pre-requisite: STS3732: Data Processing
Module description: Sampling inspection: OC curve average run length, process curve and method of choosing sample plans. Mood's theorem. Control charts: simple control charts for variables, properties of charts, economic designs of charts, charts for variables and qualitative data. CUSUM charts: economic design control charts and use of monogram to design interval CHEmes.

STS3811 STATISTICAL COMPUTER PROGRAMMING AND SIMULATION

Module Title: **STATISTICAL COMPUTER PROGRAMMING AND SIMULATION**
Code: **STS3811**
NQF Level: **8**
Contact hours: 4 laboratory- based lectures per week / 14 weeks, 3 hour practical per wek/14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour lab-based examination).
Pre-requisite: STS3732: Data Processing
Module description: Introduction to programming (in C/C++/etc.): Algorithms, simple data types, assignment, conditionals, iteration, functions and procedures, complex data types, array processing. Statistics: Introduction to statistical package programmes; SPSS syntax/MS Excel scripts/etc., generation of random numbers, simulations of probability distributions; normal, binomial, etc. Data analysis; elementary distribution theory: binomial and normal distributions; random sampling; population parameters and sample statistics; estimation, confidence intervals and hypothesis testing based on the binomial and normal distributions.

STS3801 TIME SERIES ANALYSIS

Module Title: **TIME SERIES ANALYSIS**
Code: **STS3801**
NQF Level: 8
Contact hours: 2 Lectures per week/14 weeks, 3 hour practical every other week
Credits: 8
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper)
Pre-requisite: STS 3711: Linear Models
Module description: Components of a Time Series; Smoothing techniques; Trend Analysis; Time Series Analysis: Multiplicative Models and Additive Models; Measuring the Cyclical Effect; Measuring the Seasonal Effect.

STS3821 DECISION ANALYSIS

Module Title: **DECISION ANALYSIS**
Code: **STS3821**
NQF Level: 8
Contact hours: 2 Lectures per week/14 weeks, 1 hour tutorial per week
Credits: 8
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper)
Pre-requisite: STS3711: Linear Models
Module description: Types of decision problems. Decision-making under uncertainty: Basic concepts; ways of expressing outcomes: Payoffs and opportunity losses. Characterizing the uncertainty in decision problems. Solving decision problems using the expected payoff criterion and the expected utility criterion. Classifying decision makers by their utility functions. Revising state of nature probabilities: Bayes' rule. Solving decision problems using posterior probabilities.

STS3831 STOCHASTIC PROCESSES

Module Title: **STOCHASTIC PROCESSES**
Code: **STS3831**
NQF Level: 8
Contact hours: 4 Lectures per week/14 weeks, 1 hour tutorial per week
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper)
Pre-requisite: STS3721: Distribution Theory
Module description: Conditional Probability and conditional expectations; Elements of Stochastic Processes: Definition, Stationarity, finite –dimensional distributions, versions and modification, **Markov Chains in discrete time and Markov Chains in continuous time:** The basic limit theorem of Markov chains and applications, Classification of states, Limiting probabilities, Branching processes; **The Poisson Processes:** Counting process, Compounding stochastic processes. **Queuing processes; Gaussian distribution:** for variables, vectors and processes; **Brownian motion and Branching Processes:** Definition, Gaussian construction, independence of increments Geometric Brownian motion, Brownian Bridge and Ornstein-Uhlenbeck process.

STS3810 RESEARCH PROJECT

Module title: **RESEARCH PROJECT**
Code: **STS3810**
NQA level: 8
Contact hours: 2 contact hours per week
Credits: **32**
Module assessment: 100% Project report 70% Oral presentation 30%
Pre-requisite: At least 75% of third year modules must have been passed
Module description: A piece of work on a selected topic showing the applications of relevant statistical tools and embodied in a project report. The project is expected to run throughout the two semesters. Students are expected to work under the supervision of a member of academic staff. The internal and external examiners will examine the student's project report at the end of the second semester. A student may be expected to do an oral on the project.

POP3811 EPIDEMIOLOGICAL METHODS

Module title: **EPIDEMIOLOGICAL METHODS**
Code: **POP3811**
NQA level: 8
Contact hours: 4 lectures per week / 14 weeks
Credits: 16
Module assessment: Continuous assessment **40%** (at least two tests and two assignments); Examination **60%**
Pre-requisite: None
Module description: Epidemiological study design; Clinical trials; Case control: Incidence and Prevalence; Design and analysis of Cohort (prospective) studies: advantages and disadvantages. Advantages and disadvantages of cross-sectional studies Matched Case control design and analyses using McNemar's test, reasons for matching: advantages and disadvantages relative to unmatched studies; Measures of Association and impact: Relative risk and odds ratio: estimation of Odds ratio from 2 X 2 tables; Bias: Selection and information bias; effects of the various forms of bias on estimation. Confounding and effect modification: its determination and control.

POP3822 POPULATION PROJECTIONS

Module title: **POPULATION PROJECTIONS**
Code: **POP 3822**
NQA level: 8
Contact hours: 2 lectures per week / 14 weeks;
Credits: 8

Module assessment: Continuous assessment **40%** (at least two tests and one assignment); Examination **60%**

Pre-requisite: None

Module description: Introducing population projection; the need for population forecast; Basic methods of population projection and applications; the mathematical method; the limitations of the mathematical method. The component method of population projection: the principles of the method, the details of the method; the use of broader age groups, data requirements. Population projections in the Namibian context.

POP3832 POPULATION MIGRATION

Module title: **POPULATION MIGRATION**
Code: **POP3832**
NQA level: 8
Contact hours: 4 lectures per week / 14 weeks
Credits: 16

Module assessment: Continuous assessment **40%**; Examination **60%**

Pre-requisite: None

Module description: Definition and terminologies in migration studies. International migration. Sources of data, quality of statistics. Evaluation and estimation of international migration. Intercensal component method. Intercensal cohort – component method. Net migration, gross migration (migration turnover) and migration ratios. Migration rates: crude immigration rate. Crude emigration rate. Crude net migration rate. Crude gross migration rate. Contribution of migration to population change. Graphic techniques of analysis (population turnover). Life-time migration. Migration streams and counter streams. Return migration. Longitudinal migration. Bases of migration rates. Sources of migration statistics. Measurement of mobility. National grouth rate method. Residual methods; vital statistics method. Residual method: survival rate method. Place of birth vs place of enumeration statistics. Residence at a fixed past date. Migration selectivity; by sex, by age, by educational level etc. Causes of migration. Ravenstein's push and pull theory. Lee's Intervening Obstacles theory. Other theories. Contribution of migration to urbanization. Other consequences of migration at the place of origin and at the place of destination. Internal migration (Namibian context)

SOS3840 ADVANCED SOCIOLOGY OF NAMIBIAN SOCIETY

Module Title: **ADVANCED SOCIOLOGY OF NAMIBIAN SOCIETY**
Code: **SOS3840**
NQF level: 8
Contact hours: 2 lectures per week / 28 weeks
Credits: 16

Module assessment: Continuous assessment **60%**, consisting of 2 written assignments, 2 oral presentations, and a minimum of two tests; examination **40%**.

Prerequisites: None

Module description: The course is presented in seminar format. It embarks on the analysis of contemporary Namibian society in its varied cultural, economic, political, historical, social, and social structural aspects. The analysis is based on the comprehensive sighting of current research, thus emphasizing the research orientation of the curriculum at final year level. The course applies sociological perspectives learned in the previous course of the curriculum. Main topical areas of the debate: land issue; labour migration; labour market and unemployment; industrial relations; societal development and Vision 2030; globalization and neo-liberalism; youth; poverty; family; gender; sexual cultures; education; media; religion; traditionalism; social structural change and post-colonial class structure; pre-colonial social formations in Namibia; colonialism, apartheid and liberation.

SOS3860 SOCIOLOGY OF GENDER AND SEXUALITY

Module title: **SOCIOLOGY OF GENDER AND SEXUALITY**
Code: **SOS3860**
NQF level: 8
Contact hours: 2 lectures per week / 28 weeks
Total credits: 16

Module assessment: Students' work will be assessed through continuous assessment (**60%**) and one written final examination (**40%**).For continuous assessment; students are required to submit a minimum of two (2) individual essays. Essays should reflect the critical analysis of the gender system based on theoretical knowledge acquired in the course, literature reviewed and analysis of own life experiences. Students are also expected to do three (3) group presentations of published articles. Additionally, students will be required to participate in monthly seminars. Seminars materials will be assigned on a monthly basis and students are expected to have read the materials in advance of the seminar. The final examination will evaluate the student's understanding of the proceedings in class and her / his theoretical ability.

Prerequisites: None

Module description: To detect that the social world is largely organised around the gender divide is perhaps one of the most difficult tasks in our current social and political climate. The fact that no two individuals experience the gender system in exactly the same way does not diminish its powerful impact on most individuals. Gender definitely structures shared experiences among categories of people (race, ethnicity, social class) and also their sexual cultures. That is the reason why gender issues have been mainstreamed into the syllabi of the first three years of the B.A. sociology curriculum. This final year course aims at an in-depth analysis of the way in which femininity and masculinity are constructed by both industrialized and developing societies. Testing sociological theories of structuralist orientation and of agency, the course will exemplify both approaches: the ways in which societies socialize individuals into gendered identities and roles, and the ways in which individuals appropriate and re-construct them. The second main focus of the course will be to put to the test gender theories within the social and cultural distinctiveness of Namibian society. Topics include: sociological schools in the conceptualization of gender, i.e. origins of biological sex, origins and strands of feminism; feminist analysis of Namibian society, women's movement in Namibia; sexuality, i.e. components of sexual identity, sexual identities, sexual cultures, sexual rights, friendship and intimate relationship; reproductive health, i.e. gender and HIV/AIDS, safe motherhood, contraception, abortion; men and masculinity, i.e. concepts of masculinity, construction of masculinities in Namibian society, masculinity and gender-based violence; gender policies and developmental organizations in Namibia, i.e. Women in Development (WID), Women and development (WAD), Gender and Development (GAD), policy approaches of state and civil society; gender and economy, i.e. poverty, empowerment, labour market and work place, gender division of labour, job and salary discrimination; gender and culture, i.e. education, media, cultural traditions and commodified culture; gender and social structure, i.e. gender stratification, gender and class; gender and politics, i.e. women and power, women in politics, the legal framework for the promotion of gender equity.

SOZ3820 SOCIOLOGY OF HEALTH

Module title: **SOCIOLOGY OF HEALTH**
Code: **SOZ3820**
NQF Level: 8
Contact hours: 2 lectures per week / 28 weeks
Credits: 16

Module assessment: Students' work will be assessed through continuous assessment (**60%**) and one written final examination (**40%**). For continuous assessment, students are required to submit a minimum of two (2) individual essays. Essays should reflect the critical analysis of health and illness behaviour.

Prerequisites: None

Module description: This module examines the social contexts of physical and mental health and illness. The module gives prominence to the debates, contrasting models and perspectives that characterise the field of sociology of health. Topics include concepts and theoretical frameworks for sociological understandings of health and illness; the individual (self), society and illness; social organisation and political economy of the health care system; the development of health professions, health professionals and the health work force; stratification, inequality and power in health care delivery organisations; health care and bureaucracy; health care and social change; comparative analyses of alternatives to the dominant paradigms of health, illness and healing; ethical issues in health care and contemporary issues in the study of health and illness.

GSP3800 CONCEPTS OF ENVIRONMENTAL MANAGEMENT

Module title: **CONCEPTS OF ENVIRONMENTAL MANAGEMENT**
Code: **GSP3800**
NQF Level: 8
Contact hours: 2 lectures / week for 28 weeks
Credits: 16

Module assessment: Continuous assessment: **60%** (minimum 04 assessments; research assignments).Examination: **40%** (1 x 3 hours paper)

Prerequisites: Successful completion of all minor modules of the 1st, 2nd and 3rd year level

Module description (content): This module advances students' comprehension of the interdependent functioning whole of the geo-system, biological and human system (geo-ecosystem) through a strong focus on environmental resources and selected environmental problem formations. The content demonstrates the need for conservation and environmental management. Discussions examine academic perspectives and build intellectual skills required in evaluation procedures such as Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). Practice-orientated assignments apply principles of Integrated Environmental Management (IEM). The module fosters the internalisation of environmental obligations, environmental auditing and environmental ethics needed for sustainable societies.

GSP3820 SPATIAL PLANNING

Module title: **SPATIAL PLANNING**
Code: **GSP3820**
NQF Level: 8
Contact hours: 2 lectures / week for 28 weeks
Credits: 16

Module assessment: Continuous assessment: **60%** (minimum 04 assessments; research assignments). Examination: **40%** (1 x 3 hours paper)

Prerequisite: Successful completion of all modules of the 1st, 2nd and 3rd year level

Module description (content): This module explores the relationship between social structures and their distribution within the territory of state. It is assumed that the triangular relationship between society, economy and territory reflected in the consumption of land reflects a rather created than incidental allocation in space. Governments, through their public services, usually regulate the triangular, interdependent and interlocked system of society, economy and land consumption at local, regional and national level. The content exposes students to the application of their geographical knowledge and understanding to structured and scaled processes of territorial planning. The module focuses institutional agents of public sector planning and assesses their contribution to the allocation of local and regional resources such as land in order to organising the sector and spatial development of state territory.

GHR3801 REMOTE SENSING

Module Title: **REMOTE SENSING**
Code: **GHR3801**
NQF Level: 8
Contact Hours: 2 periods / week for 14 weeks
Credits: 8

Module Assessment: Continuous Assessment **60%** (Minimum 02 tests, 07 Lab assignments). Examination **40 %** (1 x 3 hours Examination paper)

Prerequisite: Successful completion of all minor modules of the 1st, 2nd and third year level

Module Description (Content): This module focuses on the physical principles of remote sensing data acquisition and handling, optical and digital image processing techniques, and environmental and scientific applications of remote sensing data from local to global scales. Specifically, the module deals with the following topics: Physical principles of the visible, infrared and microwave section of the electromagnetic spectrum; Remote sensing platforms and sensors; Data acquisition, storage and processing; Image processing and analysis; Remote sensing applications in geosciences. The module is delivered through a mixture of lectures, tutorials and practicals using remotely sensed data, and practice in digital image processing techniques to provide relevant information for addressing geoscientific issues at a range of temporal and spatial scales.

GHR3822 APPLIED SPATIAL ANALYSIS

Module Title: **APPLIED SPATIAL ANALYSIS**
Code: **GHR3822**
NQF Level: 8
Contact Hours: 2 periods / week for 14 weeks
Credits: 8
Module Assessment: Research report **100%**

Prerequisite: HGHR 3811

Module Description (Content): This module allows students to deepen their previously acquired skills in geostatistic (HGIS 3711), GIS (HGIS 3732) and / or Remote Sensing (HGHR 3411) by applying them in a wide range of areas such as environmental impact assessment, water resources management, environmental modelling, and terrain analysis. It is designed to develop students' applied vocational and professional skills relevant to work or research. The content is essentially pegged to the module HGHE 3410: Research Project, in which geostatistic, GIS and or Remote Sensing could be employed as a major tool.

POP3810 RESEARCH PROJECT

Module title: **RESEARCH PROJECT**
Code: **POP3810**
NQA level: 8
Contact hours: 2 contact hours per week
Credits: **32**

Module assessment: 100% Project report 70% Oral presentation 30%

Pre-requisite: At least 75% of third year modules must have been passed

Module description: In this course students will undertake independent and practical research on a selected demographic topic which will be presented as a research report. Students will be expected to apply demographic and statistical methods and follow all phases of research process. The project is expected to run throughout the two semesters. Students are expected to work under the supervision of a member of academic staff. The internal and external examiners will examine the student's project report at the end of the second semester. A student may be expected to do an oral on the project.

T.2. SERVICE MODULES OFFERED

STS3522 INTRODUCTION TO STATISTICS

Module Title: **INTRODUCTION TO STATISTICS**
Code: **STS3522**
NQF Level: 5
Contact Hours: 2 Lectures per Week + 1 hour tutorial per week for 14 weeks
Credits: 8
Module Assessment: Continuous assessment (at least two tests and two assignments) **40%**, Examination **60%** (1x2 Hour examination paper)
Prerequisites: C in NSSC Mathematics
Module Description: Definition: Statistics; descriptive, inferential. Variables: qualitative versus quantitative. Data types: primary versus secondary, categorical versus discrete, continuous. Sources of data. Population versus sample. Types of measurements: nominal, ordinal, interval, ratio scales. Presentation of data: tabular forms and graphical methods: histograms, pie charts, bar charts, frequency polygons, ogives, stem- and- leaf plots, box- and-whiskers plots. Measures of Central Tendency: Σ notation, mean, median, mode, quartiles, percentiles. Measures of Dispersion: variance, standard deviation, range, inters- quartile range, skewness and kurtosis. Identification of outliers. Uses of scientific calculators for statistical manipulation limited to calculation of mean, standard deviation.

STS3621 STATISTICS FOR LIFE SCIENCES I

Module Title: **STATISTICS FOR LIFE SCIENCES I**
Code: **STS3621**
NQF Level: 6
Contact Hours: 2 Lectures per Week + 1 hour tutorial per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%**. (1x2 hour Examination paper).
Prerequisites: STS 3522: Introduction to Statistics
Module Description: Tests of Hypotheses: one sample and two sample cases for dependent and independent samples; Confidence Intervals. Linear regression and correlation. Test of Significance of regression and Correlation coefficients; Predictions using regression models.

STS3622 STATISTICS FOR LIFE SCIENCES II

Module Title: **STATISTICS FOR LIFE SCIENCES II**
Code: **STS3622**
NQF Level: 6
Contact Hours: 2 lectures per week/14 weeks, 1 hour tutorial per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%**. (1x2 hour Examination paper)
Prerequisites: STS3522: Introduction to Statistics
Module Description: Design of Biological Experiments: Choice of factors, sampling units, Analysis of variance: One- and two-way. Selecting samples, replications. Nonparametric tests: Sign test, Mann- Whitney U- test, Wilcoxon- Signed Ranks test, Spearman rank correlation test, Kruskal – Wallis H – test, Friedman's test; Use of Chi- square test for independence and goodness of fit. Tests for normality should be included Shannon-Wiener index?

STS3691 STATISTICS FOR ENGINEERS

Module Title: **STATISTICS FOR ENGINEERS**
Code: **STS3691**
NQF Level: 6
Contact Hours: 4 Lectures per week/14 weeks, 2 hours practical per week for 14 weeks
Credits: 16
Module Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%** (1x3 hour examination paper).
Prerequisite: STS 3522: Introduction to Statistics
Module Description: Probability: Theory (Random experiments, Random events), Conditional Probability, Mathematical Expectation and Decision making; Probability Distributions and Densities: Binomial, Geometric, Hypergeometric, Poisson, Normal, Uniform, Gamma, Beta, Weibull; Sampling Distributions: Mean, Variance; Inferences concerning Mean, Variance and Proportions: Point and Interval Estimations, Parametric tests, Nonparametric tests; Linear Regression and Correlation: Simple and Multiple Linear Regression, Correlation; Analysis of Variance: Completely Randomized and Randomized Block Designs, Multiple Comparisons; Applications to Quality Assurance: Control Charts for Measurements and for Attributes, Tolerance Limits, OC Curves, Acceptance Sampling; Applications to Reliability and Life Testing: Reliability, Failure-time distributions, Exponential Model in Reliability and in Life Testing, Weibull Model in Life Testing.

T.3. STATISTICS AND POPULATION STUDIES MODULE EQUIVALENTS

Old Module		New/Revised Module	
STS3531	Descriptive Statistics	STS3531	Descriptive Statistics
STS3532	Introduction to Probability	STS3532	Introduction to Probability
STS3611	Probability Theory	STS3611	Probability Theory
STS3631	Statistical Estimation	STS3671	Statistical Methods
STS3612	Introduction Statistical Computing	STS3652	Fundamentals of Statistical Computing
STS3632	Statistical Inference	STS3771	Statistical Inference
STS3711	Linear Models	STS3772	Linear Models
STS3721	Distribution Theory	STS3672	Distribution Theory
STS3731	Sampling Techniques	STS3731	Sampling Techniques
STS3732	Data processing	STS3732	Data processing
STS3752	Experimental Design and Analysis of Variance	STS3752	Experimental Design and Analysis of Variance
STS3701	Research and Survey Methods	STS3702	Research and Survey Methods
STS3712	Non-Parametric & Categorical Statistics	STS3741	Non-Parametric & Categorical Statistics
		STS3871	Survival Analysis
STS3821	Decision Analysis	STS3851	Operational research
STS3831	Stochastic Processes	STS3831	Stochastic Processes
STS3811	Statistical Computer Programming	STS3652	Fundamentals of Statistical Computing
STS3812	Multivariate Distribution Theory	STS3812	Multivariate Distribution Theory
STS3810	Research Project	STS3810	Research Project
STS3801	Time Series Analysis	STS3872	Time series and forecasting
STS3852	Forecasting Methods and Application	STS3872	Time series and forecasting
SSTS3832	Statistical Quality Control	STS3832	Statistical Quality Control
None		POP3512	Fundamentals of Population Theory
POP3631	Official Statistics and National Statistical Systems	POP3631	Official Statistics and National Statistical Systems
POP3611	Introduction to Demography	POP3611	Introduction to Demography
POP3811	Epidemiological Methods	POP3612	Epidemiological Methods
		POP3632	Fundamentals of Population and Development
POP3711	Demographic Methods I	POP 3711	Demographic Methods I
POP3731	Fundamentals of Data Processing	POP 3731	Fundamentals of Data Processing
POP3732	Demographic Methods II	POP3732	Demographic Methods II
		POP3831	Monitoring & Evaluation Techniques
POP3832	Population Migration	POP3872	Population Migration and Urbanization
POP3822	Population Projections	POP3852	Population Projections
POP3810	Research Project	POP 3810	Research Project
		POP3892	Indirect Estimation

U. PART-TIME COURSE/DISTANCE EDUCATION

The Faculty of Science does not offer a part-time curriculum. Some courses may be offered in the evening due to the time - table division. Prospective students should contact the Faculty Officer/Head of Department for further information. Part-time studies see Faculty Prospectus: Centre for External studies.

V. GENERAL INFORMATION

All general information as well as the general examination dates and the dates for registration appear in the General Information and Regulations Prospectus.