FACULTY PROSPECTUS 2014

FACULTY

OF

SCIENCE

UNIVERSITY OF NAMIBIA

EDUCATION SERVICE DEVELOPMENT

Inspiring minds & shaping the future

NOTE

Regulations and curricula for 2014 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 2013.

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 course will be offered in 2014 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 courses 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 2014

SEMESTER 1

16 January	University opens
20 January – 07 February	Registration (Last day for Late Registration: 12 February)
28 January	Academic staff resumes office duties
10 February	Lectures commence for SEMESTER 1
14 April	1st SEMESTER Break starts
22 April	Lectures resume after 1st SEMESTER Break
23 May	Lectures end for SEMESTER 1
27 May	Regular Examinations commence (Semester 1 modules)
18 June	Regular Examinations end
23 June – 27 June	Supplementary/Special Examinations
27 June	End of Semester 1
07 July - 11 July	Mid-year recess

SEMESTER 2

21 July	Lectures commence for SEMESTER 2
08 September	2ND SEMESTER Break starts
15 September	Lectures resume after 2ND SEMESTER Break
24 October	Lectures end for SEMESTER 2
28 October	Regular Examinations commence (Semester 2 & Double modules)
18 November	Regular Examinations end
21 November – 27 November	Supplementary/Special Examinations
27 November	End of 2nd Semester
12 December	Academic Year ends & University closes (until 08 January 2015)
08 January 2015	University opens (2015 academic year)
20 January 2015	Academic staff resumes office duties

DUE DATES FOR THE 2014 ACADEMIC YEAR

(i) GENERAL

Last day for appeals (Semester 1 modules – Regular & Supplementary/Special Examinations)…………… (Nov 2013)21 Jan

Last day for application of retention of continuous assessment mark & Promotion Exam.......................... ……………..07 Feb

Last day for application for exemption(s)... ……………..07 Feb

Last day for Late Registration (*Late fee payable*)... ……………..12 Feb

Last day for approval of exemption(s) .... ……………..12 Feb

Last day for approval of retention of continuous assessment mark & Promotion Exam.............................. ……………..12 Feb

Last day for approval of module(s) & qualification changes .... ……………..12 Feb

Last day to change Examination Centres at Regional Centres (Semester 1 modules - Regular & Supplementary / Examinations) .... ……………28 March

Last day for appeals (Semester 1 modules – Regular & Supplementary/Special Examinations) .... ……………….25 July

Last day to submit outstanding documentation .... ……………….22 Aug

Last day to change Examination Centres at Regional Centres (Semester 2 &Double modules – Regular & Supplementary / Examinations) .... ……………….29 Aug

Last day to cancel enrolment .... ……………….26 Sept

Last day for submission of Theses and Dissertations for examination .... ……………….14 Nov

Last day for appeals (Sem 2 & Double modules – Regular & Suppl/Special Examinations)………………...(Nov 2014)23 Jan 2015

(ii) **CANCELLATIONS**

Semester 1 modules

Last day to cancel Semester 1 modules .... 09 May

Semester 2 modules

Last day to cancel Semester 2 modules .... 26 Sept

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

Last day to cancel Double modules... 26 Sept

(iii) **FINANCE**

Semester 1 modules

Last day to cancel with 100 % credit .... 07 March

Last day to cancel with 50 % credit .... 17 April

Semester 2 modules

Last day to cancel with 100 % credit .... 08 August

Last day to cancel with 50 % credit .... 29 August

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

Last day to cancel with 100 % credit .... 07 March

Last day to cancel with 50 % credit .... 06 June

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)

☎(+264 61) 206 3793🖷(+264 61) 206 3791💻**fgideon@unam.na**✉ Private Bag 13301, Windhoek, Namibia

DEPUTY DEAN

Dr M A Kandawa-Schulz: M.Sc. Dr.rer.nat. (University of Rostock)

☎(+264 61) 206 3635🖷(+264 61) 206 3791💻**kschulz@unam.na**✉ Private Bag 13301, Windhoek, Namibia

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)

☎(+264 61) 206 3561🖷(+264 61) 206 3791💻**ejulies@unam.na** @unam.na✉ Private Bag 13301, Windhoek, Namibia

HEAD OF DEPARTMENT: DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

Dr V Uahengo: B.Sc. (UNAM), MSc & PhD (Wuhan University, China)

☎(+264 61) 206 3465🖷(+264 61) 206 3791💻vuahengo@unam.na✉ Private Bag 13301, Windhoek, Namibia

HEAD OF DEPARTMENT: DEPARTMENT OF COMPUTER SCIENCE

Dr. T K Mufeti: B.Sc. (UNAM), B.Sc.Hons (Rhodes), M.Sc. (Rhodes), PhD (Rhodes University)

☎(+264 61) 206 3348🖷(+264 61) 206 3791💻**tndakunda@unam.na**✉ Private Bag 13301, Windhoek, Namibia

HEAD OF DEPARTMENT: DEPARTMENT OF GEOLOGY

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

☎(+264 61) 2063833🖷(+264 61) 206 3791💻**awanke@unam.na**✉ Private Bag 13301, Windhoek, Namibia

HEAD OF DEPARTMENT: DEPARTMENT OF MATHEMATICS

Dr M M Mugochi BSc Hons (UZ), MPhil (UZ), PhD (UNISA)

☎(+264 61) 206 3524🖷(+264 61) 206 3791💻**mmugochi@unam.na**✉ Private Bag 13301, Windhoek, Namibia

HEAD OF DEPARTMENT: DEPARTMENT OF PHYSICS

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

☎(+264 61) 206 3673🖷(+264 61) 206 3791💻**rsteenkamp@unam.na**✉ Private Bag 13301, Windhoek, Namibia

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)

☎(+264 61) 206 3495🖷(+264 61) 206 3226💻**ineema@unam.na**✉ Private Bag 13301, Windhoek, Namibia

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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)

Assistant Faculty Officer
Ms J.Chaka, HED (Sec) UNAM,B ED HONOURS(North West University)

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

Telephone: +264-61-206-3741
Fax: +264-61-206 3791
E-mail: mmatengu@unam.na

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:

Mrs Tekla Tjipura:
The Faculty Officer
Faculty of Science
University of Namibia
Private Bag 13301
WINDHOEK

Telephone: +264-61-206-3047
Fax: +264-61-206 3791
E-mail: ttjipura@unam.na

A.2. ACADEMIC DEPARTMENTS

DEPARTMENT OF BIOLOGICAL SCIENCES

☏(+264 61) 206 3561🖷(+264 61) 206 3791💻ejulies@unam.na @unam.na✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr. E.M. Julies
Professor:	Vacant
Associate Professor:	Prof. I. Mapaure: B.Sc.Hons, MSc, Ph.D (Univ of Zimbabwe)
Associate Professor:	Prof. P.M. Chimwamurombe: B.Sc.Biochemistry, MSc. Biotechnology (UZ), PhD Plant Biotechnology (Univ of Pretoria, RSA)
Senior Lecturer:	Dr. E. Kwembeya: BSc Hons.(Univ of Zimbabwe), MSc (UCT), PhD (University of Oslo, Norway)
Senior Lecturer:	Dr. J.K.E .Mfune: B.Sc.B.Sc.Hons (Malawi) M.Sc, Ph.D (Aberdn, U.K)
Senior Lecturer:	Dr. K.C. Chinsembu: B.Sc. (Zambia), MSc. (Brussels), PhD (UNAM)
Senior 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:	Dr. R. Böck: M.Sc. (Saarbrücken/Germany), Ph.D (Oklahoma State/USA)
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:	Ms. I. Mujoro: National Certificate in Forestry, Ogongo Agricultural College, BSc Natural Resources and Environmental Management, The Australian National University, MSc Biodiversity Management and Research (UNAM and Humboldt Universität zü Berlin)
Lecturer:	Ms. P. Kadhila-Muandingi B.Sc.(China), MSc Applied biology (UNAM)
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)
Technologist:	Mr. A. Hijarunguru: B.Sc. (US)
Technologist:	Ms. M. A Morkel: B.Sc. (Humboldt, USA), MSc. Biodiversity Management and Research (UNAM and Humboldt Universität zü Berlin)
Technologist:	Ms. M.J Johnson: B.Sc. (UNAM)
Technologist:	Mr. A.T Mbangu: B. Sc. (UNAM)
Lab. Ass. Technician:	Ms. R. Shimwooshili: Med and Lab Science Cert (Limbe Cameroon)

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

☎(+264 61) 206 3465🖷(+264 61) 206 3791💻vuahengo@unam.na✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr V Uahengo: B.Sc. (UNAM), MSc & PhD (Wuhan University, China)
Professor:	Prof E M R Kiremire: B.Sc. (Hons), University of East Africa, Makerere University College) Ph.D. (Univ. of New Brunswick, Canada)
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) **(Deputy Dean)**
Senior Lecturer:	Dr Stefan Louw PhD (Stellenbosch University)
Senior 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:	Dr P Kapewangolo: B.Sc, MSc (UNAM), PhD (University of Pretoria)
Lecturer	Dr L S Daniel: BSc (UNAM), MSc (UNAM), PhD (Kogakuin University, Tokyo, Japan)
Lecture	Dr KM Kalili: Bsc (UNAM), Hons, MSc, PhD (Stellenbosch University)
Lecturer, PhD student:	Ms C V Raidron: B.Sc., HED (UNAM), MPhil (Murdoch University, Australia)
Lecturer, PhD student:	Mr G Uiseb: B.Sc.(UNAM), MSc (Loughborough University, UK), Staff Development Fellow
Lecturer:	Ms T Thomas B.Sc. (UNAM), MSc. (UCT)
Lecturer:	Mr N Gariseb B.Sc, MSc (UNAM)
Lecturer:	Ms C Maritz B.Sc (US),
Asst. Lecturer: MSc Student	Mrs M van Wyk B. Sc (UWC); HED (UNAM); B.ED POSTGRAD (UNAM)
Tutor, MSc Student:	Mr P N Hishimone B. Sc Honours (UNAM)
Researcher:	Ms N Pogori B.Sc. (UNAM), MSc, (Jiangnan University, China)
Senior Technologist:	Mr W Song: B. Eng. (South East University. China)
Snr. Technologist, PhD student:	Ms C Mukakalisa: B.Sc. (UNAM), MSc (UNAM)
Technologist:	Ms M Nyambe (UNAM), Hons (Stellenbosch), MSc (UNAM)
Technologist, MSc Student:	Mr T Ndunge: B.Sc. (UNAM)
Technologist, MSc Student:	Mr P Kapolo: B.Sc. (UNAM)
Technologist, MSc Student:	Ms N Shifeta B.Sc. (UNAM)
Technologist, MSc Student:	Ms H Hakwenye B.Sc. (UNAM)
Technologist:	Mr P Shaanika: B.Sc. (UNAM)
Technologist:	Ms S Namwandi B.Sc (Stellenbosh)
Technologist:	Ms C Tjiurutue B.Sc. (UNAM) Staff Development Fellow
Assistant Technician:	Vacant

DEPARTMENT OF COMPUTER SCIENCE

☎(+264 61) 206 3348🖷(+264 61) 206 3791💻**tndakunda@unam.na**✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr. T K Mufeti
Professor:	Vacant
Associate Professor:	Prof. 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:	Dr. T K Mufeti: B.Sc. (UNAM), B.Sc.Hons (Rhodes),M.Sc. (Rhodes), PhD (Rhodes)
Lecturer:	Dr. V Hashiyana: PhD. (St. Petersburg, Russia)
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)
Assistant Lecturer:	Ms. S R Mwatilifange: B.Sc.(Strayer, USA)
Assistant Lecturer:	Ms. M N Ntinda: B.Sc. (UNAM),M.Sc. (Rhodes)
Assistant Lecturer:	Ms. T K Mukaya: B.Sc. (UNAM)
Assistant Lecturer:	Mr . F D Bernardo: B.Sc.Eng (HIMEE – Varna, Bulgaria)
Assistant Lecturer:	Mrs. A K Nkandi-Hauwanga: B.Sc.(Boumerdes, Algeria)
Assistant Lecturer:	Mr. A M Ghania: BSc (Benha, Egypt), PGDC (Azahr, Egypt), M.Sc. (Azahr, Egypt)
Assistant Lecturer:	Mr. G B Kooper: B.Sc. (UNAM)
Assistant Lecturer:	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

☎(+264 61) 206 3465🖷(+264 61) 206 3791💻**vuahengo@unam.na**✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr. A.w. Wanke: Diplom/MSc (Göttingen), PhD (Würzburg)
Associate Professor:	Dr. A.F. Kamona: B.Sc. (UNZA). MMinSc (UNZA), PhD (Aachen, Germany)
Associate Lecturer:	Dr. B.S. Mapani: B.Sc. (UNZA), MSc. (Nancy), PhD (Melbourne)
Senior Lecturer:	Vacant
Senior Lecturer:	Vacant
Lecturer:	Vacant
Lecturer:	Dr. A.W. Wanke: Diplom/MSc (Göttingen), PhD (Würzburg)
Lecturer:	Dr. H.U. Wanke: Diplom/MSc (Kiel), PhD (Würzburg)
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)
Tutor:	Mr J.T. Shilunga: B.Sc. (UNAM)
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

☎(+264 61) 206 3524🖷(+264 61) 206 3791💻**mmugochi@unam.na**✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr M M Mugochi BSc Hons, MPhil (UZ), PhD (UNISA)
Professor:	Prof K Pandey BSc Hons, MSc, PhD (Univ of Delhi, India)
Associate Professor:	Prof J-B Gatsinzi BSc, MSc (NUR, Butare), PhD (UCL, Louvain-La-Neuve)
Adjunct Professor:	Prof O D Makinde BSc Hons (Univ of Ife), MSc (Obafemi Awolowo), PhD (Univ of Bristol)
Senior Lecturer:	Dr F. Gideon BSc (UNAM), BSc Hons, MSc (Rhodes Univ), Ph.D (Univ of North West) **(Dean)**
Senior Lecturer:	Dr M M Mugochi BSc Hons, MPhil (UZ), PhD (UNISA)
Lecturer:	Mr T Sikwambi BSc (UNAM), MSc (China)
Lecturer:	Mr S M Nuugulu BSc (UNAM), MSc (Univ of Free State)
Lecturer:	Mr D Elago BSc, PGDE (UNAM), BSc Hons, MSc (UWC)
Lecturer	Mr Vijayakumar Kandaswamy, BSc, MSc (BDU, India), PGDCS (Central Univ, Hyderabad, India)
Lecturer:	Mr R G Batogna BSc Hons, MSc (Univ of Free State)
Lecturer:	Mr D Iiyambo BSc, PGDE (UNAM), BSc Hons, MSc (UCT)
Lecturer:	Mr P Haihambo BSc (UNAM), BSc Hons, MSc (UCT)
Staff Development Fellow:	Mr A Shikongo BSc (UNAM), BSc Hons (University of Pretoria), MSc (UWC)
Tutor:	Ms B B Nambahu BSc (UNAM)
Tutor:	Ms C Amakutsi BSc, PGDE (UNAM)
Tutor:	Mr L Komomungondo BSc (UNAM)
Tutor:	Mr W Nangolo BSc (UNAM)
Tutor:	Mr S S Amukugo Licentiate in Education – Maths (Cuba)
Tutor:	Mr J Lichela BSc (UNAM)
Tutor:	Mr V Shaumbwa BSc (UNAM)
Tutor:	Ms P Nangolo BSc (UNAM)

DEPARTMENT OF PHYSICS

☎(+264 61) 206 3673🖷(+264 61) 206 3791💻**rsteenkamp@unam.na**✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr R Steenkamp
Professor:	Prof J A Oyedele: B.Sc.(Ife, Nigeria), M.Sc., PhD (Mc Master, Canada)
Associate Professor:	Prof S Singh M.Sc., PhD. (India)
Senior Lecturer:	Dr R Steenkamp: B.Sc., M.Sc., Ph.D. (NWU, RSA)
Lecturer:	Dr M. Backes, FRAS: Dr.rer.nat.Dipl.-Phys. (Dortmund, Germany)
Lecturer:	Mr. ID Davids: B.Sc., PGDE (UNAM), BSc.-Hons, M.Sc (NWU, RSA)
Lecturer:	Ms P Dobreva: M.Sc. (Sofia, Bulgaria)
Lecturer:	Mr W Liu: B.Sc. (Harbin), M.Sc. (Heilongjiang, China)
Lecturer:	Mr S Shimboyo: B.Sc. (UNAM), M.Sc. (UNAM)
Staff Development Fellow:	*vacant*
Tutor:	Mr. N Shafudah: 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), B.Ed. (UNAM)

DEPARTMENT OF STATISTICS AND POPULATION STUDIES

☏(+264 61) 206 3495🖷(+264 61) 206 3226💻**ineema@unam.na**✉ Private Bag 13301, Windhoek, Namibia

Head of Department:	Dr I Neema
Professor:	Vacant
Professor:	Prof. L Kazembe: B.Soc. Sc (UNIMA), MSc. (Eastern Mediteranean, Cyprus), PhD (UKZN)
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)
Senior 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 L. Pazvakawambwa: MSc. Stats (UZ), Bsc. Hons (Stats) (UZ)
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)
Assisstant Lecturer:	Mr. K. Mutorwa: BSc. (UNAM), Hons. (Wits)
Lecturer:	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 PROGRAMMESAND POSTGRADUATE PROGRAMMES

IN 2014 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
11MMBL	Master of Science Microbiology (implementation in 2015)	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
11DPSC	Doctor of Philosophy (by Thesis only)	3 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		
11MSGL	Master of Science Applied Geology (next intake 2014)	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.1.5 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
11MSNU	Master of Science in Nuclear Science	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
	PhD in Applied Statistics	3 years full-time
	PhD in Population Studies	3 years full-time

C. GENERAL REGULATION PERTAINING TO UNDERGRADUATE STUDIES

C.1. DURATION OF STUDY

All Bachelor of Scienceand Bachelor of Science (Honours) degreeprogrammes cannot be completed in less than four (4) years. AllB.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 whose programmes require Analytic Geometry **(MAT3501)** and Matrices & Complex Numbers **(MAT3521)** must register for these modules. 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 Special Modecourses are Basic Mathematics A**(MAT3580)**, Analytic Geometry A **(MAT3520)**,Matrices& Complex Numbers A **(MAT3540)** and PrecalculusA **(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 Inf**or**mation and Regulations Prospectus**.

C.5. PRACTICALS

Attendance of practical classes is compulsory.

C.6. CURRICULUM

C.6.1. COURSES, 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 course** 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 -course**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-course counts as one half **(0.5)** of a course.
A **double-course**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-course is equivalent to two **(2)**courses.
Refer to the relevant programmes (to determine the credits and contact hours of any particular course).

C.6.2. CURRICULUM COMPILATION

To be awarded a Bachelor's degree by the Faculty, a student must pass all the courses prescribed for each curriculum combination.In the BSc degree programme a student may compile his/her curriculum by selecting the coursesoffered 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 four (4) courses (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-courses:

SEMESTER	**CODE**	**COURSE NAME**
1&2	CSI3580	Contemporary Social Issues (half-course)
1	CLC3509	Computer Literacy (half-course)

Students furthermore add the equivalent of **two (2)**full English courses 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/Exempted**for **LCE3419 English Communication and Study Skills** and will register for the coursebelow: (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**	**COURSE NAME**
1	LCE3419	English Communication and Study Skills
2	LEA3519	English for Academic Purposes

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

SEMESTER	**CODE**	**COURSE NAME**
1 & 2	LEG 2410	English for General Communication (double-course)

LEG2410 ENGLISH FOR GENERAL COMMUNICATION

Course title: **English for General Communication**
Code: **LEG2410**
NQF Level: 4
Contact hours: 4 hours per week for 28 weeks
Credits: 32
Course 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
Course description: This course attempts to assist students to improve their general English proficiency. The main goal of this course 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.

C.6.3.2. UNIVERSITY CORE CURRICULUM COURSE DESCRIPTIONS

LCE3419 ENGLISH COMMUNICATION & STUDY SKILLS

Course title: **ENGLISH COMMUNICATION AND STUDY SKILLS**
Code: **LCE3419**
NQF Level: 4
Contact hours: 4 hours per week for 14 weeks
Credits: 16
Course Assessment: Continuous assessment (60%):two tests (reading and writing), two reading assignments, one oral presentationExamination (40%): one three hour examination paper
Pre-requisites: None
Course description: This course 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 course also focuses on study skills that students need throughout their academic careers and beyond. The course 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 course therefore, focuses on the skills that students need throughout their academic careers and beyond.

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Course title: **ENGLISH FOR ACADEMIC PURPOSES**
Code: **LEA3519**
NQF level: 5
Contact hours: 4 periods per week for 14 weeks
Credits: 16
Course assessment: Continuous assessment (**60%**): 2 tests (reading and writing), 1 academic written essay,1oral presentation Examination **(40%)** : One three hour examination paper
Prerequisites: None
Course description: This course 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

Course title: **COMPUTER LITERACY**
Code: **CLC3509**
NQF level: 4
Contact hours: 1 lecture theory and 1 lecture practical per week for 14 weeks
Credits: 8
Course assessment: Continuous Assessment **100%**: 2 Practical Tests 50%, 2 Theory Tests 50%
Prerequisites: None
Course description: The aim of this course 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 course 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

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%)**
PrerequisiteNone
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 CORECURRICULUM

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

MAT3511 Basic Mathematics
MAT3512 Precalculus

C.6.3.4. FACULTY CORE CURRICULUM COURSE DESCRIPTIONS

MAT3511 BASIC MATHEMATICS

Course name: **BASIC MATHEMATICS**
Code: **MAT3511**
NQF level: 5
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: None
Course 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

Course name: **PRECALCULUS**
Code: **MAT3512**
NQF level: 5
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: None
Course 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 seetheGeneral 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 courses to be re-admitted

C.9. PASS REQUIREMENTS

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

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

C.10. MAXIMUM NUMBER OF COURSES PER YEAR

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

C.11. COURSE RESTRICTIONS

A student will be admitted to a specific course only if he/she meets the requirements for the particular course. The **UNAM C**OR**E**, as well as **MAT3511Basic Mathematics** and **MAT3512 Precalculus**are compulsory for all **first year** B.Sc. (Honours) degree students, including all students from other Faculties who wish to major in a subject offered by the Faculty of Science.

NEW CURRICULUM

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 Honours**course 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 courses, 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 courses required as indicated below:

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

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 courses 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 courses of the following year. In all cases **prerequisites** for courses have to be passed before a student can proceed to register for courses that require prerequisites.

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

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

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

D.1.3.2 MAXIMUM NUMBER OF COURSES PER YEAR

No student will be allowed to register for more than **12**courses 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 course**Field Ecology (SEBF3800)**. Failure to take part in these field-based courses will disqualify students from sitting the theory examination of the specific **co-requisite**courses.

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	COURSE	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	COURSE	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
	Social Geography	GHE3682	None	8	None
Total Credits				**136**	

YEAR 3

SEMESTER	COURSE	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	GIS3711	16	None
	Hydrogeology I **and**	GLY3702	GLY3621& GLY3642	8	None
	Introduction to Petrology	GLY3662	GLY3521	8	None
Total Credits				**160**	

YEAR 4

SEMESTER	COURSE	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: COURSE EQUIVALENTS

YEAR	SEMESTER	COURSE TITLE (new courses)	COURSE 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 course
		EBL3711Aquatic Ecology	EBL3711 Fresh Water & Marine Ecology
		EBL3721Biosystematics I - Students who fail the old course, 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 course
	2	EBL3712 Ecosystem Ecology	EBL3712 Ecosystem Ecology
		EBL3752 Ecophysiology	MBL3751 Plant Physiology MBL3752 Comparative Animal Physiology
		EBL3722 Biosystematics II - Students who fail the old course, 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	COURSE	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	COURSE	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	BLG3511&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	COURSE	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	COURSE	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 COURSE EQUIVALENTS

YEAR	SEMESTER	COURSE TITLE (new courses)	COURSE 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 Course
	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 course
		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 course 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 COURSE DESCRIPTIONS

FIRST YEAR COURSES

BLG3511 INTRODUCTION TO BIOLOGY

Course 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
Course 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)
Course description: This is an introductory biology Course 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

Course 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
Course 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)
Course description: This course is designed to give students a detailed understanding of the diversity of life. This course 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 course 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 course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.The course 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 COURSES

BLG3611 ANIMAL FORM AND FUNCTION

Course 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
Course assessment: Continuous assessment **40%**: Practicals (at least 10 graded practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites: **BLG3512** Diversity of Life
Course 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

Course 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
Course 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
Course 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

Course 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
Course 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
Course 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.

BLG3622BIOMETRICS II

Course title: **BIOMETRICS II**
Code: **BLG3622**
NQA level: 6
Contact hours: 2 lecture periods/week for 14 weeks and one 3-hour practical session every second week for 14 weeks.
Credits: 8
Course 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: **STS3522** Introduction to Statistics
Course 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.

BLG3612 PLANT FORM AND FUNCTION

Course 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
Course 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
Course 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

Course 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
Course 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
Course 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

Course 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
Course 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.
Course 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: 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 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, Achaea, eukaryotic microorganisms, viruses, bacteriophages, prions, diversity of microbial metabolism, microbial ecology, and methods in microbial ecology.

BLG3621BIOMETRICS I

Course 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
Course 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:STS3522 Introduction to Statistics
Course 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.

MBL3611 MICROBIAL SYSTEMATICS

Course 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
Course 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
Course 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 COURSES

BLG3701MICROBIAL ECOLOGY

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

EBL3711 AQUATIC ECOLOGY

Course title: **FRESHWATER AND MARINE ECOLOGY**
Code: **EBL3711**
NQF Level: 7
Contact hours: 4 lectures / week for 14 weeks
Credits: 16
Course 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
Course 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).

MBL3771 PHYSIOLOGY

Course 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
Course assessment: Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites: **None**
Course 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).

EBL3741ECOLOGICAL SYSTEMS AND CLIMATE CHANGE

Course 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
Course 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
Course description: This course 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 course 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 course 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.

EBL3712 ECOSYSTEM ECOLOGY

Course title: **ECOSYSTEM ECOLOGY**
Code: **EBL3712**
NQF level: 7
Contact hours: 4 hours lectures / week, 3 hrs practicals per week
Credits: 16
Course 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
Course 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

Course 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

Course 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 course.

Prerequisites:BLG3621 Biometrics I, **BLG3622** Biometrics II

Course 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

Course 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
Course 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

Course 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.

EBL3721 BIOSYSTEMATICS I

Course 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

Course 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

Course description: This course 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.

MBL3711MICROBIAL GENETICS

Course 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
Course 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
Course description: This course 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.

EBL3722 BIOSYSTEMATICS II

Course 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
Course 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
Course description: This course will deal with Classification and Phylogeny in animals
Introduction to Phylogeny and systematics: Definition and basic concepts; The tree of LifeTheories 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 diversitya 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.

MBL3701RECOMBINANT DNA TECHNOLOGY

Course 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
Course 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
Course 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

Course title: **BIOTECHNOLOGY**
Code: **MBL3712**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16

Course 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,

Course 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

Course title: **GENETICS**
Code: **MBL3732**
NQF level: 7
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16

Course 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**

Course 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 COURSES

EBL3800 FIELD ECOLOGY

Course title: **FIELD ECOLOGY**
Code: **EBL3800**
NQF level: 8
Contact hours: 4 weeks field trip (2 weeks in each semester)
Credits: 16
Course 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
Course description: This course 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 courses they will have completed. This course is fully field-based. It will be conducted in various localities, to cover diverse ecosystems in Namibia. During the field course, 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 course will be jointly offered by diverse expertise / lecturers / collaborating partners to ensure that multidisciplinary skills are acquired in an integrated manner. During the field course, 75% of the time will be dedicated to activities to enhance acquisition of practical skills. The course 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

Course title: **RESEARCH PROJECT**
Code: **BLG3810**
NQF level: 8
Contact hours: Research project for one year
Credits: 32
Course 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
Course description: This course 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

Course 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
Course assessment: Continuous assessment 40% (minimum of 2 tests and 1 assignment) Examination 60% (3 hour exam paper)
Prerequisites: MBL 3711 Microbial Genetics
Course description: Theory: The course 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 Complexand 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.**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

Course 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
Course 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
Course 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.

EBL3841INTEGRATED NATURAL RESOURCES MANAGEMENT I

Course 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
Course 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
Course 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).

EBL3871 POPULATION ECOLOGY

Course 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
Course 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**
Course description: This course 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).

EBL3852 INTEGRATED NATURAL RESOURCES MANAGEMENT II

Course 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
Course 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

Course description: This course 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

Course title:	**BIOGEOGRAPHY**
Code:	**EBL3851**
NQF level:	8
Contact hours:	4 lecture periods per week, 3 hour practical per week for 14 weeks
Credits:	16

Course assessment: Continuous Assessment 40% (at least 10 assessed practicals, 1 assignment, 2 tests)Exam 60% (1x3 hours theory paper)

Pre-requisites:EBL3712 Ecosystem Ecology

Course description: This course will introduce students to the science of BIOGEOGRAPHY; a study of the distribution of past and present life on the earth. This course 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

Course 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
Course 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

Course 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 course is designed to equip students with the knowledge about various disturbance factors and their impacts on the quality of habitats. The course 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 (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.

MIC3822 MEDICAL BACTERIOLOGY

Course 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
Course 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

Course 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).

MIC3852 PARASITOLOGY

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

Course 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 course. The course 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 course 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.

EBL3812 BEHAVIOURAL ECOLOGY

Course 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
Course 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

Course description: This course 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.

MIC3842 VIROLOGY

Course 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
Course assessment: Continuous assessment 40%: Practicals (at least 6 assessed practicals), Theory (3 tests)
Examination 60%: 1x2 hour theory paper
Prerequisites: **MBL3711** Microbial Genetics

Course 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 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 virologycourse, emphasis on those infectious diseases that are of great actual or potential importance to humans should be made

MIC3831 ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY

Course title: **ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY**
Code: **MIC3831**
NQF level: 8
Contact hours: 4 lecture periods / week for 14 weeks
Credits: 16
Course 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

Course 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.

MBL3801 BIOINFORMATICS

Course 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
Course assessment: Continuous assessment: 40% (3 tests – 60% + at least 10 practical marks – 40%)
Examination: 60% (1 x 3h examination paper)
Prerequisites:MBL3732 Genetics,
Course 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 course 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

Course 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
Course assessment: Continuous assessment **40%:** Practicals; 2 theory tests.
Examination **60%:** 1 x 2 hour theory paper.
Prerequisites: MBL3711 Microbial Genetics
Course 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.

EBL3822 ENTOMOLOGY

Course title: **ENTOMOLOGY**
Code: **EBL3822**
Course equivalent: None – new course
NQF level: 8
Contact hours: 2 lecture periods / week for 14 weeks and 1x3hour practical sessions every second week for 14 weeks
Credits: 16
Course 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
Course 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).

MIC3872 DEVELOPMENTAL BIOLOGY

Course 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
Course 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
Course description Thiscourse is designed to provide students with an understanding and appreciation of the complex processes of plant growth and development from a molecular perspective. The course 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 course 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 course 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.

MBL3850 INTERNSHIP

Course title: **INTERNSHIP**
Code: **MBL3850**
Course equivalent: None – new course
NQF level: 8
Contact hours: This course 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
Course 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
Course descriptionduring 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 COURSES FOR EDUCATION STUDENTS ONLY

MBE3771 CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS

Course Title: **CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS**
Code: **MBE 3771**
Course 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
Course 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
Course 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 course 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

Course Title: **ENVIRONMENTAL BIOLOGY FOR EDUCATORS**
Course Code: **EBE3772**
Course 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
Course 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
Course description: This course is designed to equip students with the necessary understanding of various topics in environmental studies. The main focus of this course 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 course: 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.

EBE3801 ENVIRONMENTAL EDUCATION

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

Course description: The course 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%. Admission to this programme is only every second year; there will be no new intake in 2014.

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 course examinations. In addition to course-specific regulations, attendance of at least 80% in a particular course is a requirement for examination admission. Students must pass all courses 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	COURSE	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	COURSE NAME	CODE	PRE-REQUISITES	CREDIT	COMPULSORY/ ELECTIVE	CORE-REQUISITE
1	Internship	EBL5902	Students must pass all year 1 courses and register for thesis	9	Compulsory	none
1 & 2	Thesis	EBL5900	Student must pass all year 1 courses	120	Compulsory	none
Total Credits				**129**		

FIRST YEAR COURSES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Course Title: **ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code: **UAE5819**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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 course 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

Course Title: **ASSESSING BIODIVERSITY**
Code: **EBM5931**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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.

EBL5911 INTEGRATED LAND USE AND WATER RESOURCES MANAGEMENT

Course Title: **INTEGRATED LAND USE AND WATER RESOURCES MANAGEMENT**
Code: **EBL5911**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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.

EBM5911 BIOSTATISTICS, SCIENTIFIC PRESENTATION AND PUBLICATION

Course Title: **BIOSTATISTICS, SCIENTIFIC PRESENTATION AND PUBLICATION**
Code: **EBM5911**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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

Course Title: **EVOLUTION OF BIODIVERSITY**
Code: **EBB5911**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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 versusFisherian 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

Course Title: **APPLIED BIOGEOGRAPHY**
Code: **EBB5931**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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 course 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.

EBL5952 GIS AND REMOTE SENSING

Course Title: **GIS AND REMOTE SENSING**
Code: **EBL5952**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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).

EBL5912 NATURAL RESOURCE ECONOMICS AND MANAGEMENT

Course Title: **NATURAL RESOURCE ECONOMICS AND MANAGEMENT**
Code: **EBL5912**
NQF Level: 9
Contact hours: 42
Credits: 18

Course 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

Course Title: **ENVIRONMENTAL LAW**
Code: **EBL5932**
NQF Level: 9
Contact hours: 42
Credits: 18

Course 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 course 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 course 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).

EBM5912 MANAGEMENT OF NATURAL HISTORY COLLECTIONS

Course Title:	**MANAGEMENT OF NATURAL HISTORY COLLECTIONS**
Code:	**EBM5912**
NQF Level:	9
Contact hours:	42
Credits:	18

Course 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 course 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

Course Title:	**FUNCTIONAL BIODIVERSITY OF ARID AND SEMI-ARID ECOSYSTEMS**
Code:	**EBF5912**
NQF Level:	9
Contact hours:	42
Credits:	18

Course 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 course 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 course 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 course shall further discuss natural resources found in deserts and how they should be managed. Students shall also learn about desertification. The course 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 course. 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

Course Title: **FUNCTIONAL BIODIVERSITY OF WOODLAND AND FOREST ECOSYSTEMS**
Code: **EBF5932**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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

Course Title: **FUNCTIONAL BIODIVERSITY OF MARINE ECOSYSTEMS**
Code: **EBF5952**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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 course 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.

EBF5902 INTERNSHIP

Course Title: **INTERNSHIP**
Code: **EBF5902**
NQF Level: 9
Contact hours: None: 6 weeks attachment
Credits: 9
Course 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 courses and register for thesis
Content: The content of the course will be determined by the needs, requirements and interests of the respective students. This is a student-centered course. The place of attachment and nature of knowledge sought and skills acquired will be determined by the students and as advised by the lecturers.

EBF5972 FUNCTIONAL BIODIVERSITY OF FRESHWATER ECOSYSTEMS

Course Title: **FUNCTIONAL BIODIVERSITY OF FRESHWATER ECOSYSTEMS**
Code: **EBF5972**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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.

EBL5900 THESIS

Course Title: **THESIS**
Code: **EBL5900**
NQF Level: 9
Contact hours: 42
Credits: 120
Course 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 courses
Content: The content and nature of research for the thesis will depend on the topic of research selected by the student.

D.8. MSc MICROBIOLOGY (11MMBL) - Implementation in 2015

D.8.1. DEPARTMENTAL REGULATIONS

D.8.1.1. ADMISSION REQUIREMENTS

Applicants who have obtained a Bachelors of Science (Hons) degree in Microbiology, Biochemistry, Molecular Biology, Biotechnology, Food Science, and Veterinary Sciences at NQF level 8 are eligible to apply. The applicants will be accepted on the basis of their undergraduate records with an average mark of at least 60%. Applicants who graduated from UNAM with a 4-year BSc degree and an average of at least 60% may also be admitted if they passed Research Methodology and had a Research component in Microbiology or Molecular Biology as part of their undergraduate degree. The department will evaluate such applications. Admission is competitive and a maximum of 20 students will initially be allowed into the programme.

D.8.1.2. DURATION OF STUDY

The Master of Microbiology 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.8.1.3. CURRICULUM COMPILATION

The curriculum for the MSc Microbiologyconsists 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.

D.8.1.4. EXAMINATION REGULATIONS

Formal examination will take place at the end of each semester. Examinations will be subject to external assessment. In addition to course-specific regulations, attendance of at least 80% in a particular course is a requirement for examination admission. Students must pass all courses 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.8.1.5. 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 follow the format as prescribed in the guide for Post-graduate studies at UNAM. The thesis will be evaluated by internal and external examiner within one month after submission. The UNAM grading system will be used for the evaluation.

D.8.1.6. PRACTICALS

Attendance of practical classes and field trips is compulsory.

D.8.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: Master of Science Microbiology (11MMBL)

YEAR 1

SEMESTER	COURSE	CODE	PRE-REQUISITE	CREDIT	COMPULSORY/ ELECTIVE	CORE-REQUISITE
All students in this programme will take all of the following courses						
1	Computing Techniques and Bioinformatics	MMB5921	Admission requirements	12	Compulsory	none
1	Academic Writing for Post Graduate Students	UAE5819	Must be a registered postgraduate student		Compulsory	none
2	Microbial Evolution	MMB5922	Admission requirements	12	Compulsory	none
1	Research Methodology and Project Proposal Writing	MMB5941	Admission requirements	12	Compulsory	none
2	Bio prospecting and Entrepreneurship in Microbiology	MMB5942	Admission requirements	12	Compulsory	none
Students in the Food Microbiology stream will take all of the following courses						
1	Food Microbiology	MMF5911	Admission requirements	24	Compulsory	none
1	Food safety	MMF5921	Admission requirements	12	Compulsory	none
2	Food Biotechnology	MMF5912	Admission requirements	24	Compulsory	none
2	Climate Change and Food Security	MMF5922	Admission requirements	12	Compulsory	none
2	Microbiology of wastewater	MME5912	Admission requirements	24	Compulsory	none
Students in the Biomedical Microbiology stream will take all of the following courses						
1	Clinical Microbiology and Diagnostics	MMM5931	Admission requirements	24	Compulsory	none
1	Microbial Principles and Processes	MMM5911	Admission requirements	24	Compulsory	none
2	Molecular Microbiology and Biotechnology	MMM5912	Admission requirements	24	Compulsory	none
2	Climate Change and emerging diseases	MMM5932	Admission requirements	24	Compulsory	none
Students in the Environmental Microbiology stream will take all of the following courses						
1	Environmental Biotechnology	MME5911	Admission requirements	24	Compulsory	none
1	Geo-Microbiology and biogeochemistry	MME5921	Admission requirements	12	Compulsory	none
2	Microbiology of wastewater	MME5912	Admission requirements	24	Compulsory	none
2	Extremophiles	MME5922	Admission requirements	12	Compulsory	none
2	Climate change and Microbial Biodiversity	MME5932	Admission requirements	24	Compulsory	none
Total Credits				**144**		

YEAR 2

SEMESTER	COURSE NAME	CODE	PRE-REQUISITES	CREDIT	COMPULSORY/ ELECTIVE	CORE-REQUISITE
1 & 2	Thesis	MMB5900	Student must pass all year 1 courses	120	Compulsory	none
Total Credits				**120**		

FIRST YEAR COURSES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Course Title: **ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code: **UAE5819**
NQF Level: 9
Contact hours: 42
Credits: 18
Course 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 course 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.

MMB5941Research Methodology and Project Proposal writing

Course Title: **Research Methodology and Project Proposal writing**
Code: **MMB5941**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites : Must be a registered postgraduate student
Content: In this course the following content will be covered: Research design; project planning, Proposal writing; problem analysis; Research questions formulation; quantitative and qualitative Bio statistical methods of data analysis in Microbiology, research ethics and responsibilities.

MMB5921Computing Techniques and Bioinformatics

Course Title: **Computing Techniques and Bioinformatics**
Code: **MMB5921**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit independent practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting:Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Genome sequence acquisition and analysis, genomes sequence answers to specific questions, genome variations, DNA microarrays, proteomics, Protein 3D structures, Whole genome perspectives, genomic circuits in single genes, integrating single gene circuits, complex gene circuits, modeling whole genome circuits, genomics and medical case studies

MMB5922Microbial Evolution

Course Title: **Microbial Evolution**
Code: **MMB5922**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content for this course will include: formation and early history of earth; origin of cellular life, microbial diversification; endosymbiotic origin of eukaryotes, the evolutionary process, theoretical aspects of evolutionary analysis; analytical methods of evolutionary analysis, microbial phylogeny, various phylogenetic methods, microbial classification and nomenclature

MMB5942Bio prospecting and Entrepreneurship in Microbiology

Course Title: **Bio prospecting and Entrepreneurship in Microbiology**
Code: **MMB5942**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content of this course will deal with: Definitions and theory-practice of bioprospecting; a critique of bioprospecting; bioprospecting as post-modern ecological capitalism; Bioprospecting for genetic resources; Bioprospecting for Microbes; Bioprospecting of medicinal plants and drug natural products , Bioprospecting for natural food products and nutriceuticals; Bioprospecting for new species of microbes, plants, and animals; Bioprospecting of desert, soil, marine and other environments; Policies, laws, regulations, and conventions that guide bioprospecting; Case studies of bioprospecting programmes; Valuation of bioprospecting samples. In addition, this course focuses on the realities of working in the field of microbiology and biotechnology. It includes aspects such as entrepreneurship development, economic implications and financing, intellectual property and patents, bioethics, biotechnology and public understanding thereof. Knowledge and insights gained from this course will be assessed by means of a simulated grant application for the development of a hypothetical microbiological/biotechnological venture.

MMF5912Food Biotechnology

Course Title: **Food Biotechnology**
Code: **MMF5912**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Continuous assessment will be composed of the graded reports during laboratory presentation as well as 2 assignments that will be presented orally and 1 written assignment. The exam will consist of 1 x 3hour paper.
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Techniques in Food industries (breweries, dairies, wines etc.): Fermentation Technology; Yeast based products; Bacteria based fermented products; Mold based products and other microbial based products such as sweeteners, flavours, amino acids, vitamins.
Theme 2: Safety evaluation of novel food products and food fortification
Theme 3: Bio engineering: Genetically modified foods; New Frontiers for Food Processing; Advances in Lactic Acid Bacteria for Novel applications
Theme 4: Food industrial wastes
Theme 5: Functional foods; Prebiotics and probiotics ingredients
Theme 6: Indigenous food technology
Practical aspects and skills that will be addressed during the teaching of the various themes include

- Isolation, purification and maintenance of yeast and bacterial cultures.
- Aerobic and anaerobic fermentation.
- Production of various fermented food products
- Identification of microorganisms (molecular methods)
- Production of metabolites and enzymes: detection of enzymes and bacteriocins

MMF5911Food Microbiology

Course Title: **Food Microbiology**
Code: **MMF5911**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Continuous assessment will be composed of the graded reports during laboratory presentation as well as 2 assignments that will be presented orally and 1 written assignment. The exam will consist of 1 x 3hour paper.
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Growth conditions for bacteria.
Theme 2: Microbes in foods: Sources of Microorganisms in Foods; Food spoilage; pathogens; Beneficial Bacteria; Characteristics of Predominant Microorganisms in Food; Food Ingredients and Enzymes of Microbial Origin; Food Standards and Food Environment
Theme 3: Food Biopreservatives of Microbial Origin
Theme 4: Microbiology of Fermented food: Microorganisms Used in Food Fermentation
Theme 5: Prebiotics and probiotics
Practical aspects and skills that will be addressed during the teaching of the various themes include

- Microbial techniques (spoilage organisms, pathogens, fermented foods)
- Detection and Enumeration of micro-organism in food samples
- Isolation and enrichment of microorganisms
- Identification of microorganisms (biochemical methods)
- Use of automated rapid and conventional methods for microbial toxins, metabolites, inhibitory substances, pathogens and bacteriophages through HPLC and GC.

MMF5921Food safety

Course Title: **Food safety**
Code: **MMF5921**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content for this course will include topics such as: Transfer of pathogens from environment to food, the HACCP system, ISO standards, preservation techniques, quality control, food processing, radiation, water quality control, From harvesting or farms to consumer: chemical, microbiological and technological aspects of food; Microbial indicators in Food; Foodborne pathogens and illnesses; New and Emerging Foodborne Pathogens; Food toxicology (Microbiological toxins, Intolerance and allergy to food); Adverse Effects of Food and Nutrition; Risk analysis in relation to food and its components; Food protection and defense: bioterrorism and genetically modified organisms and potential dangers in packaging and labeling of food products; Food safety regulations in Namibia and elsewhere in the World (globally) – International Food laws and regulations.

MMF5922Climate Change and Food Security

Course Title: **Climate Change and Food Security**
Code: **MMF5922**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content for this courses will include topics such as: Evidence analysis and predictions on overall negative or positive effects microorganism changes on agricultural production as a result of climate change, effects of Climate on pests and pathogens affecting agricultural crops; crop–pest/pathogen models in prediction of changes in pest/pathogen dynamics, design sound plant health management practices, climate change and increase risk to food and feed contaminated by mycotoxin-producing fungi. Use of transgene(s) enhanced adaptation to abiotic stresses that are exacerbated by climate change. Relationship of microbes, Climate change and declining nutritional quality of food crops. The use of high-throughput phenomic platforms to relationships of microbes measure plant growth and development and analyze nutritional traits, development of climate resilience production systems; Sustaining food quality by manipulating soil microbial Diversity Increased use of agro biodiversity and generation of agro biodiversity to coping with adverse impacts climate change.

MME5912Microbiology of wastewater

Course Title: **Microbiology of wastewater**
Code: **MME5912**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Continuous assessment will be composed of the graded report during laboratory presentation as well as 2 assignments that will be presented orally and 1 written assignment. The exam will consists of 1 x 3hour paper.
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Sources and typical characteristics of Wastewater: Domestic wastewater, industrial wastewater (food and beverage industry, chemical industry, tanneries, textile industry etc), agricultural run-off. **Theme 2:** Environmental consequences of not treating wastewater: eutrophication in surface water, groundwater contamination, pollution with pathogens, toxic chemicals in water, presence of endocrine disrupting chemicals. The use of indicator organisms to determine water quality using culturing techniques and selective media as well as molecular techniques.**Theme 3:** Overview of a sewage treatment plant: description of typical aerobic and anaerobic processes and a detailed study of the biology of microorganisms involved in these processes, including nitrification, carbon removal, denitrification and phosphate removal. Detailed study of the biology and importance of microorganisms in clarifiers and those that can be utilized in post-treatment of sludge. Microbial processes in waste stabilization ponds. **Theme 4:** Operational procedures and their importance to microbial processes, such as the sludge retention time, hydraulic retention time, sludge loading rate, Feed ratios and the importance and processes of on-line monitoring in wastewater treatment plants. **Theme 5:** Necessary adaptations of a sewage treatment plant for the treatment of various industrial wastewaters, focusing on the microbiological processes in such plants such as the use of microorganisms for toxicity testing. **Theme 6**: Reclamation of wastewater for drinking water production and microbial aspects and processes in drinking water treatment and distribution. Theme 7: Water and Public Health.

MMM5911 Microbial Principles and Processes

Course Title: **Microbial Principles and Processes**
Code: **MMM5911**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and one case study presentation and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme Poverty related diseases in Namibia; including neglected tropical and zoonotic diseases; Ethiology and pathogenesis; host innate and adaptive immunity; Epidemiology and ecology; Treatment in humans and animals, including livestock and companion animals

MMM5932 Climate Change and emerging diseases

Course Title: **Climate Change and emerging diseases**
Code: **MMM5932**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and one case study presentation and at least 1 test during the semester that will form part of continuous assessment. Weighting:Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme Emerging and re-emerging infectious diseases and occurrence; transmission cycles for infectious diseases; historical evidence for climate change and the link between climatic conditions and infectious diseases; the phenomenon of global warming; observed and predicted impacts of long term climate change.

MMM5912 Molecular Microbiology and Biotechnology

Course Title: **Molecular Microbiology and Biotechnology**
Code: **MMM5912**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and one case study presentation and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme Drug development, biosprospecting, Vaccine development (Viral vaccines: conventional: killed/attenuated; DNA; peptide; recombinant protein Sterilization techniques: biohazard hoods; containment facilities) Bacterial and viral vectors, Biological warfare agents, insulin production, molecular techniques, beneficial microbes and their potential use, biomedicines, Mode of action of antibiotics and antivirals: molecular mechanism of drug resistance (MDR), indigenous practices, climate change and emerging diseases, Gene therapy-concept, vectors, gene targeting and tissue-specific expression, Ethics and human genetics (Social- genetic discrimination: human cloning, foeticide, sex determination, Ethical: somatic and germ line gene therapy, clinical trials, the right to information, ethics committee function), pharmacogenomics and toxicogenomics, Cellular therapy; Stem cells, Recombinant therapy, Immunotherapy, Patenting and Intellectual property rights.

MMM5931 Clinical Microbiology and Diagnostics

Course Title: **Clinical Microbiology and Diagnostics**
Code: **MMM5931**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and undertake written tests during the semester; this will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The course will be organized into four themes:

- Organization and function of the clinical microbiology laboratory;
- Handling clinical specimens for microbiological studies;
- Aetiological agents recovered from clinical material; and
- Methods for identification of aetiological agents of infectious and non-infectious diseases.

MME5911Environmental Biotechnology

Course Title: **Environmental Biotechnology**
Code: **MME5911**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and undertake written tests during the semester; this will form part of continuous assessment. Weighting:Continuous assessment 50%, Examination 50% (1 x 3 hour paper)

Prerequisites: Must be a registered postgraduate student

Content: THEME1: MICROBIAL INTERACTIONS AND THEIR ROLE IN THE ENVIRONMENT:
Mobilization and immobiilisation of carbon with rhizosphere; mechanism of biological nitrogen fixation, ammonification, nitrification, denitrificatioin and microorganisms involved in such processes; Biofertilizer for sustainable agriculture Rhizobium Azospirillium, Azotobacter,Azolla, applications methods of biofertilizers - significance of biofertilizers.
THEME2: POLLUTION, ITS MONITORING AND CONTROL: Sources, major pollutants, adverse effect on living organisms; acid rain and its impact on ecosystem-gaseous emission; Droplet neuclei –Aerosol; Assessment of air quality; Airbone diseases, their symptoms and preventive measures; Types of wastes, characterization of solid and liquid waste; Brief account on bioterrorism.
THEME3: BIOREMEDIATION: Use of Biotechnology and commercial blends of Microorganism and Enzymes in wastewater treatment; Solid waste treatment
THEME 4: BIODEGRADATION OF POLLUTANTS AND RECALCITRANT COMPOUNDS: Principles of Bioremediation: Phytoremediation of xenobiotics and bioaccumulation of metals using plants; Biodegradation of petroleum constituents and associated heavy metals; • Phytoremediation of soil contaminated with toxic metals and radionucleids; • Entrapped microbial cultures and their utility in environmental biodegradation process.; Application of Recombinant DNA technology in waste treatment; Application of genetically engineered microbes; Microbial leaching and mining; Biosensors in Detection of Environment Pollutants; Biopesticides and Biofertilizers
THEME 6: Biodiversity and Biotechnology: Cellular and molecular aspects of Biotechnology; Reforestation through micro-propagation; Biotechnology in preservation of bio-diversity; In situ and ex situ conservation through gene banks; Genetically modified plants and the environment.
THEME 7: BIOENERGETICS

MME5921 Geo-Microbiology and biogeochemistry

Course Title: **Geo-Microbiology and biogeochemistry**
Code: **MME5921**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Continuous assessment will be composed of the graded report during laboratory presentation as well as 1 written assignment and 1 assignment that will be in the form of an oral presentation. The exam will consist of 1 x 3hour paper.

Prerequisites: Must be a registered postgraduate student

Content: Theme 1: Thermodynamics of microbial processes (free energy, electrode potentials, energy conservation such as phosphorylation) and redox cascades in sediments which affect microbial metabolism. **Theme 2:** Measurement and calculation of fluxes between water, sediment and microorganisms. **Theme 3:** Geomicrobiological methods: Use of stable isotopes and biomarkers, microsensors, RT-PCR, DGGE, FISH, CARD-FISH, flow cytometry etc. **Theme 4:** The role of microorgansms in geochemical cycles: Carbon, nitrogen, phosphorus, sulfur cycles, iron and manganese. **Theme 5:** Role of microorganisms in geological processes: Microbial dolomite precipitation, Acid Mine Biogeochemistry, Anaerobic oxidation of methane, Geomicrobiology of fossil fuels.

MME5932 Climate change and Microbial Biodiversity

Course Title: **Climate change and Microbial Biodiversity**
Code: **MME5932**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)

Content: Theme 1: Role of microorganisms in controlling the climate via the carbon, nitrogen and sulfur cycles e.g. contribution of microbial processes in ruminants to methane in the atmosphere, the role of nitrogen fixing bacteria in the oceans and soils etc. Climate change versus climate variability.**Theme 2:** Climate change and health – the effect of climate change on the pathology and spread of diseases such as malaria. **Theme 3:** Effect of climate change on the diversity, distribution and abundance of microorganisms and on microbial processes. **Theme 4:** the role of microorganisms in climate change adaptation and mitigation e.g. the production of alternative biofuels; Climate change impact on Marine , soil and Terrestrial Biodiversity in relation to microorganism changes.

MME5922 Extremophiles

Course Title: **Extremophiles**
Code: **MME5922**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Continuous assessment will be composed of the graded report during laboratory presentation as well as 1 assignment that will be presented orally and 1 written assignment. The exam will consist of 1 x 3hour paper.
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Thermophiles: Biotopes; Isolation and physiology of thermophiles; Biochemical basis of thermophily; Biotechnological perspective; Enzymes in thermophilic microorganisms and other adaptations that allow them to survive in high temperature environments. **Deserts:** Classification, hyperthermophilic habitats and ecological aspects; Extremely Thermophilic Archaebacteria, Thermophily, commercial aspects of thermophiles; Applications of thermozymes; Methanogens: Classification, Habitats, applications. **Hydrothermal vents:** Examples of hydrothermal vents and the processes that lead to their formation, Conditions at hydrothermal vents, primary production through chemosynthesis at hydrothermal vents and the role of microorganisms in support in vent ecosystems; Strategies for survival at hydrothermal vents; Diversity and physiology of microorganisms at hydrothermal vents including processes of sulfide and methane oxidation.
Theme 2: Halophiles and Barophiles: Hyper-saline environment; Taxonomic distribution and isolation of halophiles Physiology of extreme halophiles and barophiles; Barophiles: Classification, high-pressure habitats, life under pressure, barophily, death under pressure.
Theme 3: Acidophiles and Alkaliphiles: Occurrence of life at low and high pH; Isolation and enumeration of acidophiles and alkalophiles; Physiology of microbial adaptation to extreme pH; Bioleaching and bio-beneficiation of mineral-ores
Theme 4: Oxygen-free environments: Oxygen minimum zones in the environment and the redox potentials existing as well as the diversity of microorganisms in such anaerobic conditions, Anaerobic microbial processes in anoxic environments: methanogenesis, sufate reduction, anaerobic oxidation of methane, denitrification, anaerobic oxidation of ammonium (ANNAMOX)
Theme 5: Psychrophiles: Enzymes of phychrophiles; Distribution and isolation; Mechanisms and molecular aspects of psychrophiles

MMB5900 Thesis

Course Title: **Thesis**
Code: **MMB5900**
NQF Level: 9
Contact hours: Face to face consultations with supervisors on a regular basis
Credits: 120
Course Assessment: The written thesis makes up 100% of the final thesis mark
Content: The content and nature for the thesis will depend on the topic of research selected by the student. Students will engage in independent research within industries, laboratories and the field through attachments.

E. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

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 courses 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 courses required as indicated below:

- 64 credits of total 160 credits by the end of the first year (about 40%); 2 of these courses (equivalent to 32 credits) must be non-core
- 8 full courses (equivalent to 128 credits of 288 cumulative credits) by the end of the second year (about 45%)
- 15 full courses (equivalent to 240 credits of 424 cumulative credits) by the end of the third year (about 57%)
- 24 full courses (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 courses of the curriculum f**or** 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 courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for courses.

- **From year 1 to year 2:** At least **7** full courses (equivalent to **112** credits of **160** credits at level **5**) prescribed for year **1**.
- **From year 2 to year 3:** All first year courses plus at least **5** full courses (equivalent to **80** credits of **128** credits at level **6**).
- **From year 3 to year 4:** All second year courses plus at least **5** full courses (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 courses 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 courses:

YEAR 1

SEMESTER	COURSE 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		CHM3511
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	COURSE 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
2	Introduction to microbiology	MBL3632	16	BLG3511; BLG3512	None
Total Credits			**128**		

Biochemistry I (CHB36) has phased out this year, students are taking Biomolecules and Catalysis (CHB3632)

YEAR 3

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	None
1	Inorganic Chemistry II	CHM3701	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	CHM3651	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 Chemistry and Biochemistry courses	None
2	Transmission of Genetic Information	CHB3722	8	CHB3632	None
2	Biosafety, Bioethics and Intellectual property Rights	CHB3742	8	None	CHB3731
Total Credits			**136**		

YEAR 4

SEMESTER	COURSE 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 courses and at least one statistics course	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 courses and at least one statistics course	None
2	Natural Product Chemistry II	CHM3822	8	CHM3752,	CHM3801
2	Medicinal Chemistry II	CHP3842	8	CHP3741, , CHP3721	CHM3811
2	Medical Bacteriology	MIC3822	8	MBL 3711	None
Total Credits			**128**		

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

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

YEAR 1

SEMESTER	COURSE 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		CHM3511
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	COURSE 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,CHM35 12	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Radiochemistry	CHP3621	8	CHM3511;CHM35 12	None
2	Physics for Physical Sciences II	PHY3512	16		None
2	Introduction to Statistics	STS3522	8		None
2	Analytical Chemistry I	CHM3602	8	CHM3511;CHM35 12	None
2	Introduction to Earth Systems	GLY3502	8		None
2	Introduction to Microbiology	MBL3632	16	BLG3511;BLG3512	None
Total Credits			**128**		

YEAR 3

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none
1	Inorganic Chemistry II	CHM3701	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 courses	none
2	Crystallography & Mineral Chemistry	GLY3632	16	MAT3512 & CHM3512	none
Total Credits			**136**		

YEAR 4

SEMESTER	COURSE 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 courses and at least one statistics course	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 courses and at least one statistics course	none
2	Environmental Chemistry II	CHP3822	8	CHP3711	none
Total Credits			**120**		

TABLE FOR ALL COURSES IN BSC IN CHEMISTRY (HONOURS) WITH THE GEOCHEMISTRY APPLICATION: 11BSGC

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

YEAR 1

SEMESTER 1	COURSE NAME	COURSE CODE	Credits	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication & 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		CHM3511
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	COURSE 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	GLY3521	none
2	Introductory to Petrology	GLY3662	8	GLY3521	none
2	Introduction to Geochemistry	GLY3642	8	MAT3512 ; GLY3521 & CHM3512	none
Total Credits			**136**		

YEAR 3

SEMESTER 1	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none
1	Inorganic Chemistry II	CHM3701	16	CHM3611 MAT3512	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Sedimentology	GLY3751	16	GLY3621; 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 courses	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	COURSE 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 courses and at least one statistics course	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	CHM3701, CHM3752	None
2	Research Project	CHM3810	16	Pass in all third year courses and at least one statistics course	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 COURSES IN BSC IN APPLIED BIOCHEMISTRY (HONOURS) WITH THE BIOMEDICAL APPLICATION: 11BCAC
Students opting for a BIOMEDICAL application must take all of the following courses:

YEAR 1

SEMESTER	COURSE 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		CHM3511
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	COURSE 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
2	Introduction to microbiology	MBL3632	16	BLG3511 BLG3512	None
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	None
Total credits			**112**		

YEAR 3

SEMESTER	COURSE 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 Discovery and Development	CHP3721	8	CHM3651	None
1	Medicinal Chemistry I	CHP3741	8	CHM3651;	CHP3721
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 courses	none
2	Innovation and Entrepreneurship	CHB3762	8	CHP3721, CHB3741	none
2	Biosafety, Bioethics and Intellectual	CHB3742	8	CHB3731	none

	property Rights (IPR)				
Total credits			**136**		

YEAR 4

SEMESTER	COURSE 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 courses	none
1	Natural Product Chemistry I	CHM3821	8	CHM3752, CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Clinical Biochemistry	CHB3821	8	CHP3721,CHP3731, CHB3731	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 courses	none
2	Natural Product Chemistry II	CHM3822	8	CHM3752	CHM3801
2	Medicinal Chemistry II	CHP3842	8	CHP3741, CHP3721	CHM3811,
2	Medical Bacteriology	MIC3822	8	MBL 3711	none
2	Health and Nutritional Biochemistry	CHN3842	8	CHB3731,CHP3741	none
Total credits			**136**		

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

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

YEAR 1

SEMESTER	COURSE 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		CHM3511
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	COURSE 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
2	Introduction to microbiology	MBL3632	16	BLG3511 BLG3512	none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none
Total credits			**120**		

YEAR 3

SEMESTER	COURSE 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 courses	none
2	Innovation and Entrepreneurship	CHB3762	8	CHP3721, CHB3741	none
Total credits			**136**		

YEAR 4

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Bioinformatics for Biochemistry	CHB3831	16	CHB3711, MBL3631	none
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Research Project	CHM3810	16	Pass in all third year courses	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 courses	none
2	Chemical Xenobiotics and Toxicology	CHB3832	16	CHP3711, CHP3701	none
Total credits			**120**		

E.4. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY COURSE DESCRIPTIONS

FIRST YEAR COURSES

CHM3511CHEMISTRY 1A

Course Title:	**Chemistry 1A**
Course 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
Course 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	None

Course Descriptor **:**The following topics are covered:Introduction: Matter, Measurement and Molecules; Stoichiometry: Calculations with ChemicalFormulae 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.

CHM3512CHEMISTRY 1B

Course Title:	**Chemistry 1B**
Course 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
Course 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	None, **Co-requisite:** CHM3511 (Chemistry 1A)

Course 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 COURSES

CHM3611INORGANIC CHEMISTRY I

Course Title:	**Inorganic Chemistry I**
Course 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
Course 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)

Course 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

Course Title:	**ORGANIC CHEMISTRY I**
Course 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
Course 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)

Course 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

Course Title:	**Physical Chemistry I**
Course 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
Course 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)

Course 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.

CHP3621RADIOCHEMISTRY

Course Title: **Radiochemistry**
Course Code **CHP3621**
NQF Level 6
Contact Hours: 2 lecture periods per week for 14 weeks
NQF Credits 8
Contact Hours 2lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Course 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
Course 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.

CHB3632BIOMOLECULES 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
Course 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)
Cor**equisite** CHM3651OrganicChemistry I
Course 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; ionisation; folding and conformation; **Membranes and membrane transp**or**t:** 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**

CHM3602ANALYTICAL CHEMISTRY I

Course Title: **Analytical Chemistry I**
Course 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
Course 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)
Course 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 COURSES

CHB3741BIOCHEMICAL 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
Course 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)

Course 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)

CHP3701WATER ANALYSIS

Course Title:	**Water Analysis**
Course 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
Course 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

Course 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.

CHB3731BIOENERGICS 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
Course 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	CHB3632 **(**Biomolecules and Catalysis)

Course 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 carbohydratemetabolism: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

CHP3741MEDICINAL CHEMISTRY I

Course Title:	**Medicinal Chemistry I**
Course Code	**CHP3741**
NQF Level	8
NQF Credits	8
Contact Hours	2lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Course 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)

Course 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.

CHP3721DRUG DISCOVERY & DEVELOPMENT

Course Title:	**Drug Discovery & Development**
Course 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
Course 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)

Course 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;

CHM3721ANALYTICAL CHEMISTRY II

Course Title:	**Analytical Chemistry II**
Course Code	**CHM3721**
NQF Level	7
NQF Credits	8
Contact Hours	2lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks
Course 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)

Course 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.

CHM3701INORGANIC CHEMISTRY II

Course Title:	**Inorganic Chemistry II**
Course Code	**CHM3701**
NQF Level	7
Contact Hours:	4 lecture periods per week for 14 weeks and1 practical session per week for 14 weeks
NQF Credits	16
Course 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), MAT3512 (Precalculus)

Course 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. Chemical applications of group theory: Continuation of symmetry elements and symmetry operations, point group and character tables. Symmetry applications; Infrared and Raman spectroscopy. In-depth treatment of chemical bonding and molecular orbital theory, Electronic spectra of transition metal complexes; Russel-Saunders and ligand field terms, selection rules and electronic transitions

CHP3711ENVIRONMENTAL CHEMISTRY I

Course Title:	**Environmental Chemistry I**
Course 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
Course 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 (CHP3621)

Course 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.

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
Course 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)

Course Descriptor**:** This course is designed to teach the students the Expression and transmission of genetic information: The following topics are covered: **Nucleotide metabolism:** synthesis of purine ribonucleotidees; synthesis of pyrimidine ribonucleotides; formation of deoxyribonucleotides; nucleotide degradation; biosynthesis of nucleotide Coenzyme; **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

CHM3761INDUSTRIAL CHEMISTRY I

Course Title:	**Industrial Chemistry I**
Course 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
Course 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)

Course Descriptor**:** The following topics are covered: **Sources of chemical industry:** inorganic chemicals, organic chemicals from biomass, coke, natural gas, crude oil. **The wo**rl**d's maj**or **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. **Flav**or **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.

CHM3752 OR**GANIC CHEMISTRY II**

Course Title:	OR**GANIC CHEMISTRY II**
Course 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
Course 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)

Course 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.

CHM3712PHYSICAL CHEMISTRY II

Course Title:	**Physical Chemistry II**
Course 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
Course 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	CHM3631 (Physical Chemistry I), MAT3611 (Calculus I)

Course 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. Processes at electrodes: The electrode-solution interface. The rate of charge transfer.Butler-Volmer equation.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.

CHB3762 INNOVATION AND ENTREPRENEURSHIP

Course Title:	**Innovation and Entrepreneurship**
Course Code	CHB3762
NQF Level	8
NQF Credits	8
Contact Hours:	2lecture periods per week for 14 weeks
Course 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

Course Descriptor: **Introduction to innovation and entrepreneurship; Entrepreneurship in biotechnology (Context specific);** Or**ganizational Structures;** Virtual and Real Enterprises; R & D Networks; Outsourcing Registrations/Permissions: **Markets and Fact**ors: 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	None, **Co-requisite:** Bioenergics and Metabolism (CHB3731)

Course 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

Course Title:	**Instrumental Analysis I**
Course 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)

Course 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/CHB3722 RESEARCH METHODOLOGY

Course Title:	**Research Methodology**
Course Code	CHM3722/ CHB3722
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 Chemistry and Biochemistry courses

Course 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 COURSES

CHM3821NATURAL PRODUCT CHEMISTRY I

Course Title:	**Natural Product Chemistry I**
Course 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 (Instrumental Analysis I)

Course Description: This course 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.

CHB3831 BIOINFORMATICS FOR BIOCHEMISTRY

Course Title:	**Bioinformatics for Biochemistry**
Course Code	CHB3831
NQF Level	8
NQF Credits	16
Contact Hours	4 lectureperiods per week and 1 practical session per week for 14 weeks
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	**CHB3731** (Bioenergics and metabolism), **MBL3631** (Cell Molecular Biology and Genetics)

Course Descriptor: 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 inactive 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 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.

CHM3801 INSTRUMENTAL ANALYSIS II

Course Title:	**Instrumental Analysis II**
Course Code	CHM3801
NQF Level	8
NQF Credits	8
Contact Hours	2 lectureperiods 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)

Course 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.

CHM3811 ORGANIC CHEMISTRY III

Course Title:	O**RGANIC CHEMISTRY III**
Course Code	CHM3811
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	CHM3752 (Organic Chemistry II)

Course 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.

CHM3810 / CHB3810 RESEARCH PROJECT

Course Title:	**Research Project**
Course Code	CHM3810 / CHB3810
NQF Level	8
Contact Hours:	2consultation 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	Passin all third year courses and at least one statistics course

Course 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.

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, (CHP3741), Drug discovery and development (CHP3721)

Course 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

CHM3831PHYSICAL CHEMISTRY III

Course Title:	**Physical Chemistry III**
Course 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)

Course 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.

CHP3811 WASTEWATER TREATMENT

Course Title:	**Wastewater Treatment**
Course 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)

Course 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.

CHP3822 ENVIRONMENTAL CHEMISTRY II

Course Title:	**Environmental Chemistry II**
Course Code	CHP3822
NQF Level	8
Contact Hours	2lecture 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 Proposalcontributes 5%, Paper Reviewcontributes 5% and Paper peer Review contribute 5%.
Prerequisite	Environmental Chemistry I (SCHP3711)

Course 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.

CHP3842 MEDICINAL CHEMISTRY II

Course Title:	**Medicinal Chemistry II**
Course 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: CHM3811 (Organic chemistry III, **co-requisite**), CHP3741 (Medicinal Chemistry I, prerequisite), CHP3721 (Drug Discovery and Development, **prerequisite)**

Course 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).

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	CHP3721 **(**Drug discovery and development), CHB3722 (Transmission of Genetic Information)

Course 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	Bioenergics and Metabolism (CHB3731), Medicinal Chemistry (CHP3741)

Course Descriptor: **The following topics are covered: Digestion and Abso**r**ption:** 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.

CHM3822 NATURAL PRODUCT CHEMISTRY II

Course Title:	**Natural Product Chemistry II**
Course 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); **Co-requisite:** CHM3801 (Instrumental Analysis II)
Contact Hours	2 lecture periods per week for 14 weeks; 1 practical session per week for 7 weeks

Course Description: This is the continuation of natural products chemistry I. In this course, 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.

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)

Course 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

Course Title:	**Inorganic Chemistry III**
Course 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)

Course 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

Course Title:	**Industrial Chemistry II**
Course 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)

Course 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.

CHB3832 CHEMICAL XENOBIOTICS & TOXICOLOGY

Course Title:	**Chemical Xenobiotics & Toxicology**
Course Code	CHB3832
NQF Level	8
NQF Credits	16
Contact Hours	4 lectureperiods per week; 1 practical session per week for14 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)

Course Descriptor**:** this module is designed to study the interactions between environmental contaminants and living organisms. It looks at the behavior 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 behavious. Bioaccumulation and biomagnification of xenobiotics. Behavior 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.

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 course 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 course, a student must obtain a final mark of at least 50%. Refer to specific courses 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 COURSES IN MASTER OF SCIENCE IN INDUSTRIAL BIOCHEMISTRY

YEAR 1

SEMESTER	COURSE NAME	COURSE CODE	CREDIT	PRE-REQUISITE	CO-REQUISITE
1	Academic Writing for Post Graduate Students	UAE5819	24	None	None
1	Advanced Analytical and Instrumental Methods	CHM5911	24	None	None
1	Research Methodology and Project Proposal	CHM5921	12	None	None
1	Enzymology and Enzyme Technology	CHB5921	12	None	None
1	Nutrition, Metabolism and Cell Signaling	CHB5941	12	None	None
1	Neurobiochemistry and Clinical Biochemistry	CHB5961	12	None	None
2	Instrumental Methods and Techniques in Biochemical analysis	CHM5962	12	CHM5911	None
2	Biochemistry Seminars	CHB5942	12	CHM5921	None
2	Strategic Resource Management	CHB5962	12	CHM5921	None
2	Bioinformatics and Industrial Biotechnology	CHB5902	12	CHB5921	None
2	Environmental Toxicology and Management	CHC5942	12	CHB5941	None
2	Natural products and Pharmaceutical Production	CHN5942	12	CHB5961	None
Total Credits			**168**		

YEAR 2

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

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

TABLE FOR ALL COURSES IN THE PROGRAMME

Course code	Course name		Credits	Compulsory (C) /Elective (E)	Prerequisites
Year 1 Semester 1					
UAE5819	Advanced Academic Writing for Post Graduate Students		24	C	None
CHM5961	Chemistry Seminars		12	C	None
CHM5911	Advanced Analytical and Instrumental Methods		24	C	None
CHM5991	Research Methodology and Project Proposal		12	C	None
Electives (Any two courses)					
CHM5931	Advanced Organic Chemistry		24	E	None
CHM5951	Advanced Inorganic Chemistry		24	E	None
CHM5971	Advanced Physical Chemistry		24	E	None
CHI5931	Advanced Industrial Chemistry		24	E	None
Year 1 Semester 2: Electives (Any two courses)					
CHM5912	Current Topics in Analytical Chemistry		24	E	CHM5911
CHM5932	Current Topics in Organic Chemistry		24	E	CHM5931
CHM5972	Current Topics in Physical Chemistry		24	E	CHM5971
CHM5952	Current Topics in Inorganic Chemistry		24	E	CHM5951
CHI5932	Current Topics in Industrial Chemistry		24	E	CHI5931
				Total credits Year 1	**144**
YEAR 2					
CHM5900	M.Sc. Thesis		120	C	Pass in all year 1 courses
Total credits Year 2					**120**
Total credits for the programme					**264**

Course Details Year 1: SEMESTER 1

CHM5911 Advanced Analytical and Instrumental Methods

Course 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**
Course 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: None

Course 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 lecturesper 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 None

Course 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.

CHM5921RESEARCH 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 None

Course 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.

CHI5931Advanced Industrial Chemistry

Course 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**
Course 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: None
Course 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.

CHB5961 NEUROBIOCHEMISTRY AND CLINICAL BIOCHEMISTRY

Course Title: **Neurobiochemistry and Clinical Biochemistry**
Course Code **CHB5961**
NQF Level 9
Contact Hours 2lectures 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 None
Course Descriptor: Muscle Biochemistry – Skeletal muscle structure. Actin, myosin, tropomyosin, troponin.Molecularmechanism 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

CHM5951Advanced Inorganic Chemistry

Course 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**
Course 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: None
Course 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.

CHM5931Advanced Organic Chemistry

Course 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**
Course 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: None
Course 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.

CHM5971Advanced Physical Chemistry

Course 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**
Course 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: None
Course 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.

CHM5961Chemistry Seminars

Course Title: **Chemistry Seminars**
Code: **CHM5961**
NQF Level: 9
Contact Hours: 2 lectures/consultations per week for 14 weeks
Credits: **12**
Course Assessment: Presentations are graded by staff members and count toward the CA mark. **Final Mark:** 100% CA mark
Prerequisites: None
Course Description: The main component of this course involves the application of presentation skills through seminars, review of scientific literature and communication of recent developments in chemistry and biochemistry.

CHM5991Research Methodology and Project Proposal

Course 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**
Course 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: None
Course 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

Course Title: **Current Topics in Analytical Chemistry**
Code: **CHM5912**
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**

Course 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 andcounts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review 2500 words) and 50% Examination

Prerequisites: Advance Analytical and Instrumental Method (SCHM5911)

Course 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

Course Title: **Current Topics in Organic Chemistry**
Code: **CHM5932**
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**

Course 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)

Course 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.

CHM5972Current Topics in Physical Chemistry

Course Title: **Current Topics in Physical Chemistry**
Code: **CHM5972**
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**

Course 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 andcounts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review 2500 words) and 50% Examination

Prerequisites: Advanced Physical Chemistry (SCHM5971

Course 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.

CHM5952Current Topics in Inorganic Chemistry

Course Title: **Current Topics in Inorganic Chemistry**
Code: **CHM5952**
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Course Assessment: A minimum of two independent study reports (or one report and one test) which counts 80% towardsthe 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 andcounts 50% towards the final mark. **Final Mark:** 50% Continuous Assessment (literature review2500 words) and 50% Examination
Prerequisites: Advanced Inorganic Chemistry (SCHM5951
Course 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

CHI5932Current Topics in Industrial Chemistry

Course Title: **Current Topics in Industrial Chemistry**
Code: **CHI5952**
NQF Level: 9
Contact Hours: 4 lectures per week for 14 weeks
Credits: **24**
Course 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)
Course 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
Course 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

Course 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 lecturesper 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

Course 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 f**or **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.**Maj**or **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

Course Descriptor**:** The main component of this course 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

Course Descriptor**: GenePharming** (Animals and Plants) Vitamins, Amino Acids, Proteins Antibiotics, Biocatalysis. **Natural Compounds** Recovery/(Bio-Processing, Chemical–Biotechnological Syntheses, Gene Therapy. **Vect**or**s/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

Course Descriptor**:**Microbial Growth in Complex Environments: Biodegradation Using Natural Microbial Communities; Changing Environmental Conditions to Stimulate Biodegradation; **Subsurface Engineered Bi**or**emediation** System; Stimulating Hydrocarbon Degradation in Waters and Soils; Phytoremediation; Stimulation of Metal Bioleaching from Minerals; **Biosens**or**s:** 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/ CHM5900MSC 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 courses is required before a student can start with the research project.
Course 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.
Course Descriptor**:** Students will present their findings in the form of a written thesis. Poster and seminar presentations are encouraged. This course 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. DIPLOMA IN COMPUTER SCIENCE

F.1.1. MINIMUM REQUIREMENTS FOR 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 courses, 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.1.2. 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.1.3. EXAMINATION REGULATIONS

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

F.1.4. ADVANCEMENT AND PROGRESSION RULES

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

F.1.5. 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 courses in the first year of Bachelor of Science in Information Technology (Honours) or Bachelor of Science in Computer Science (Honours):

SUBJECT PASSED	COURSE 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
LEG2410 English for General Communication	LCE3419 English Communication & Study Skills
CSI3580 Contemporary Social Issues	CSI3580 Contemporary Social Issues

QUALIFICATION: Diploma in Computer Science (11DCMP)

YEAR 1

SEMESTER	COURSE 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	CMP2421	8		None
1	Basics of Statistics	STD2431	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Mathematics	MAT2432	8		None
2	Programming Principles	CMP2412	16		CMP2421
2	Information Systems Management	CMP2432	16		CMP2421
Total Credits			**128**		

YEAR 2

SEMESTER	COURSE 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**		

F.2. DIPLOMA IN COMPUTER SCIENCE COURSE DESCRIPTIONS

FIRST YEAR COURSES

CMP2411 INTRODUCTION TO COMPUTER SYSTEMS

Course Title: **INTRODUCTION TO COMPUTER SYSTEMS**
Course Code: **CMP2411**
NQF Level: 4
Contact Hours: 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits: 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Prerequisite None
Course 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

Course Title: **PRINCIPLES OF INFORMATION SYSTEMS**
Course Code **CMP 2421**
NQF Level 5
Contact Hours 2 lectures + one practical session every second week for 14 weeks
NQF Credits 8
Course Assessment: **Continuous assessment (at least two tests and one assignments) 50%; 1 x 2 hours Examination 50%**
Prerequisite None
Course 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

Course Title: **PROGRAMMING PRINCIPLES**
Course Code **CMP2412**
NQF Level 4
Contact Hours 4 lectures plus a 3 hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: **Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%**
Prerequisite CMP2421 Principles of Information Systems
Course 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

Course Title: **INFORMATION SYSTEMS MANAGEMENT**
Course Code **CMP2532**
NQF 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: **Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%**
Prerequisite CMP24231 Principles of Information Systems
Course 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.

SECOND YEAR COURSES

CMP2551 FUNDAMENTALS OF COMPUTER NETWORKS

Course Title: **FUNDAMENTALS OF COMPUTER NETWORKS**
Course Code **CMP2551**
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: **Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%**
Prerequisite CMP2411 Introduction to Computer Systems
Course 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

Course Title: **FUNDAMENTALS OF DATABASE SYSTEMS**
Course Code **CMP2511**
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Prerequisite CMP2411 Introduction to Computer Systems
Course 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

Course Title: **FUNDAMENTALS OF SYSTEMS ADMINISTRATION**
Course Code CMP2531
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%

Corequisite CMP2411 Introduction to Computer Systems
Course 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

Course Title: **PROGRAMMING I**
Course Code **CMP2571**
NQF Level 5
Contact Hours 4 Lectures per Week + 3 hour practical per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Corequisite CMP2412 Programming Principles
Course 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

Course Title: **DATABASE MANAGEMENT**
Course Code: **CMP2512**
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Corequisite CMP2511 Fundamentals of Database Systems
Prerequisite CMP2411 Introduction to Computer Systems
Course 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

Course Title: **SYSTEM ADMINISTRATION**
Course Code **CMP2532**
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Corequisite CMP2531 Introduction to System Administration
Prerequisite CMP2411 Introduction to Computer Systems
Course 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

Course Title: **NETWORK ADMINISTRATION**
Course Code **CMP2552**
NQF Level 5
Contact Hours 4 lectures + a 3-hour practical session per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Corequisite CMP2551 Fundamentals of Computer Networks
Prerequisite CMP2411 Introduction to Computer Systems
Course Aims This courses 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 course 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

Course Title: **PROGRAMMING II**
Course Code **CMP2572**
NQF Level 5
Contact Hours 4 Lectures per Week + 3 hour practical per week for 14 weeks
NQF Credits 16
Course Assessment: Continuous assessment (at least two tests and one assignments) 50%; 1 x 3 hours Examination 50%
Corequisite CMP2571 Programming I
Prerequisite CMP2412 Programming Principles
Course 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.

F.3. DEGREE PROGRAMMES

F.3.1. REGULATION PERTAINING TO THE DEGREE PROGRAMMES

To register for an undergraduate degree programme in the Faculty of Science, 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 Computer Science 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).

In addition to the Faculty of Science entry requirements, students wishing to register for the Bachelor of Science in Computer Science (Honours) and the Bachelor of Science in Information Technology (Honours) will be expected to pass a Departmental Entry Selection 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 given before registration, to enable students who do not qualify to select other programmes.

Please read this section in conjunction with the academic conditions stipulated in the **General Information and Regulations Prospectus**.

F.3.2. DURATION OF STUDY

The Bachelor of Science in Computer Science (Honours) and the Bachelor of Science in Information Technology (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.

F.3.3. MODE OF DELIVERY

The Bachelor of Science in Information Technology (Honours) and the Bachelor of Science in Information Technology (Honours) programme is offered on a full-time mode. The mode of delivery consists of a combination of lectures, tutorials, lab practicals, research projects and industrial attachments. 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 marks. Attendance of practical and tutorial classes is compulsory for all courses that have these components.

F.3.4. ASSESSMENT CRITERIA

Unless otherwise indicated, the relationship between the CA mark and the Examination mark is **50:50**.All taught modules will be assessed using a combination of continuous assessment (50%) and an examination (50%) mark. Continuous assessment will consist of a subset of the following, depending on the module: class tests, assignments, presentations, practical/laboratory demonstrations and reports. All examinable modules will have an examination administered at the end of each semester. Only candidates who obtained the required minimum continuous assessment mark of 40% will be eligible to write the examinations.

F.3.5. 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 courses as indicated below:

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

F.3.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the courses 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 courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for courses that require prerequisites.

F.4. BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY, CIRRICULUM AND PRE-REQUISITES

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 courses:

YEAR 1

SEMESTER	COURSE 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
2	Pre-calculus	MAT3512	16		None
2	Introduction to Statistics	STS3522	8		None
2	Fundamentals of Information Technology II	CIT3512	16		CIT3521
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Introduction to Database Systems	CMP3611	16	CMP3512	
1	Object Oriented Programming I	CMP3691	16	CMP3512	
1	Discreet Mathematics Concepts	CIT3631	16	MAT3512 & MAT3511	
1	Computer Networks I	CIT3611	16	CIT3511	
2	Advanced Databases	CMP3622	16	CMP3511	CMP3611
2	Object Oriented programming II	CMP3692	16	CMP3511& CMP3512	CMP3691
2	Telecommunications	CIT3632	16	CIT 3521and CIT3511	CIT3631
2	Computer Networks II	CIT3612	16	CIT 3511	CIT3611
Total Credits			**128**		

YEAR 3

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Advanced Computer Networks	CIT3711	16	CIT3611,CIT3612 and CIT3632	
1	Software Engineering	CMP3731	16	CMP3512 CMP3692	
1	Information Security	CIT3731	16	CIT3612 & CIT3611	
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	CMP3731
2	Research Methodology	CMP3752	16	STS 3522 & CMP3692	
2	Platform Technologies	CIT3732	16	CIT3632 &CIT3612	CIT3711
Total Credits			**128**		

YEAR 4

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Research Project	CIT3810	32	Pass all Third Year Courses	None
1	Network System Security	CMP3821	8	CIT3711& CIT 3731	None
1	Wireless and Mobile Computing	CMP3841	8	CIT3711 & CIT 3712	None
1	IT Project Management	CIT3811	16	CMP3712& CMP3731	None
1	Distributed Systems	CMP3851	16	CIT 3612	None
1	Artificial Intelligence	CMP3871	16	CMP3512, CMP3692& CIT3631	None
2	Research Project	CIT3810	0	Pass all Third Year Courses	None
2	Entrepreneurship and Management of IT Systems	CMP3832	16	CMP 3712	None
2	Automation	CIT3812	16	CIT3631& CMP3792	None
2	Real Time Multimedia	CMP3812	16	CIT3611,CIT3612 CMP3712	None
2	Cloud Computing	CIT3812	16	CMP 3612 & CIT3711	None
Total Credits			**160**		

F.5. 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 courses:

YEAR 1

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
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
2	Fundamentals of Information Technology II	CIT3512	16		CIT3521
2	Introduction to Statistics	STS3522	8		None
Total credits			**160**		

YEAR 2

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
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 & MAT3512	None
1	Computer Networks I	CIT3611	16	CIT3511	None
2	Advanced Databases	CMP3622	16	CMP3511	CMP3611
2	Object Oriented programming II	CMP3692	16	CMP3511 & CMP3512	CMP3691
2	Computer Networks II	CIT 3612	16	CIT3511	CIT3611
2	Computer Organization & Architecture	CIT3652	16	CIT3511 & CIT3512	none
Total credits			**128**		

YEAR 3

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Computer Theory	CMP3711	16	CMP3651& CMP3692	None
1	Software Engineering	CMP3731	16	CMP3512 CMP3692	None
1	Emerging Technologies	CMP3751	16	CIT3611 & CIT3612	None
1	Data Structures and Algorithms	CMP3791	16	CMP3692	None
2	Operating Systems	CMP3732	16	CMP3692 &CIT3652	CMP3791
2	Human Computer Interaction	CMP3792	16	CMP3692	CMP3731
2	Research Methodology	CMP3752	16	CMP3692 & STS3522	None
2	Web Design & Programming	CMP3772	16	CMP3692 & CMP3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	COURSE NAME	CODE	CREDITS	PREREQUISITES	COREQUISITES
1	Research Project	CMP3810	32	Pass all third year	None
1	Network Security	CMP3821	8	CIT3611 &CMP3751	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3792 & CMP3751	None
1	Numerical Methods and Operations Research	CMP3811	16	CMP 3651	None
1	Distributed Systems	CMP3851	16	CIT3612 & CMP 3791	None
1	Artificial Intelligence	CMP3821	8	CMP3711 & CMP 3791	None
2	Entrepreneurship and Management of IT Systems	CMP3832	16	CMP3751	None
2	Real Time Multimedia	CMP3812	16	CIT3611,CIT3612 & CMP3751	None
2	Database Programming	CMP3872	16	CMP3772 ,CMP3612 & CMP3692	None
2	Data warehousing and Data Mining	CMP3822	8	CMP3612 & CMP3791	None
Total Credits			**144**		

F.6. BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY/COMPUTER SCIENCE, COURSE DESCRIPTIONS

FIRST YEAR COURSES

CMP3511 PROGRAMMING FUNDAMENTALS I

Course 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
Course Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Final Examinations 50%
Prerequisites: Departmental Entry Test

Course description: This course 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 course 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.

CIT3511 INTRODUCTION TO DIGITAL ELECTRONICS

Course title: **Introduction to Digital Electronics**
Code: **CMP3511**
NQF level: 5
Contact hours: 4 lecture periods / week for 14 weeks; 3 hour practical session/ week, for 14 weeks
Credits: 16
Course Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Prerequisites: Departmental Entry Test

Course Description: This course 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 course 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

Course Title: **Fundamentals of Information Technology I**
Course 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

Course 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.

CMP3512 PROGRAMMING FUNDAMENTALS II

Course 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
Course Assessment	Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) Examinations **50%**
Co-Requisites:	CMP3511 Programming Fundamentals I

Course description: This course 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 course 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.

CIT3512 FUNDAMENTALS OF INFORMATION TECHNOLOGY II

Course Title:	**Fundamentals of Information Technology II**
Course Code	**CIT3512**
NQF Level	5
NQF Credits	16
Contact Hours	4 lecture periods per week and onepractical session per week for 14 weeks
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Co-Requisites:	CIT3521Fundamentals of Information Technology I

Course Descriptions: Introduction to Data Communications; principles and structure of communication systems, Introduction to wired and wireless LAN technologies; Introduction to Telecommunications Systems; telecommunications standards and protocols; principles behind telecommunications; Introduction to Web design and Web applications

SECOND YEAR COURSES

CMP3611 INTRODUCTION TO DATABASE SYSTEMS

Course Title:	**Introduction to Database Systems**
Course Code	**CMP3611**
NQF Level	**Contact Hours** 4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3512 Programming Fundamentals II

Course 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

Course Title	**Object Oriented Programming I**
Course Code	**CMP3691**
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisites	CMP3512 Programming Fundamentals II

Course Aims This course 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.Course Content: The course 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.

CIT3631 DISCRETE MATHEMATICS CONCEPTS

Course Title:	**Discrete Mathematics Concepts**
Course Code	**CIT3631**
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisite	MAT3512 Precalculus& MAT 3511 Basic mathematics

Course Content: Fundamentals: This part contains a miscellany of basic material in the course.
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.

CIT3611 COMPUTER NETWORKS I

Course Title:	**Computer Networks I**
Course Code	**CIT3611**
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisite	CIT3511 Introduction to Digital Electronics

Course 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.

CMP3622 ADVANCED DATABASES

Course Title:	**Advanced Databases**
Course Code	**CMP3622**
NQF Level	6
Contact Hours	4 lecture periods per week and 1x3-hour practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3511 Introduction to Digital Electronics
Co-Requisites	CMP3611 Introduction to Database Systems

Course Aims This course 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.

CMP3651 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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	MAT3511 Basic Mathematics & MAT 3512 Precalculus

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.

CMP3692 OBJECT ORIENTED PROGRAMMING II

Course Title	**Object Oriented Programming II**
Course Code	**CMP3692**
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3511 Introduction to Digital Electronics and CMP3512 Programming Fundamentals II
Co-requisite	CMP3691 Object Oriented Programming I

Course 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.

CIT3632 TELECOMMUNICATIONS

CourseTitle	**Telecommunications**
Course Code	**CIT3632**
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3521 Fundamentals of Information Technology I & CIT3511 Introduction to Digital Electronics

Course Content: Introduction to the principles and practice of wireless communications. The course 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 course also presents modern wireless systems and standards. The focus of the course 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 course includes a project related to new technological advances in wireless systems.

CIT3612COMPUTER NETWORKS II

Course Title	**Computer Networks II**
Course Code	**CIT3612**
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3511 Introduction to Digital Electronics
Co-requisite	CIT3611 Computer Networks I

Course Aims: This course 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.

CIT3652 COMPUTER ORGANISATION AND ARCHITECTURE

Course Title:	**Computer Organization and Architecture**
Course Code	**CIT3652**
NQF Level	6
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CIT3511Introduction to Digital Electronics and CIT3512Fundamentals of Information Technology II

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;

THIRD YEAR COURSES

CIT3711 ADVANCED COMPUTER NETWORKS

Course Title	**Advanced Computer Networks**
Course 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 Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3611 Computers Networks I, CIT 3612 Computers Networks II and CIT3632 Telecommunications

Course 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 course.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.

CMP3711 COMPUTER THEORY

Course Title:	**Computer Theory**
Course Code	**CMP3711**
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3651 Mathematics for Computer Science and CMP3692 Object Oriented Programming II

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.

CMP3751 EMERGING TECHNOLOGIES

Course Title:	**Emerging Technologies**
Course Code	**CMP3751**
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CIT3611Computer Networks I and CIT3612 Computer Networks I I

Course 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.

CMP3791 DATA STRUCTURES AND ALGORITHMS

Course Title	**Data Structures and Algorithms**
Course Code	**CMP3791**
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre -Requisite	CMP3692 Object Oriented Programming II

Course 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.

CMP3731 SOFTWARE ENGINEERING

Course Title	**Software Engineering**
Course Code	CMP3731
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP3512 programming Fundamentals II and CMP3692 Object Oriented Programming II

Course 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.

CIT3731 INFORMATION SECURITY

Course Title	**Information Security**
Course 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 Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3611 Computer Networks I and CIT3612 Computer Networks II

Course 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.

CIT3771 SYSTEM ADMINISTRATION AND MAINTENANCE

Course Title	**System Administration and Maintenance**
Course 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 Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3632 Fundamentals of Information Technology II and CIT3612 Computer Networks II

Course 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.

CMP3712 INTERNET TECHNOLOGIES AND APPLICATIONS

Course Title	**Internet Technologies and Applications**
Course Code	**CMP3712**
NQF Level	7
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3632 Telecommunications and CIT3612 Computer Networks II

Course 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.

CMP3732 OPERATING SYSTEMS

Course Title:	**Operating Systems**
Course Code	**CMP3732**
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CIT3652 Computer Organization and Architecture and CMP3692 Object oriented programming II
Co-requisite	CMP3791 Data Structures and Algorithms

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

CMP3751 HUMAN COMPUTER INTERACTION

Course Title	**Human computer interaction**
Course Code	**CMP3792**
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CMP3692 Object Oriented Programming II
Co-requisite	CMP3731 Software Engineering

Course 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.

CMP3752 RESEARCH METHODOLOGY

Course Title	**Research Methodology**
Course Code	**CMP3752**
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	STS3522 Introduction to Statistics
Co-Requisite:	CMP3692 Object Oriented Programming II

Course 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.

CIT3732 PLATFORM TECHNOLOGIES	
Course Title	**Platform Technologies**
Course Code	**CIT3732**
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3632 Telecommunications & CIT3612 Computer Networks II
Co-requisites	CMP3712 Internet Technologies and Applications and CIT3711Advanced Computer Networks

Course 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.

CMP3772 WEB DESIGN AND PROGRAMMING	
Course Title:	**Web Design and 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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3692 Object Oriented Programming II and CMP3622 Advance Databases

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.

FOURTH YEAR COURSES

CMP3810 RESEARCH PROJECT

Course Title:	**Research Project**
Course 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 Courses

Course Content: This course 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.

CMP3821NETWORK SYSTEM SECURITY

Course Title	**Network Security**
Course 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 Assessement 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite	CIT 3711Advanced Computer Networks & CIT373 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.

CMP3841WIRELESS AND MOBILE COMPUTING

Course Title	**Wireless And Mobile Computing**
Course 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 Assessment 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite	(CMP3792 Human Comouter Interaction & CMP3751 Emerging Technologies) OR (CIT 3711Advanced Computer Networks & CIT3712 Internet Technolgies and Applications)

Course 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.

CIT3811 IT PROJECT MANAGEMENT

Course Title	**IT Project Management**
Course Code	**CIT3811**
NQF Level	8
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3712 Internet Technolgies and Applications& CMP3731 Software Engineering

Course Description: This course 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.

CIT3810RESEARCH PROJECT

Course Title	**Research Project**
Course Code	**CIT3810**
NQF Level	8
NQF Credits	32
Pre-requisite	Pass All Third Year Courses

Course 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.

CMP3871ARTIFICIAL INTELLIGENCE

Course Title	**Artificial Intelligence**
Course Code	**CMP3871**
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3512 Programming Fundamentals II, CIT3631 Discrete mathematics Concept &CMP 3692 Object Oriented programming I**I**

Course Description: The course 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.

CMP3832 ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS

Course Title	**Entrepreneurship & Management of IT Systems**
Course 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 Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP3712 Internet Tehchnologies and Applications

Course 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.

CIT3812AUTOMATION

Course Title	**Automation**
Course Code	**CIT3812**
NQF Level	8
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3631 Discrete Mathematics Concepts & CMP3792 Human Computer Interaction

Course 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.

CIT3812CLOUD COMPUTING	
Course Title:	**Cloud Computing**
Course 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 Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP3612 Advanced DatabasesI & CIT3711Advanced Computer Networks

Course 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.

CMP3821NETWORK SECURITY	
Course Title	**Network Security**
Course 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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3611 Computer Networks I & CMP3751Emerging Technologies

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:
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.

CMP3811 NUMERICAL METHODS AND OPERATIONS RESEARCH	
Course Title	**Numerical Methods & 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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3651 Mathematics of Computer Science

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.

CMP3821ARTIFICIAL INTELLIGENCE	
Course Title	**Artificial Intelligence**
Course 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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3711 Computer Theory & CMP3791 Data Structure and Algorithms

Course Description: The course 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.

CMP3851DISTRIBUTED SYSTEMS

Course Title	**Distributed Systems**
Course Code	**CMP3851**
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3612 Computer Networks II & CMP3791 Data Structure and Algorithms

Course 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.

CMP3812REAL TIME MULTIMEDIA

Course Title	**Real Time Multimedia**
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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Compulsory/Elective	Elective
Pre-requisite	(CIT3611 Computer Networks I, CIT3612 Computer networks II & CMP3751 Emerging Technologies) OR (CIT3611 Computer Networks I, CIT3612 Computer networks II and CMP 3712 Internet Technologies & Applications)

Course 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.

CMP3832 ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS

Course Title	**Entrepreneurship And Management of IT systems**
Course Code	**CMP3832**
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for 14 weeks
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CMP3751 Emerging Technologies

Course 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.

CMP3872 DATABASE PROGRAMMING

Course Title	**Database Programming**
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
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3772 Web Design & Programming, CMP3612 Advance Databases II & CMP 3692 Object Oriented Programming II

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.

CMP3822 DATA WAREHOUSING AND DATA MINING

Course Title:	**Data Warehousing and Data Mining**
Course Code	**CMP3822**
NQF Level	8
Contact Hours	2 lecture periods per week and half a practical session every week for 14 weeks
NQF Credits	8
Prerequisite	CMP3612 Advanced Databases and CMP 3791 Data Structures and Algorithms

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.7. COMPUTER SCIENCE COURSE EQUIVALENTS

OLD MODULES	NEW MODULES
CMP3511 Programming Fundamentals I	CMP3511 Programming Fundamentals I
CMP3512 Programming Fundamentals II	CMP3512 Programming Fundamentals II
CMP3521 Fundamentals of Digital Electronics	CMP3531 Introductions to Digital Electronics
CMP3532 Computer Organization	MAT3512 Precalculus
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	CIT3611 Computer Networks I
CMP3611 Introduction to Database Systems	CMP3611 Introduction to Database Systems
CMP3622 Introduction to Database Systems	CMP3622 Introduction to Database Systems
CMP3671 Mathematics for Computer Science I	CMP3651 Mathematics for Computer Science
CMP3672 Mathematics for Computer Science II	*****No exact equivalence
CMP3631 Object Oriented Programming	CMP3691 Object Oriented Programming I
CMP 3611 Telecommunications	CIT3632 Telecommunications
CMP 3632 Foundations of Data Communications	CIT3672 Computer Organization and Architecture
CME3612 Networking and Emerging Technologies	*****No exact equivalence
CMP 3652 Software Engineering II	CIT3612 Computer Networks II
CMP3612 Data Structures and Algorithms	CMP3692 Object Oriented Programming II
CMP3701 Research Methodology I	CIT3731 Software Engineering
CMP3721 Computer Networks	CIT3711 Advanced Computer Networks
CMP3741 Computer Theory	CMP3711 Computer Theory
CMP3761 Computer Architecture	CIT3771 System Administration and Maintenance
CMP3771 Artificial Intelligence	CIT3731 Information Security
CME3731 Introduction to Network Security	CIT3731 Information Security
CMP3702 Research Methodology II	CMP3752 Research Methodology
CMP3712 Internet Technologies and Applications	CIT3732 Platform Technologies
CMP3742 Human Computer Interaction and	CMP3792 Human Computer Interaction
CMP3762 Computer Graphics	CMP3772 Web Design and Programming
CMP3722 Operating Systems	
CMP3819 Software Project Management	CIT3811 IT Project Management
CMP3831Operations Research	CMP3811 Numerical Methods and Operations Research
CMP3802 Field Attachment	CMP3832 Entreprenuership and Management of IT Systems
CMP3821 Network Systems Security	CMP3821 Network Systems Security
CMP3841 Wireless and Mobile Computing	CMP3841 Wireless and Mobile Computing
CMP3822 Data Warehousing and Data Mining	CMP3822 Data Warehousing and Data Mining
CMP3812 Real Time Multimedia	CMP3812 Real Time Multimedia
CMP3872 Database Programming	CMP3872 Database Programming

F.8. M.Sc. INFORMATION TECHNOLOGY (IT) PROGRAMME (11MSCI)

F.8.1. 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.8.2. 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.8.3. 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.

F.8.4. 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 Course. 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.8.5. 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.8.6. PRACTICALS

Attendance of practical classes is compulsory.

NB: STUDENT MUST PASS ALL COURSES/COURSES AND PRE/CO-REQUISITES AS LISTED FOR THE PARTICULAR COURSES. 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.8.7. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

YEAR 1

SEMESTER	COURSE 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	AdvancedSoftware Engineering	CMP5952	16	None	None
2	Data Communication and Computer Networks	CMP5972	16	None	None
Total Credit			**128**		

YEAR 2

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

FIRST YEAR COURSES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Course 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
Course 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
Course Description: This course 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

Course title: **DISCRETE MATHEMATICS**
Code: **CMP5931**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Course Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None
Course 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

Course title: **COMPUTER GRAPHICS**
Code: **CMP5951**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Course Assessment Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None
Course 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

Course title: **ADVANCED OPERATING SYSTEMS**
Code: **CMP5971**
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 16
Course Assessment: Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments) and Examinations **50%**
Prerequisites: None
Course description: Thecourse equips studentswith 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.

CMP5912 CRYPTOGRAPHY AND NETWORK SECURITY

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

Course 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 course 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

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

Course description: This course 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 course CMP5900, Thesis. The course 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

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

Course description: The course 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

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

Course description: The course is designed to provide the computer candidates with a working knowledge of data communications, computer networks and open systems. The course 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 COURSE

CMP5900 THESIS

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

Course 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 Courses in the first year of study

Course 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. In addition students will be required to purchase certain items essential for field work.

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 courses required as indicated below:

1. 4 courses (equivalent to 64 credits) by the end of the first year; 2 of these courses (equivalent to 32 credits) be non-core (30%)
2. 9 courses (equivalent to 144 credits) by the end of the second year (45%)
3. 16 courses (equivalent to 256 credits) by the end of the third year (57%)
4. 24 courses (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 courses. In exceptional cases, students who have failed a single course 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 courses and at least 2/3 of the prescribed second year courses, i.e. 6 courses (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 courses and at least 2/3 of the prescribed third year courses, i.e. 6 courses (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 courses 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 2014 *no* space is available).
5. Final approval of the change will be made by the Geology Department.

In 2014 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 courses. 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)

QUALIFICATION: B.Sc. (honours) Geology (11BSCG)

Students opting for a B.Sc. (Honours) in Geology must take all of the following courses:

YEAR 1

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

YEAR 2

SEMESTER	COURSE NAME	CODE	CREDITS	ELECTIVE	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	No	MAT3512	None
1	Inorganic Chemistry I	CHM3611	16	No	CHM3511 & CHM3512	None
1	Introduction to Hydrology	GLY3621	8	No	MAT3512 & GLY3521	None
1	Physical Chemistry I	CHM3631	16	No	CHM3511 & CHM3512, MAT3511 & MAT3512	None
2	Calculus II	MAT3612	16	No	MAT3512	None
2	Stratigraphy & Geological Mapping	GLY3612	16	No	GLY3521	None
2	Crystallography & Mineral Chemistry	GLY3632	16	No	MAT3512 & CHM3512	None
2	Introduction to Geochemistry	GLY3642	8	No	MAT3512 & GLY3521 & CHM3512	None
2	Introductory Petrology	GLY3662	8	No	GLY3521	None
1&2	Field Geology I	GLY3600	8	No	GLY3521	None
Total Credits Yaer 2			128			

YEAR 3

SEMESTER	COURSE NAME	CODE	CREDITS	ELECTIVE	PRE–REQUISITES	CO-REQUISITES
1	GIS	GLY3741	8	No	GLY3612	None
1	Mineralogy	GLY3711	16	No	GLY3632 &CHM3512	None
1	Plate Tectonics	GLY3721	8	No	GLY3612	None
1	Sedimentology	GLY3751	16	No	GLY3612 & GLY3662	None
1	Regional Geology of Namibia	GLY3761	8	No	GLY3521	None
1	Environmental & Engineering Geology I	GLE3701	8	No	GLY3642 &GLY3621	None
2	Hydrogeology I	GLY3702	8	No	GLY3621 & GLY3642	None
2	Structural Geology I	GLY3712	16	No	GLY3612 & MAT3612& GLY3600	None
2	Igneous & Metamorphic Petrology	GLY3732	16	No	GLY3662 & GLY3642 &GLY3600	None
2	Research Methodology	GLY3762	8	No	GLY3600	None
2	Exploration Geochemistry and Geostatistics	GLE3742	8	No	GLY3642	None
1&2	Field Geology II	GLY3700	8	No	GLY3600	None
Total Credits Year 3			128			

YEAR 4

SEMESTER	COURSE NAME	CODE	CREDITS	ELECTIVE	PRE–REQUISITES	CO-REQUISITES
1	Environmental & Engineering Geology II	**GLE3821***	8	Yes	GLE3701	None
1	Industrial Minerals and Gemstones	**GLY3801***	8	Yes	GLY3711	None
1	Economic Geology	GLY3831	16	No	GLY3711 & GLY3721	None
1	Igneous & Metamorphic Petrogenesis	**GLY3871***	16	Yes	GLY3732 & GLY3711	None
1	Coal, Gas & Petroleum	**GLY3811***	16	Yes	GLY3751	None
2	Hydrogeology II	**GLY3812***	16	Yes	GLY3702	None
2	Exploration Geology and Geophysics	GLY3832	16	No	GLY3712	None
2	Remote Sensing	GLY3822	8	No	GLY3712	None
2	Structural Geology II	GLY3862	8	No	GLY3712 & GLY3700	None
1&2	Research Project	GLY3810	32	No	All third year courses	GLY3820
1&2	Field Geology III	GLY3800	8	No	SGLY3700	None
1&2	Field Geology for Research	GLY3820	8	No	All third year courses	GLY3810
Total Credits Year 4			**120**			

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 (GLE3821 or GLY3801)

2. GLY3811 Coal, Gas & Petroleum plus any other **half module** of the elective modules (GLE3821 or GLY3801)

3. GLY3812 Hydrogeology II plus any other **half module** of the elective modules (GLE3821 or GLY3801). It is recommended to take GLE3821 Environmental & Engineering Geology II

*** ELECTIVE COURSE**

G.3. COURSE DESCRIPTIONS GEOLOGY

FIRST YEAR COURSES

GLY3521: INTRODUCTION TO PHYSICAL GEOLOGY AND SURFACE PROCESSES

Course 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
Course assessment: Continuous 40%: At least 5 practicals; 2 tests, 1 assignment. Examination 60%: One 3 hour exam paper.
Prerequisites: None
Course 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

Course 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
Course Assessment: Continuous 40%: At least 5 practicals; 1-test and at least one assignment. Examination 60%: One 3 hour exam paper.
Pre-requisites: None
Course 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 COURSES

GLY3600: FIELD GEOLOGY I

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

GLY3621: INTRODUCTION TO HYDROLOGY

Course title: **INTRODUCTION TO HYDROLOGY**
Code: **GLY3621**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course 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
Course 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). Overview of Hydrogeological regions in Namibia.

GLY3612: STRATIGRAPHY & GEOLOGICAL MAPPING

Course Title: **STRATIGRAPHY & GEOLOGICAL MAPPING**
Code: **GLY3612**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week.
Credits: 16
Course 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
Course 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

Course title: **CRYSTALLOGRAPHY & MINERAL CHEMISTRY**
Code: **GLY3632**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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
Course 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

Course Title: **INTRODUCTION TO GEOCHEMISTRY**
Code: **GLY3642**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: Continuous 40%: At least 6 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes, CHM3521 Chemistry 1B
Course 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

Course Title: **INTRODUCTORY PETROLOGY**
Code: **GLY3662**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: Continuous 40%: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 2 hour theory paper and one 2 hour practical paper.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes
Course 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 COURSES

GLY3700: FIELD GEOLOGY II

Course 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
Course 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

Course 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

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

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

GLY3711: MINERALOGY

Course title:	**MINERALOGY**
Code:	**GLY3711**
NQF level:	7
Contact hours:	4 lecture hours per week; 3 practical hours per week
Credits:	16
Course 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

Course 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

Course Title:	**PLATE TECTONICS**
Code:	**GLY3721**
NQF level:	7
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight
Credits:	8
Course 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

Course 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; Seismic crustal structure, Benioff zone and earthquake distribution; Plate tectonic settings and rock associations; Crustal Provinces.

GLY3751: SEDIMENTOLOGY

Course Title: **SEDIMENTOLOGY**
Code: **GLY3751**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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.
Course 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

Course title: **REGIONAL GEOLOGY OF NAMIBIA**
Code: **GLY3761**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course 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
Course 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 & ENGINEERING GEOLOGY I

Course title: **ENVIRONMENTAL & ENGINEERING GEOLOGY I**
Code: **GLE3701**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight
Credits: 8
Course 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
Course 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

Course title: **HYDROGEOLOGY I**
Code: **GLY3702**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course 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
Course 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

Course Title: **STRUCTURAL GEOLOGY I**
Code: **GLY3712**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week..
Credits: 16
Course 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
Course Description: The course 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

Course Title: **IGNEOUS & METAMORPHIC PETROLOGY**
Code: **GLY3732**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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
Course 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

Course title: **EXPLORATION GEOCHEMISTRY AND GEOSTATISTICS**
Code: **GLY3742**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: Continuous 40%: At least 6 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3642 Introduction to Geochemistry
Course 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 course will only cover Linear Geostatistics at this level. Case studies of various deposit types.

GLY3762: RESEARCH METHODOLOGY

Course Title:	**RESEARCH METHODOLOGY**
Code:	**GLY3762**
NQF level:	7
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Course Assessment:	Continuous 100%: 5 assignments, 1 test. Examination: Not applicable
Pre-requisites:	GLY3600 Field Geology I

Course 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 COURSES

GLY3800: FIELD GEOLOGY III

Course 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
Course 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

Course 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

Course 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

Course 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 courses should be failed.

Pre-requisites:	All third and second year courses
Co-requisite:	GLY3820 Field Geology for Research

Course Description: The course 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

Course 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
Course 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 courses
Co-requisite:	GLY3810 Research Project

Course 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 & ENGINEERING GEOLOGY II*

Course title: **ENVIRONMENTAL & ENGINEERING GEOLOGY II**
Code: **GLE3821**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 hours practical per fortnight
Credits: 8
Course 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
Course description: 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 and planning: 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 sites: 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. 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 scoping, impact prediction and mitigation.

GLY3801: INDUSTRIAL MINERALS AND GEMSTONES*

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

Course title: **ECONOMIC GEOLOGY**
Code: **GLY3831**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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
Course 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*

Course title: **IGNEOUS & METAMORPHIC PETROGENESIS**
Code: **GLY3871**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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

Course description: Igneous Petrogenesis: 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.
Metamorphic Petrogenesis: 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*

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

Course 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*

Course title: **HYDROGEOLOGY II**
Code: **GLY3812**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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

Course 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

Course title: **EXPLORATION GEOLOGY AND GEOPHYSICS**
Code: **GLY3832**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course 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

Course 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

Course Title:	**REMOTE SENSING**
Code:	**GLY3822**
NQF level:	8
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Course 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

Course 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

Course Title:	**STRUCTURAL GEOLOGY II**
Code:	**GLY 3862**
NQF level:	8
Contact hours:	2 lecture hours per week; 3 practical hours per fortnight.
Credits:	8
Course 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

Course Description: The course 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.

G.4. LIST OF EQUIVALENT COURSES DURING TRANSITION PHASE

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

11BGLY Old BSc Geology (Honours) Courses (2008-2012)		**11BSCG New BSc Geology (Honours) Courses (2013-2016)**	
Course Name	**Code**	**Course Name**	**Code**
Introduction to Physical Geology & Surface Processes	GLY3521	Introduction to Physical Geology & Surface Processes	GLY3521
Introduction to Earth Systems	GLY3502	Introduction to Earth Systems	GLY3502
Field Geology I	GLY3600	Field Geology I	GLY3600
Stratigraphy & Geological Mapping	GLY3612	Stratigraphy & Geological Mapping	GLY3612
Introduction to Hydrology	GLY3621	Introduction to Hydrology	GLY3621
Earth Resources	GLY3641	Introduction to Earth Systems	GLY3502
Introduction to Geochemisty	GLY3642	Introduction to Geochemisty	GLY3642
Introduction to Petrology	GLY3652	Introductory Petrology	GLY3662
Field Geology II	GLY3700	Field Geology II	GLY3700
Coal, Petroleum & Gas	GLY3701	Coal, Gas & Petroleum	GLY3811
Hydrogeology I	GLY3702	Hydrogeology I	GLY3702
Mineralogy	GLY3711	Mineralogy	GLY3711
Structural Geology I	GLY3712	Structural Geology I	GLY3712
Plate Tectonics	GLY3721	Plate Tectonics	GLY3721
Sedimentology & Palaeontology	GLY3731	Sedimentology	GLY3751
Igneous Petrology	GLY3722	Igneous & Metamorphic Petrology	GLY3732
Metamorphic Petrology	GLY3742		
Regional Geology of Namibia	GLY3761	Regional Geology of Namibia	GLY3761
Research Methology	GLY3762	Research Methology	GLY3762
Environmental and Engineering Geology I	GLE3771	Environmental & Engineering Geology I	GLE3701
Exploration Geochemistry & Geostatistics	GLY3782	Exploration Geochemistry & Geostatistics	GLE3742
Field Geology III	GLY3800	Field Geology III	GLY3800
Environmental and Engineering Geology II	GLE3801	Environmental & Engineering Geology II	GLE3821
Industrial Minerals & Gemstones	GLY3801	Industrial Minerals & Gemstones	GLY3801
Research Project	GLY3810	Research Project	GLY3810
		Field Geology for Research	GLY3820
Hydrogeology II	GLY3812	Hydrogeology II	GLY3812
Economic Geology	GLY3831	Economic Geology	GLY3831
Exploration Geology & Geophysics	GLY3832	Exploration Geology & Geophysics	GLY3832
Igneous Petrogenesis	GLY3821	Igneous & Metamorphic Petrogenesis	GLY3871
Metamorphic Petrogenesis	GLY3841		
Remote Sensing & GIS	GLY3852	Remote Sensing	GLY3822
		GIS	GLY3741
Structural Geology II	GLY3862	Structural Geology II	GLY3862

G.5. APPLIED MASTER IN GEOLOGY 11MSGL

G.5.1. REGULATIONS

G.5.1.1. 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.5.1.2. MODE OF DELIVERY

The programme is offered on a full-time basis on a block course 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 courses are offered only every second year (first year courses in odd years [i.e. 2013, 2015,…] and second year courses in the even years [i.e. 2014, 2016]. **There is no student intake for 2014.**

G.5.1.3. 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.5.1.4. 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.5.1.5. 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.5.1.6. 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 course 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.5.1.7. 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.5.2. CURRICULUM APPLIED MASTER IN GEOLOGY 11MSGL

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

YEAR 1

SEMESTER	COURSE	CODE	CREDITS	PRE-/CO-REQUISITE	COMPULSORY	ELECTIVE
1&2	Academic Writing for Postgraduate Studies	UAE5819	(24)	none	Yes	
1	Applied GIS and Remote Sensing	GLY5901	12	none	Yes	
1	Mineral Processing and Metallurgy	GLY5921	12	none	Yes	
2	Applied Geochemistry	GLY5902	12	none	Yes	
2	Applied Geophysics	GLY5922	12	none	Yes	
1	Project Management, Economics and Law	GLY5911	24	none	Yes	
1	Research methodology	GLY5941	12	none	Yes	
2	Field Techniques and Technical Visits	GLY5912	24	none	Yes	
1&2	Industry Internship	GLY5919	24	none	Yes	

YEAR 2

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-/CO-REQUISITE	COMPULSORY	ELECTIVE
Courses for Major: Exploration & Economic Geology						
1	Ore Forming Processes	GLA5901	12	GLY5902, GLY5912	Yes	
1	Exploration Techniques, Methodology, and Economics	GLA5911	24	GLY5901, GLY5912, GLY5922	Yes	
1	Ore Body Modelling and Evaluation	GLA5931	24	GLY5912		
1	Underground and Open Pit Mining	GLA5921	12	GLY5921, GLY5912	Yes	
Courses for Major: Exploration & Economic Geology						
1	Hydro-geochemistry	GLE 5911	24	GLY5902	Yes	
1	Protection and Management of Water Resources	GLE 5931	24	GLY5902, GLY5911	Yes	
1	Environmental impact assessment and sustainable development	GLE5941	12	GLY5911, GLY5912	Yes	
1	Impact of mining activities on aquatic systems	GLE5961	12	GLY5902, GLY5911	Yes	
Courses for both Major						
1&2	Master Thesis (Mini Thesis)	GLY5900	60	All first year courses	Yes	

G.5.3. COURSE DESCRIPTIONS MSC APPLIED GEOLOGY

FIRST YEAR COURSES

GLY5901: APPLIED GIS AND REMOTE SENSING

Course title: **Applied GIS and Remote Sensing**
Code: **GLY 5901**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.
Course 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

Course Title: **Mineral Processing and Metallurgy**
Code: **GLY5921**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.
Course 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

Course Title: **Applied Geochemistry**
Code: **GLY5902**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments.Examination 50%: One 2 hour exam paper.
Course 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

Course title: **APPLIED GEOPHYSICS**
Code: **GLY5922**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.
Course 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

Course Title: **Project Management, Economics and Law**
Code: **GLY5911**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Course Assessment: Continuous 50%: At least 3 seminars; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.
Course 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

Course title: **Research Methodology**
Code: **GLY5941**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical
Credits: 12
Course assessment: Continuous 100%: At least 5 assignments and one written test.
Course 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

Course Title: **Field Techniques and Technical Visits**
Code: **GLY5912**
NQF level: 9
Contact hours: 18 days.
Credits: 24
Course 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.
Course 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

Course Title: **INDUSTRY INTERNSHIP**
Code: **GLY5919**
NQF level: 9
Contact hours: Face to face consultations with supervising lecturer and/or coordinating lecturer on a regular basis.
Credits: 24
Course Assessment: Continuous 100%: daily field/lab logbook (30%), Company assessment (10%), Lecturer assessment (10%), Final Report (30%), and Seminar Presentation (20%).

Course 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 COURSES

GLY5900: MSC THESIS (MINI THESIS)

Course title: **MSc Thesis (Mini Thesis)**
Code: **GLY5900**
NQF level: 9
Contact hours: Face to face consultation with supervisor and coordinator on a regular basis.
Credits: 60
Prerequisites: Pass all first year courses

Course 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..

Course 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 COURSES: MAJOR IN EXPLORATION & ECONOMIC GEOLOGY

GLA5901: ORE FORMING PROCESSES

Course title: **Ore Forming Processes**
Code: **GLA5901**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5902, GLY5912

Course assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.

Course 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

Course Title:	**Exploration Techniques, Methodology, and Economics**
Code:	**GLA5911**
NQF level:	9
Contact hours:	56 h lectures and 72 h practical.
Credits:	24
Prerequisites:	GLY5901, GLY5912, GLY5922

Course Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.

Course 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

Course Title:	**Ore Body Modelling and Evaluation**
Code:	**GLA5931**
NQF level:	9
Contact hours:	56 h lectures and 72 h practical.
Credits:	24
Prerequisites:	GLY5912

Course Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.

Course 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

Course title: **Underground and Open Pit Mining**
Code: **GLY5921**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5912, GLY5921
Course assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.
Course 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 COURSES

MAJOR IN ENVIRONMENTAL GEOLOGY & HYDROGEOLOGY

GLE5911: HYDRO-GEOCHEMISTRY

Course Title: **Hydro-geochemistry**
Code: **GLE5911**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Prerequisites: GLY5902
Course Assessment: Continuous 50%: At least 3 seminars; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.
Course 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

Course title: **Protection and Management of Water Resources**
Code: **GLE5931**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Prerequisites: GLY5902, GLY5911
Course assessment: Continuous 50%: At least 3 seminars; 2 tests, 2 assignments. Examination 50%: One 3 hour exam paper.
Course 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

Course Title: **Environmental Impact Assessment and Sustainable Development**
Code: **GLE5941**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5911, GLY5912
Course Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.
Course 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

Course Title: **Impact of mining activities on aquatic systems**
Code: **GLE5961**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5911, GLY5902
Course Assessment: Continuous 50%: At least 5 practicals; 2 tests, 2 assignments. Examination 50%: One 2 hour exam paper.
Course 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. . To register for a B.Sc. in Financial Mathematics (Honours), a candidate needs to have obtained at least a B-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 courses, 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 courses in this programme. Continuous assessment will consist of a subset of the following, depending on the course 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 courses as indicated below:

- **4 courses** (equivalent to **64** credits) by the end of the **first year**; **2** of these courses (equivalent to **32 credits**) must be **non-core**,
- **8 courses** (equivalent to **144** credits) by the end of the **second year**,
- **15 courses** (equivalent to **240** credits by the end of the **third year**, and
- **23 courses** (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 courses 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 courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for such courses.

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

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

A student may not take more than the equivalent of **12 full courses** 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 courses, **368** are from Mathematics courses and **112** from elective courses 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 courses: **11BSCM**

YEAR 1

SEMESTER	COURSE NAME	COURSE 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	Physics for Physical Sciences I	PH 3511	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	Physics for Physical Sciences II	PHY3512	16		PHY 3511
Total Credit			**144**		

YEAR 2:

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1`	Sets and Logic	MAT3661	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3641	8	MAT3521	None
1	Optics	PHY3601	8	PHY3512 and MAT3512	None
1	Mechanics and Waves	PHY3651	16	PHY3511 and MAT3512	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 course at first year and MAT3521	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Electromagnetism	PHY3612	16	PHY3512 and MAT3512	None
2	Electronics	PHY3622	8	PHY3512 and MAT3512	None
Total Credit			**136**		

YEAR 3:

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	MAT3611 and MAT3612	None
1	Linear Algebra I	MAT3711	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) and MAT3641	None
1	Elements of Set Theory	MAT3781	8	(MAT3611 or MAT3612) and MAT3661	None
1	Research Methodology	MAT3761	8	MAT3661	None
1	Electrodynamics	PHY3711	16	PHY3612 and MAT3612	None
2	Real Analysis II	MAT3732	16	MAT3611 and MAT3612	None
2	Linear Algebra II	MAT3712	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
2	Vector Analysis	MAT3742	8	MAT3611 and MAT3612	None
2	Number Theory	MAT3722	8	(MAT3611 or MAT 3612) and MAT 3661	None
2	Partial Differential Equations	MAT3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			**136**		

YEAR 4:

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Research Project	MAT3810	16	All mathematics courses 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 courses up to Year 3	None
2	Normed Vector Spaces	MAT3822	8	(MAT3731 or MAT3732) and (MAT3711 or MAT3712)	None
2	Category Theory	MAT3802	8	MAT3781	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 courses: **11BSMC**

YEAR 1

SEMESTER	COURSE / NAME	COURSE 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	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3641	8	MAT3521	None
1	Introduction to Database Systems	CMP3611	16	CMP3512	None
1	Object Oriented Programming I	CMP3691	16	CMP3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics course at first year and MAT3521	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Advanced Databases	CMP3622	16	CMP3511	CMP3611
2	Object Oriented Programming II	CMP3692	16	CMP3511& CMP3512	CMP3691
Total Credit			**136**		

YEAR 3

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	MAT3611 and MAT3612	None
1	Linear Algebra I	MAT3711	16	(MAT 3611 or MAT3612) and MAT3661 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) and MAT3641	None
1	Elements of Set Theory	MAT3781	8	(MAT3611 or MAT3612) and MAT3661	None
1	Research Methodology	MAT3761	8	MAT3661	None
1	Data Structures and Algorithms	CMP3791	16	CMP3692	None
2	Real Analysis II	MAT3732	16	MAT 3611 and MAT3612	None
2	Linear Algebra II	MAT3712	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
2	Vector Analysis	MAT3742	8	MAT3611 and MAT3612	None
2	Number Theory	MAT3722	8	(MAT3611 or MAT3612) and MAT3661	None
2	Partial Differential Equations	MAT3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			**136**		

YEAR 4

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Research Project	MAT3810	16	All mathematics courses 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 courses up to Year 3	None
2	Normed Vector Spaces	MAT3822	8	(MAT3731 or MAT3732) and (MAT3711 or MAT3712)	None
2	Category Theory	MAT3802	8	MAT3781	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 courses: **11BSMS**

YEAR 1

SEMESTER	COURSE / NAME	COURSE 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	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3641	8	MAT3521	None
1	Probability Theory	STS3611	16	STS3532 and MAT3512	None
1	Statistical Methods	STS3671	16	STS3532	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics course 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	Distribution Theory	STS3692	16		STS3611 and MAT3611
Total Credit			**136**		

YEAR 3:

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	MAT3611 and MAT3612	None
1	Linear Algebra I	MAT3711	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) and MAT3621	None
1	Elements of Set Theory	MAT3781	8	(MAT 3611 or MAT3612) and MAT3661	None
1	Research Methodology	MAT3761	8	MAT3661	None
1	Statistical Inference	STS3771	16	STS3671	None
2	Real Analysis II	MAT3732	16	MAT3611 and MAT3612	None
2	Linear Algebra II	MAT3712	16	(MAT 3611 or MAT3612) and MAT3661 and MAT3652	None
2	Vector Analysis	MAT3742	8	MAT3611 and MAT3612	None
2	Number Theory	MAT3722	8	(MAT3611 or MAT 3612) and MAT3661	None
2	Partial Differential Equations	MAT3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			**136**		

YEAR 4

SEMESTER	COURSE / NAME	COURSE CODE	CREDITS	PREREQUISITES	CO-REQUISITES
1	Research Project	MAT3810	16	All mathematics courses 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 courses 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 3781	None
2	Algebra	MAT3872	16	MAT 3711 or MAT 3712	None
2	Complex Analysis II	MAT3852	16	MAT 3731 or MAT 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 courses:

YEAR 1

SEMESTER	COURSE	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		
1	Basic Mathematics	MAT3511	16		
1	Computer Literacy	CLC3509	8		
1	Analytic Geometry	MAT3501	8		
1	Matrices and Complex Numbers	MAT3521	8		
1	Basic Microeconomics	EMI3571	16		
2	English for Academic Purposes	LEA3519	16		
2	Contemporary Social Issues	CSI3580	8		
2	Precalculus	MAT3512	16		
2	Basic Financial Mathematics	MAF3532	16		
2	Mathematical Statistics	MAF3552	16		
2	Basic Macroenomomics	EMA3572	16		
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	CODE	CREDITS	PRE-COREQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Probability theory	STS3611	16	MAF3532	None
1	Numerical Methods with MATLAB	MAT3641	8	MAT3521	None
1	Financial Mathematics I	MAF3651	16	MAF3532	None
1	Economics I	MAF3671	16	EMA3572 & EMI3571	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 & 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	COURSE	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	MAT3611 & MAT3612	None
1	Assets and Liabilities	MAF3751	16	MAF 3651 & MAF3652	None
1	Numerical Analysis I	MAT3701	8	(MAT3611 or MAT3612) & MAT3621	None
1	Differential Equations & Integral Transforms	MAF3771	16	MAT3611 or MAT3612	None
1	Distribution Theory	STS3721	8	STS3611 & STS3632	None
2	Real Analysis II	MAT3732	16	MAT3611 & MAT3612	None
2	Mathematical Modeling	MAF3762	8		MAF3771
2	Financial Modeling	MAF3782	8		MAF3771
2	Risk Theory	MAF3732	16	MAF3651 and MAF3652	None
2	Programming	MAF3742	8	MAT3641	None
2	Research Methodology	MAF3722	16	STS3611 and STS3632	None
Total Credits			**136**		

YEAR 4

SEMESTER	COURSE	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 courses 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	MAT3701 or MAT3732	None
2	International Business Finance	MAF3862	8	MAF3732 and MAF3751	None
Total Credits			**128**		

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

FIRST YEAR COURSES:

MAT3511BASIC MATHEMATICS (MAT3580 BASIC MATHEMATICS A)

Course Code	**MAT3511**
NQF Level	5
Notional Hours	160
NQF Credits	16
Prerequisite	NSSC Mathematics
Contact Hours	4 lectures plus 2 tutorials per week for 14 weeks

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

Course 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.**Trigonometry:** Trigonometric ratios, angle orientation in the *xy*-plane, graphs of trigonometric functions , trigonometric identities, justifying (proving) equality of relatively simple trigonometric expressions. Sum/difference, double angle, half angle and sum to product formulas.**Sequences:** Definition, notation, obtaining the general term in sequences, arithmetic sequences, geometric sequences, recursively defined sequences.

MAT3501ANALYTIC GEOMETRY (MAT3520 ANALYTIC GEOMETRY A)

Course Code	**MAT3501**
NQF Level	5
Notional Hours	80
NQF Credits	8
Prerequisite	NSSC Mathematics
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks

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

Course Content: Introduction: Lines, circles and tangent lines. **Conic sections:** ellipse, parabola, hyperbola. Translation and rotation of the axes.**Parametric equations:** circle, ellipse, Parabola, Hyperbola,cycloids. **Polar coordinates:** definition, relating polar and Cartesian coordinates, Conic sections in polar coordinates. **Surfaces and quadrics:** Spheres, cylinders, ellipsoids, paraboloids, hyperboloids, cones. Spherical and cylindrical coordinates.

MAT3521 MATRICES AND COMPLEX NUMBERS (MAT3540 MATRICES AND COMPLEX NUMBERS A)

Course Code	**MAT3521**
NQF Level	5
Notional Hours	80
NQF Credits	8
Prerequisite	NSSC Mathematics
Contact Hours	2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment:	Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Course 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.

MAT3512 PRECALCULUS (MAT3570 PRECALCULUS A)

Course Code **MAT3512**
NQF Level 5
Notional Hours 160
NQF Credits 16
Prerequisite IGCSE Mathematics
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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. Polynomial functions, rational functions and their graphs. Introduction of exponential and logarithmic functions.Trigonometric functions and their graphs, inverse trigonometric functions, 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, derivatives of polynomial and rational functions, increasing and decreasing functions and graph sketching.**Integration:** Antiderivatives (polynomial functions and rational exponents), the definite integral, area under a graph.

MAF3552 MATHEMATICAL STATISTICS

Course name: **MATHEMATICAL STATISTICS**
Code: **MAF3552**
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
Course 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.

MAF3532 BASIC FINANCIAL MATHEMATICS

Course name: **BASIC FINANCIAL MATHEMATICS**
Code: **MAF3532**
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
Course 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 COURSES:

MAT 3661 SETS AND LOGIC

Course Code **MAT 3661**
NQF Level 6
Notional Hours 80
NQF Credits 8
Prerequisite MAT 3511
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course 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.

MAT3611 CALCULUS I

Course Code **MAT3611**
NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite MAT3512
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT3641 NUMERICAL METHODS WITH MATLAB

Course Code **MAT3641**
NQF Level 6
Notional Hours 80
NQF Credits 8
Prerequisite MAT3521
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course 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).

MAT3642OR**DINARY DIFFERENTIAL EQUATIONS**

Course Code **MAT3642**
NQF Level 6
Notional Hours 80
NQF Credits 8
Prerequisite MAT 3521 and MAT 3512
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course 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.

MAT3612 CALCULUS II

Course Code **MAT3612**
NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite MAT3512
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT3652ELEMENTARY LINEAR ALGEBRA

Course Code **MAT3652**
NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite Any full course of the first year and MAT 3521
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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

Course name: **FINANCIAL MATHEMATICS I**
Code: **MAF3651**
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
Course 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.

MAF 3652 FINANCIAL MATHEMATICS II

Course name: **FINANCIAL MATHEMATICS II**
Code: **MAF3652**
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
Course 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.

MAF3671 ECONOMICS I

Course 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 and EMI3571

Course 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.

MAF3671 ECONOMICS II

Course 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: EMA3572 and EMI3571

Course 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 COURSES:

MAT3731 REAL ANALYSIS I

Course Code **MAT3731**
NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite MAT3611 and MAT3612
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT3701 NUMERICAL ANALYSIS I

Course Code **MAT3701**
NQF Level 7
Notional Hours 80
NQF Credits 8
Prerequisite (MAT3611 or MAT 3612) and MAT3641
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination 50% (1 x 2-hour paper).
Course 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.

MAT3781ELEMENTS OF SET THEORY

Course Code **MAT3781**
NQF Level 7
Notional Hours 80
NQF Credits 8
Prerequisite (MAT3611 or MAT 3612) and MAT3661
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination 50% (1 x 2-hour paper).
CourseContent 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.

MAT3711 LINEAR ALGEBRA I

Course Code **MAT3711**
NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite (MAT3611 or MAT3612) and MAT3661 and MAT3652
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT 3722NUMBER THEORY

Course Code **MAT 3722**
NQF Level 7
Notional Hours 80
NQF Credits 8
Prerequisite (MAT 3611 or MAT 3612) and MAT 3661
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course 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.

MAT3752 PARTIAL DIFFERENTIAL EQUATIONS

Course Code **MAT3752**
NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite (MAT3611 or MAT3612) and MAT3642
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT3732 REAL ANALYSIS II

Course Code **MAT3732**
NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite MAT 3611 and MAT 3612
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT 3742VECTOR ANALYSIS

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

MAT 3761RESEARCH METHODOLOGY

Course Code **MAT 3761**
NQF Level 7
Notional Hours 80
NQF Credits 8
Prerequisite MAT3661

Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 100% (Seminar presentation, proposal writing).
Course Content This course 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.

COURSE TITLE: **LINEAR ALGEBRA II**

Course Code **MAT 3712**
NQF Level 7
Notional Hours 160
NQF Credits 16
Prerequisite (MAT 3611 or MAT 3612) and MAT 3661 and MAT 3652
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAF3741 DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS

Course name: **DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS**
Code: **MAF3771**
NQF level: 7
Notional Hours 160
NQF Credits 16
Prerequisite MAT3611 or MAT3612
Contact hours: 4 lectures per week for 14 weeks 2 tutorial per week for 14 weeks
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Course 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

Course name: **ASSETS AND LIABILITIES**
Code: **MAF3751**
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: MAF3651and MAF3652
Course 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

Course 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).
Co-requisite:	MAF3771

Course description: MATLAB. Data types and control structures. Functions, procedures and subroutines and courses. 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

Course name:	**FINANCIAL MODELING**
Code:	**MAF3782**
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), Practical examination **50%** (2 hours examination paper).

Co-requisite: MAF3771

Course description: The course 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

Course 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 and MAF3652

Course 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.

MAF3722 RESEARCH METHODOLOGY

Course 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: 100% (Seminar presentation, proposal writing).
Prerequisite:	STS3611 and STS3692

Course description: This course 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 COURSES:

MAT 3811GENERAL TOPOLOGY

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

MAT 3872ALGEBRA

Course Code **MAT 3872**
NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite MAT 3711 or MAT 3712
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT 3851COMPLEX ANALYSIS I

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

MAT 3822NORMED VECTOR SPACES

Course Code **MAT 3822**
NQF Level 8
Notional Hours 80
NQF Credits 8
Prerequisite (MAT 3731 or MAT 3732) and (MAT 3711 or MAT 3712)
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course 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.

MAT 3871 NUMERICAL ANALYSIS II

Course Code **MAT 3871**
NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite MAT 3701 or MAT 3732
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT 3852COMPLEX ANALYSIS II

Course Code **MAT 3852**
NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite MAT 3731 or MAT 3732
Contact Hours 4 lectures plus 2 tutorials per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course 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.

MAT 3802CATEGORY THEORY

Course Code **MAT 3802**
NQF Level 8
Notional Hours 80
NQF Credits 8
Prerequisite MAT 3781
Contact Hours 2 lectures plus 1 tutorial per week for 14 weeks
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course 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.

MAT 3810RESEARCH PROJECT

Course Code MAT 3810
NQF Level 8
Notional Hours 320
NQF Credits 32
Prerequisite All courses of mathematics up to third year
Contact Hours 1 contact hour with supervisor per week throughout academic year
Course Assessment: Continuous Assessment 100% (Seminar Presentations: 30%, Written Project: 70%)
Course 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

Course name: **ELEMENTS OF DYNAMICAL SYSTEMS**
Code: **MAF3881**
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 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: MAF3751 and MAF3732
Course 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

Course 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 and MAF3732
Course 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

Course name: **MATHEMATICAL METHODS**
Code: **MAF3821**
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: MAT3671 or MAT3672
Course 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

Course 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 and MAF3732
Course 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.

MAF3862: INTERNATIONAL BUSINESS FINANCE

Course name:	**INTERNATIONAL BUSINESS FINANCE**
Code:	**MAF3862**
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%** [30% (Assignments)] Examination **50%** [70% (oral presentation of written project 20%, written project 80%)]
Prerequisite:	MAF3732 and MAF3751

Course 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.

COURSE TITLE: RESEARCH PROJECT

Course Code	**MAF 3810**
NQF Level	8
Notional Hours	320
NQF Credits	32
Prerequisite	All courses of financial mathematics up to third year
Contact Hours	1 contact hour with supervisor per week throughout academic year
Course Assessment:	Continuous Assessment 100% (Seminar Presentation: 30%, Written Project: 70%)

Course 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.

MAF3842: OPERATIONS RESEARCH

Course 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 and MAF3732

Course 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.

H.5. MATHEMATICS: COURSE EQUIVALENTS

OLD COURSES (Started in 2008)	NEW COURSES (Revised in 2012)
MAT3511: Basic Mathematics MAT3580: Basic Mathematics A	MAT3511: Basic Mathematics MAT3580: Basic Mathematics A
MAT3531: Analytic Geometry, Complex Numbers and Matrices	MAT3501: Analytic Geometry MAT3521: Matrices and Complex Numbers
MAT3590: Analytic Geometry, Complex Numbers and Matrices A	MAT3520: Analytic Geometry A MAT3540: Matrices and Complex Numbers A
MAT3512: Precalculus MAT3570: Precalculus A	MAT3512: Precalculus MAT3570: Precalculus A
MAT3601: Sets and Numbers	MAT3661: Sets and Logic
MAT3611: Calculus I	MAT3611: Calculus I
MAT3621: Numerical Methods	MAT3641: 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	MAT3781: 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 courses 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 course he/she may proceed to the next semester. However he/she must repeat the course in the following year. A minimum of 50% is required to pass each course.

H.6.1.5. SEMINARS

Students are expected to give a seminar presentation as part of their continuous assessment in each course.

H.6.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: MSc Mathematics (11MSCM)

YEAR 1

SEMESTER	COURSE 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	COURSE 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 courses	None
Total Credits			120		

FIRST YEAR COURSES

UAE5819 ACADEMIC WRITING FOR POSTGRADUATE STUDENTS

Course 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
Course Assessment:CA: (1 x 3 hour exam paper)
Prerequisites: Must be a postgraduate student.
Content: This course 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

Course 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
Course Assessment:CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: None
Content: The course 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

Course 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
Course Assessment: CA**: 50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: None
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.

MAA5902 STOCHASTIC DIFFERENTIAL EQUATIONS

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: None
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.

MAT5951 DIFFERENTIAL GEOMETRY

Course 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
Course 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.

MAT5922 RESEARCH METHODOLOGY

Course 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
Course Assessment: **50%** CA (Supervisor's Evaluation); **50%** Departmental Evaluation
Prerequisites: None
Content: The course 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

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50% (**2 hours examination paper)
Prerequisites: None
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.

MAT5942 ALGEBRAIC TOPOLOGY

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: None
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.

MAT5932 TOPICS IN TOPOLOGY

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: None

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

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: None

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.

MAA5942 DYNAMICAL SYSTEMS

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (2 hours examination paper)
Prerequisites: None

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

Course 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
Course Assessment:CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: None
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

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: None
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 COURSES

MAT5931 MEASURE THEORY AND INTEGRATION

Course 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
Course Assessment: CA: **50%** (40% from at least 2 tests and seminar presentation 10%), Examination **50%** (3 hours examination paper)
Prerequisites: None
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.

MAT5950 MSc THESIS

Course Title: **MSc THESIS**
Code: **CHM5950**
NQF Level: 9
Contact Hours: Minimum one year
Credits: 96
Course 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 courses 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 needs 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 courses in this programme. Continuous assessment will consist of a subset of the following, depending on the course 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 courses as indicated below:

- **4** courses (equivalent to **64** credits) by the end of the first year; **2** of these courses (equivalent to **32 credits**) must be non-core,
- **8** courses (equivalent to **144** credits) by the end of the **secondyear**,
- **15** courses (equivalent to **240** credits by the end of the **third year**, and
- **23** courses (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 courses 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 courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for such courses.

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

I.1.5. MAXIMUM NUMBER OF COURSES THAT MAY BE TAKEN PER YEAR

A student may not take more than the equivalent of **12** full courses 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 courses, 376—384 are from physics courses and prescribed mathematics courses and 112—120 credits from elective courses 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 – STREAMS A1, A2, B & C

I.2.1.1. QUALIFICATION: Bachelor of Science in Physics (Honours)

Students opting for **Stream A1 (Mathematics slant)** must take all the following courses **(11BPHY)**

YEAR 1

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices & Complex Numbers	MAT3521	8		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Programming Fundamentals I	CMP3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Physics for Physical Sciences II	PHY3512	16		PHY3511
2	Programming Fundamentals II	CMP3512	16		CMP3511
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	PHY3651	16	PHY3511, MAT3512	None
1	Optics	PHY3601	8	PHY3512, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3641	8	MAT3521	None
1	Object Orientated Programming I	CMP3691	16	CMP3512	None
2	Electromagnetism	PHY3612	16	PHY3512, MAT3512	None
2	Electronics	PHY3622	8	PHY3512, MAT3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics course at first year and MAT3521	None
Total Credits			**136**		

YEAR 3

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	None
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3651,MAT3612	None
1	Computational Physics	PHY3741	8	CMP3511 or CMP3512 or MAT3641	None
1	Real Analysis I*	MAT3731	16	MAT3611 **&** MAT3612	None
2	Analytical Mechanics	PHY3742	16	PHY3651, MAT3612	None
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612	None
2	Research Methodology	PHY3722	8	Any **2**:PHY3651,PHY 3612 or (PHY3601 **&**PHY3622)	None
2	Partial Differential Equations**	MAT3752	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credits			**104**		

*** Any one of MAT3711** or **MAT3731 may be swapped f**or **both the 2 half-courses MAT3701: Numerical Analysis I and** MAT3781**: Elements of Set The**or**y**
**** MAT3752 may be replaced by either MAT3712: Linear Algebra II** or **MAT3732: Real Analysis II**

YEAR 4

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3742, PHY3752	None
1	Statistical Mechanics	PHY3831	16	PHY3651, PHY3701	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Plasma Physics	PHY3821	8	PHY3711	None
2	Solid State Physics	PHY3812	16	PHY3701, PHY3752	None
2	Nuclear Physics	PHY3802	8	PHY3752 or PHE3751	None
2	Optics & Laser Physics	PHY3822	8	PHY3601,PHY3651,PHY3711	None
2	Astrophysics	PHY3842	8	PHY3752	None
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	None
1&2	Research Project	PHY3810	**32**	**All** 3rd-year courses	None
Total Credits			**128**		

I.2.1.2. Bachelor of Science in Physics (Honours)

Students opting for **Stream A2 (Computer Science slant)**must take all the following courses **(11BPCO)**

YEAR 1

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices & Complex Numbers	MAT3521	8		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Programming Fundamentals I	CMP3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Physics for Physical Sciences II	PHY3512	16		PHY3511
2	Programming Fundamentals II	CMP3512	16		CMP3511
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	PHY3651	16	PHY3511, MAT3512	None
1	Optics	PHY3601	8	PHY3512, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Object Orientated Programming I	CMP3691	16	CMP3512	
2	Electromagnetism	PHY3612	16	PHY3512, MAT3512	None
2	Electronics	PHY3622	8	PHY3512, MAT3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics course at first year and MAT3521	None
2	Object Orientated Programming II	CMP3692	16	CMP3511&CMP3512	CMP3691
Total Credits			**128**		

YEAR 3

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	None
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3651, MAT3612	None
1	Computational Physics	PHY3741	8	CMP3511 or CMP3512 or MAT3641	None
1	Linear Algebra I*	MAT3711	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
1	Software Engineering	CMP3731	16	CMP3692	None
2	Analytical Mechanics	PHY3742	16	PHY3651, MAT3612	None
2	Modern Physics	PHY3752	16	PHY(3651 or PHY3612)	None
2	Research Methodology	PHY3722	8	Any **2**: PHY[3651, PHY 3612 or (PHY 3601 **&** PHY 3622)]	None
2	Human Computer Interaction**	CMP3732	16	CMP3692	CMP3731
Total Credits			**120**		

*** MAT3711 may be replaced by MAT3731: Real Analysis I**
**** CMP3732 may be replaced by any one of the following: CMP3772: Web Design& Programming, MAT3712: Linear Algebra II,** or **MAT3732: Real Analysis II**

YEAR 4

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3742, PHY3752	None
1	Statistical Mechanics	PHY3831	16	PHY3651, PHY3701	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Plasma Physics	PHY3821	8	PHY3711	None
2	Solid State Physics	PHY3812	16	PHY3701, PHY3752	None
2	Nuclear Physics	PHY3802	8	PHY3752 or PHE3751	None
2	Optics & Laser Physics	PHY3822	8	PHY3601,PHY3651,PHY3711	None
2	Astrophysics	PHY3842	8	PHY3752	None
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	None
1&2	Research Project	PHY3810	**32**	**All** 3rd-year courses	None
Total Credits			**128**		

I.2.1.3. QUALIFICATION: Bachelor of Science in Physics (Honours)

Students opting for **Stream B (Geology Electives)** must take all the following courses **(11BPGL)**

YEAR 1

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices & Complex Numbers	MAT3521	8		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Programming I	CMP3511	16		None
1	Introduction to Physical Geology & Surface Processes	GLY3521	8		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Physics for Physical Sciences II	PHY3512	16		PHY3511
2	Introduction to Earth Systems	GLY3502	8		None
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	PHY3651	16	PHY3511, MAT3512	None
1	Optics	PHY3601	8	PHY3512, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Introduction to Hydrology	GLY3621	8	MAT3512, GLY3521	
2	Electromagnetism	PHY3612	16	PHY3512, MAT3512	None
2	Electronics	PHY3622	8	PHY3512, MAT3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	16	MAT3521 and MAT3512	None
2	Elementary Linear Algebra	MAT3652	8	Any full mathematics course at first year and MAT3521	None
2	Introductory Petrology	GLY3662	16	GLY3521	None
2	Geological Mapping & Stratigraphy	GLY3612	16	GLY3521	None
Total Credits			**152**		

YEAR 3

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	None
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3651, MAT3612	None
1	Computational Physics	PHY3741	8	CMP3511 or CMP3512 or MAT3641	None
1	Real Analysis I*	MAT3731	16	MAT3611 and MAT3612	None
1	Regional Geology of Namibia	GLY3761	8	GLY3521	None
1	Plate Tectonics	GLY3721	8	GLY3621	None
2	Analytical Mechanics	PHY3742	16	PHY3651, MAT3612	None
2	Modern Physics	PHY3752	16	PHY(3651 or PHY3612)	None
2	Research Methodology	PHY3722	8	Any **2**: PHY[3651, PHY 3612 or (PHY3601 **&** PHY3622)]	None
2	Structural Geology I	GLY3712	16	GLY3612, MAT3612	None
Total Credits			**128**		

*** MAT3731 may be replaced by MAT3711: Linear Algebra I**

YEAR 4

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	SPHY3811	16	PHY3742, PHY3752	None
1	Statistical Mechanics	SPHY3831	16	PHY3651, PHY3701	None
1	Advanced Electrodynamics**	SPHY3809	8	PHY3711	None
1	Plasma Physics**	SPHY3821	8	PHY3711	None
1&2	Research Project	SPHY3810	32	**All** 3rd-year courses	None
2	Solid State Physics	SPHY3812	16	PHY3701, PHY3752	None
2	Nuclear Physics	SPHY3802	8	PHY3752 or PHE3751	None
2	Optics & Laser Physics**	SPHY3822	8	PHY3601,PHY3651,PHY3711	None
2	Astrophysics**	SPHY3842	8	PHY3752	None
2	Advanced Potential Field Methods	SPHY3862	8	PHY3711	None
Total Credits			**128**		

**** Any two of these half courses (PHY3809, 3821, 3822** or **3842) may be replaced by GLY3832: Exploration Geology & Geophysics**

I.2.1.4. Bachelor of Science in Physics (Honours)

Students opting for **Stream C (Chemistry Electives)** must take all the following courses **(11BPCH)**

YEAR 1

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	English Comunication & Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry	MAT3501	8		None
1	Matrices & Complex Numbers	MAT3521	8		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Chemistry 1A	CHM3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Physics for Physical Sciences II	PHY3512	16		PHY3511
2	Chemistry 1B	CHM3512	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Mechanics & Waves	PHY3651	16	PHY3511, MAT3512	None
1	Optics	PHY3601	8	PHY3512, MAT3512	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Inorganic Chemistry I	CHM3611	16	CHM3511 **&** CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511 **&** CHM3512 **&** MAT3511 **&**MAT3512	None
2	Electromagnetism	PHY3612	16	PHY3512, MAT3512	None
2	Electronics	PHY3622	8	PHY3512, MAT3512	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521 and MAT3512	None
2	Elementary Linear Algebra	MAT3652	16	Any full mathematics course at first year and MAT3521	None
2	Analytical Chemistry I	CHM3602	8	CHM3511 **&** CHM3512	None
Total Credits			**144**		

YEAR 3

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Electrodynamics	PHY3711	16	PHY3612, MAT3612	
1	Thermodynamics & Kinetic Theory	PHY3701	8	PHY3651, MAT3612	
1	Real Analysis I*	MAT3731	16	MAT3611 and MAT3612	
1	Analytical Chemistry II	CHM3721	8	CHM3602	
1	Inorganic Chemistry II	CHM3701	8	CHM3611, MAT3612	
2	Analytical Mechanics	PHY3742	16	PHY3651, MAT3612	
2	Modern Physics	PHY3752	16	PHY(3651 or PHY3612)	
2	Research Methodology	PHY3722	8	Any **2**: PHY[3651PHY 3612 or (PHY3601 **&** PHY3622)]	
2	Physical Chemistry II	CHM3712	16	CHM3631	
Total Credits			**112**		

*** MAT3731 may be replaced by MAT3711: Linear Algebra I**

YEAR 4

SEMESTER	COURSE	CODE	CREDIT	PREREQUISITES	COREQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3742, PHY3752	
1	Statistical Mechanics	PHY3831	16	PHY3651, PHY3701	
1	Advanced Electrodynamics	PHY3809	8	PHY3711	
1	Plasma Physics	PHY3821	8	PHY3711	
2	Solid State Physics	PHY3812	16	PHY3701, PHY3752	
2	Nuclear Physics	PHY3802	8	PHY3752 or PHE3751	
2	Optics & Laser Physics	PHY3822	8	PHY3601,PHY3651,PHY3711	
2	Astrophysics	PHY3842	8	PHY3752	
2	Advanced Potential Field Methods	PHY3862	8	PHY3711	
1&2	Research Project	PHY3810	**32**	**All** 3rd-year courses	
Total Credits			**128**		

I.3. PHYSICS SERVICE COURSES

SEMESTER	COURSE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
I	Physics for Life Sciences I	PHY3501	8	NSSC Physical Science	None
I	Modern Physics for Educators	PHE3751	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
II	Electricity and Magnetism	PHE3642	8	PHY3512, MAT3511, MAT3512	None
Total Credit			**56**		

I.4. PHYSICS CURRICULUM COURSE DESCRIPTIONS

FIRST YEAR COURSES

PHY3511: PHYSICS FOR PHYSICAL SCIENCES I

Course title: **PHYSICS FOR PHYSICAL SCIENCES I**
Code: **PHY3511**
NQF level: 5
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course 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)
Course 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

Course title: **PHYSICS FOR LIFE SCIENCES I**
Code: **PHY3501**
NQF level: 5
Contact hours: 28 Lectures and 14 Practical Sessions/Tutorials
Credits: 8
Course 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)
Co-requisites: PHY3511
Course description: This course is to introduce Life science students to physics concepts and applications that will be useful to them in their undergraduate studies and carrier. The course 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

Course Title: **PHYSICS FOR PHYSICAL SCIENCES II**
Code: **PHY3512**
NQF Level: 5
Contact Hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course 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)
Course description (contents): This course 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

Course Title: **PHYSICS FOR LIFE SCIENCES II**
Code: **PHY3532**
NQF Level: 5
Contact Hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course 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
Course description (contents): This course 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 course 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

Course Title: **PHYSICS FOR RADIOGRAPHERS**
Code: **PHY3402**
NQF Level: 4
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course 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
Course 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 COURSES

PHY3651: MECHANICS & WAVES

Course title: **MECHANICS & WAVES**
Code: **PHY3651**
NQF level: 6
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course 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 and MAT3512: Precalculus
Course 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

Course Title: **OPTICS**
Code: **PHY3601**
NQF Level: 6
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course Assessment: Continuous [**50%**], Minimum 2 tests and 2 assignments. Exam [**50%**], 1 x 2-hour paper
Pre-requisites: PHY3512: Physics for physical sciences II and MAT3512: Precalculus
Course 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

Course 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 and MAT3512: Precalculus
Model description (contents): This course 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

Course Title: **ELECTRONICS**
Code: **PHY3622**
NQF Level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course Assessment: Continuous: **50%**, Examination: **50%** (1 x 2 hour exam)
Pre-requisites: PHY3512: Physics for Physical Sciences II and MAT3512: Precalculus
Course description: This course 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

Course title: **ELECTRICITY AND MAGNETISM**
Code: **PHE3642**
NQF Level: 6
Contact Time: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course 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.
Course description (content): The content of the course 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 COURSES

PHY3711: ELECTRODYNAMICS

Course title: **ELECTRODYNAMICS**
Code: **PHY3711**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16 NQF credits
Course 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
Course 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

Course title: **THERMODYNAMICS AND KINETIC THEORY**
Code: **PHY3701**
NQF Level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course 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: PHY3651: Mechanics & Waves and MAT3612: Calculus II
Course 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

Course title: **COMPUTATIONAL PHYSICS**
Code: **PHY3741**
NQF level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course 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 Fundamentals I or CMP3512: Programming Fundamentals II or MAT3641: Numerical Methods with Matlab
Course 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;

PHY3742: ANALITICAL MECHANICS

Course title: **ANALITICAL MECHANICS**
Code: **PHY3742**
NQF level: 7
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 16

Course assessment: Continuous Assessment (**50%**) and one 3-hour Exam Paper (**50%**). Continuous assessment will consist of class tests, assignments and practical reports.

Pre-requisites: PHY3651: Mechanics & Waves, MAT3612: Calculus II

Course 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;

PHE3751: MODERN PHYSICS FOR EDUCATORS

Course title: **MODERN PHYSICS FOR EDUCATORS**
Code: **PHE3751**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16

Course 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.

Course 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.

PHY3752 MODERN PHYSICS

Course title: **MODERN PHYSICS**
Code: **PHY3752**
NQF Level: 7
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16

Course assessment: Continuous assessment (class tests, assignments) **50%**, 3-hour written exam **50%**

Pre-requisites: MAT3612: Calculus II and **either** PHY3651: Mechanics & Waves or PHY3612: Electromagnetism

Course 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

Course title: **RESEARCH METHODOLOGY**
Code: **PHY3722**
NQF Level: 7
Contact hours: 28 Lectures only
Credits: 8 NQF credits
Course assessment: 100% coursework (assignments & a typed report on literature review on some physic topic)
Pre-requisites: At least the equivalent of any two full Physics modules at 2nd-year level, i.e. any 2 of PHY3651: Mechanics & Waves, PHY3612: Electromagnetism or **both** PHY3601: Optics **and** PHY3622: Electronics
Course description (content): Although the actual topics will be adapted to the students research area the following topics will be "generally" covered in this course: 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 COURSES

PHY3811: QUANTUM MECHANICS

Course title: **QUANTUM MECHANICS**
Code: **PHY3811**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course 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: PHY3742: Analytical Mechanics and PHY3752: Modern Physics
Course 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

Course title: **STATISTICAL MECHANICS**
Code: **PHY3831**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course assessment: Continuous assessment (class tests, assignments) **50%**, three hours written exam **50%**
Pre-requisites: PHY3651: Mechanics & Waves and PHY3701: Thermodynamics and Kinetic Theory
Course 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

Course 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
Course 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: All 3rd-year courses
Course description (content): This one-year course constitutes the research and report writing for an available project within the various fields of physics. The actual content of the course 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

Course title: **ADVANCED ELECTRODYNAMICS**
Code: **PHY3809**
NQF Level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8 NQF credits
Course assessment: Continuous assessment (minimum of 2 tests, 2 assignments and practical reports) **50%**, written examination **50%**
Pre-requisites: PHY3711: Electrodynamics
Course description (content): This course is a follow-up on the course 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

Course title: **PLASMA PHYSICS**
Code: **PHY3821**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course 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
Course 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

Course title: **SOLID STATE PHYSICS**
Code: **PHY3812**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16

Course 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.

Course 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.

PHY3822: OPTICS AND LASER PHYSICS

Course Title: **OPTICS AND LASER PHYSICS**
Code: **PHY3822**
NQF Level: 8
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8

Course Assessment: Continuous [**50%**], Minimum 1 test and 1 assignment Exam [**50%**], 1 x 2-hour paper

Pre-requisites: PHY3601: Optics, PHY3651: Mechanics & Waves and PHY3711: Electrodynamics

Course Description (contents): This course 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.

PHY3802: NUCLEAR PHYSICS

Course title: **NUCLEAR PHYSICS**
Code: **PHY3802**
NQF Level: 8
Contact hours:28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8

Course 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: PHY3752: Modern Physics or PHE3751: Modern Physics for Educators

Course 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.

PHY3842: ASTROPHYSICS

Course title: **ASTROPHYSICS**
Code: **PHY3842**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment **(50%)** and 1 2-hour Exam Paper **(50%)**
Continuous Assessment will consist of class tests, assignments and practical reports.
Pre-requisites: PHY3752: Modern Physics
Course 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

Course Title: **ADVANCED POTENTIAL FIELDS**
Code: **PHY3862**
NQF Level: 8
National Professional: None
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous assessment (**50%**, Minimum 2 tests and 2 or more practical assignments) Examination (**50%**1 x 3-hour paper)
Pre-requisites: PHY3711: Electrodynamics
Course 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
PHY3511: Physics for Physical Sciences I	PHY3511: Physics for Physical Sciences I
PHY3512: Physics for Physical Sciences II	PHY3512: Physics for Physical Sciences II
PHY3611: Classical Mechanics	PHY3651: Mechanics & Waves
PHY3631: Waves & Optics	PHY3601: Optics **&**PHY3651: Mechanics & Waves
PHY3612: Electromagnetism	PHY3612: Electromagnetism
PHY3602: Modern Physics I	(to be offered again)
PHY3711: Electrodynamics	PHY3711: Electrodynamics
PHY3701: Thermodynamics & Kinetic Theory	PHY3701: Thermodynamics & Kinetic Theory
PHY3721: Computational Physics with C++	PHY3741: Computational Physics
PHY3712: Theoretical Mechanics	PHY3742: Analytical Mechanics
PHY3732: Modern Physics II	PHY3752: Modern Physics
PHY3702: Electronics I	(to be offered again)
PHY3722: Research Methodology	PHY3722: Research Methodology
PHY3811: Quantum Mechanics	PHY3811: Quantum Mechanics
PHY3831: Statistical Mechanics	PHY3831: Statistical Mechanics
PHY3810: Research Project	PHY3810: Research Project
PHY3809: Advanced Electrodynamics	PHY3809: Advanced electrodynamics
PHY3821: Plasma Physics	PHY3821: Plasma Physics
PHY3812: Solid State Physics	PHY3812: Solid State Physics
PHY3802: Nuclear Physics	PHY3802: Nuclear Physics
PHY3822: Optics and Laser Physics	PHY3822: Optics & Laser Phyics
PHY3842: Astrophysics	PHY3842: Astrophysics
PHY3862: Advanced Potential Field Methods	PHY3862: Advanced Potential Field Methods
PHY3402: Physics for Radiographers	PHY3402: Physics for Radiographers
PHY3501: Physics for Life Sciences I	PHY3402: Physics for Radiographers

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 courses 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	COURSE 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	COURSE 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 course UAE5819 (a level 8 course) 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 course. Students must pass all courses 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 COURSES

PHY5911: ADVANCED QUANTUM MECHANICS

Course title: **ADVANCED QUANTUM MECHANICS**
Code: **PHY5911**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Course 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: None

Course 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

Course title: **RESEARCH METHODOLOGY**
Code: **PHY5931**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Course 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: None

Course 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

Course title: **MATHEMATICAL METHODS OF PHYSICS**
Code: **PHY5951**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Course 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: None

Course 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

Course title: **ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Code: **UAE5819**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Course 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

Course description: This course 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

Course title: **LASERS AND APPLICATIONS**
Code: **PHY5912**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Course 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: None

Course description: 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

Course title: **RADIATION PHYSICS**
Code: **PHY5932**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24

Course 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: None

Course description: 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

Course title: **COMPUTATIONAL PHYSICS**
Code: **PHY5952**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24
Course 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: None
Course description: 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

Course title: **ADVANCED CLASSICAL MECHANICS**
Code: **PHY5972**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24
Course 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: None
Course description: 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

Course title: **ASTRO- AND SPACE PHYSICS**
Code: **PHY5992**
NQF level: 9
Contact hours: 56 L + 35P/T
Credits: 24
Course 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: None
Course description: 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 COURSE

PHY5900: THESIS

Course title:	**THESIS**
Code:	**PHY5900**
NQF level:	9
Contact hours:	N/A
Credits:	120

Course 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 courses of the first year must be completed.

Course description: 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.

I.7. MSC NUCLEAR SCIENCE (11MSNU)

I.7.1 DEPARTMENTAL REGULATIONS

I.7.1.1. ADMISSION REQUIREMENTS

The admission requirement for the MSc in Nuclear Science programme will be a NQF Level 8 degree or its equivalent with major in Physics or Chemistry or Mathematics and with one of the following disciplines on at least a second year level: Chemistry, Mathematics, Physics, Geology and Computer Science (but excluding Mathematics/Computer Science and Mathematics/Geology combinations). The applicant will be accepted on the basis of his/her undergraduate academic record with an average mark of 60%. Former UNAM double major graduates with majors in two of the above mentioned disciplines may be admitted but may first have to take and pass relevant additional undergraduate modules prescribed by the Department on a case by case basis.

I.7.1.2. DURATION OF STUDY

The duration of this programme will be two (2) years minimum and three (3) years maximum. The first year will mostly consist of coursework, while the second year will be dedicated to a supervised original research project and the writing of a thesis.

I.7.1.3. CURRICULUM COMPILATION

The curriculum for the MSc in Nuclear Science consists of coursework and the writing of a research thesis. Please refer to the Postgraduate Student Guide from the School of Postgraduate Studies, and the General Prospectus: Information, Regulations & Fees.

I.7.1.4. 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 are required to be admitted to write the examination in a specific course. Students must pass all courses in order to proceed to the thesis component of the degree. In all cases, a minimum mark of 50% is required to pass.

I.7.1.5. 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 at the end of this second year. The 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.7.1.6. 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.7.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: Master of Science IN Nuclear Science (11MSNU)

YEAR 1

SEMESTER	COURSE NAME	CODE	CREDIT	PREREQUISITE	Compulsory/Elective	CO-REQUISITES
1	Principles of Nuclear Physics	NUC5911	24	Admission requirements	Compulsory	None
1	Nuclear Instrumentation	NUC5901	12	Admission requirements	Compulsory	None
1	Mathematical Methods for Nuclear Scientists	NUC5921	12	Admission requirements	Compulsory	None
1	Research Methodology	PHY5931	24	Admission requirements	Compulsory	None
1	Academic Writing for Postgraduate Students	UAE5819	24	Admission requirements	Compulsory	None
2	Nuclear Chemistry	NUC5912	24	Admission requirements	Compulsory	None
2	Radiation Protection and Health Physics	NUC5932	24	Admission requirements	Compulsory	None
2	Radiobiology	NUC5902	12	Admission requirements	Compulsory	None
2	Nuclear Reactor Science and Technology	NUC5922	12	Admission requirements	**Elective	None
2	Radiation Techniques and Applications	NUC5942	12	Admission requirements	**Elective	None
2	Special Topics in Nuclear Science and Technology	NUC5962	12	Admission requirements	**Elective	None
2	Computational Physics for Nuclear Scientists	NUC5982	12	Admission requirements	**Elective	None
Total credits			**144**			

YEAR 2

SEMESTER	COURSE NAME	CODE	CREDIT	PREREQUISITE	Compulsory/Elective	CO-REQUISITES
1 & 2	MSc Thesis	PHY5900	120	Passed all Year 1 courses	Compulsory	None
Total credits			**120**			

Total credits for the programme = 144 (year 1) + 120 (year 2) = 264
*The credit for the course UAE5819 (a level 8 course) is not included in the total credit of 264.
** A student will take only one of the four electives.

FIRST YEAR COURSES

NUC5911: PRINCIPLES OF NUCLEAR PHYSICS

Course title: **PRINCIPLES OF NUCLEAR PHYSICS**
Code: **NUC5911**
NQF level: 9
Contact hours: 56 L + 36P/T
Credits: 24
Course 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: MSc admission requirements
Course description (content): Review of atomic and nuclear structures**,** atomic and nuclear radiation, classification of radiation, natural and man-made sources of radiation; Radioactive decay and decay process; Radioactive Equilibrium; 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 and capture process; Nuclear binding energy; Nuclear reactions; Nuclear models; Fission and fusion.

NUC5901: NUCLEAR INSTRUMENTATION

Course title: **NUCLEAR INSTRUMENTATION**
Code: **NUC5901**
NQF level: 9
Contact hours: 28L + 21P/T
Credits: 12
Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements
Course description (content): A review of the interaction of nuclear radiation with matter; Methods of radiation detection**:** Ionization in gases, gas-filled detectors, Scintillation detectors, semiconductor detectors and neutron detectors; Spectroscopy and spectra unfolding; Pulse signal processing; Statistics of counting and associated errors; Components of electronic detector systems: Rate meters, High voltage power supplies, AC-DC converters, Scalars, Amplifiers, Single channel analyze and Multi-channel analyzers.

NUC5921: MATHEMATICAL METHODS FOR NUCLEAR SCIENTISTS

Course title: **MATHEMATICAL METHODS FOR NUCLEAR SCIENTISTS**
Code: **NUC5921**
NQF level: 9
Contact hours: 28L + 36P/T
Credits: 12
Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements
Course description (content): Complex variable techniques; Eigenvalue problems; Boundary value problems for ordinary differential equations, Integral equations and Partial differential equations. Analysis of data: Weighted mean, measure of dispersion, skewness and kurtosis; Significance tests and theory of errors; Binomial, Gaussian and Poisson distributions; Correlation ratio, smoothing and interpolation; Method of least squares in curve fitting and test of fit. Monte Carlo methods.

PHY5931: RESEARCH METHODOLOGY

Course title: **RESEARCH METHODOLOGY**
Code: **PHY5931**
NQF level: 9
Contact hours: 56 L + 36P/T
Credits: 24
Course 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: MSc admission requirements
Course 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.

UAE5819: ACADEMIC WRITING FOR POSTGRADUATE STUDENTS

Course title: **ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Code: **UAE5819**
NQF level: 8
Contact hours: 56 L
Credits: 24

Course assessment: Continuous Assessment 1 x 3-hour Exam Paper. 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

Course description (content): This course 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.

NUC5912: NUCLEAR CHEMISTRY

Course title: **NUCLEAR CHEMISTRY**
Code: **NUC5912**
NQF level: 9
Contact hours: 56L + 36P/T
Credits: 24

Course 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: MSc admission requirements

Course description (content): Radionuclides in nature; Natural radioactivity and decay series; Anthropogenic radioactivity; Chemistry of nuclear materials; Radiolysis; radiochemical separation techniques, Radioisotope production; Isotope identification; Determination of activity concentration; Analytical techniques: α-spectrometry, β-spectrometry and γ-spectrometry; Neutron activation analysis: Instrumental neutron activation analysis and cyclic activation analysis.

NUC5932: RADIATION PROTECTION AND HEALTH PHYSICS

Course title: **RADIATION PROTECTION AND HEALTH PHYSICS**
Code: **NUC5932**
NQF level: 9
Contact hours: 56 L + 36P/T
Credits: 24

Course 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: MSc admission requirements

Course description (content): Radiation sources; Effects of different types of radiation; Radiation quantities, units and measurements. Biological effects of radiation; Radiation safety guides and Philosophy of radiation protection. Health physics instrumentation: Radiation detectors, dose measuring instruments, neutron measurements, calibration of measuring instruments and counting statistics. External radiation protection: Distance, time and shielding, gamma-ray shielding, protection from beta radiation, and neutron shielding. Internal radiation protection.Computation of exposure and dose; Radiation shielding principles and radiation attenuation calculations.

NUC5902: RADIOBIOLOGY

Course title: **RADIOBIOLOGY**
Code: **NUC5902**
NQF level: 9
Contact hours: 28L + 21P/T
Credits: 12

Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements

Course description (content): Use of radioisotopes in molecular biology techniques; Radiation and mutations; Genomic instability; Molecular mechanisms of radiation damage; Total body irradiation; Heritable effects of radiation; Effects of radiation on developing embryo; Radiation carcinogenesis; Radiation oncology technology, quality and safety. Brachytherapy; Radiation and cataracts; Radiation safety, radioprotectors and radiosensitizers; Mutation breeding; Radiation, food and nutrition; Radiation and water treatment.Biological impacts of nuclear accidents and disasters.

NUC5922: NUCLEAR REACTOR SCIENCE AND TECHNOLOGY

Course title: **NUCLEAR REACTOR SCIENCE AND TECHNOLOGY**
Code: **NUC5922**
NQF level: 9
Contact hours: 28L + 21P/T
Credits: 12
Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements
Course description (content): Review of nuclear energy. Uses and classification of reactors; Reactor components: Moderators, fuel, coolants and control rods. Determination of neutron fluxes using foil irradiation. Thermalization of neutrons; Macroscopic slowing down process. Steady state reactor core and four factor formula. Calculations of resonance escape probability and neutron leakage; Neutron balance equation; Flux distribution in rectangular slab reactor core and in cylindrical reactor core. Transient reactor behavior and control; Reactor safety, kinetics and control; Multi-group theory.

NUC5942: RADIATION TECHNIQUES AND APPLICATIONS

Course title: **RADIATION TECHNIQUES AND APPLICATIONS**
Code: **NUC5942**
NQF level: 9
Contact hours: 28L + 21P/T
Credits: 12
Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements
Course description (content): Radiation sources and irradiation facilities. Radioisotope applications in industry, agriculture, medicine and environment.Radioactive dating techniques.Theory of X-ray fluorescence and X-ray diffraction; Operation of X-ray fluorescence and X-ray diffraction machines.Neutron diffraction, Mossbauer spectroscopy and neutron activation analysis. Other applications and techniques in basic research.

NUC5962: SPECIAL TOPICS IN NUCLEAR SCIENCE AND TECHNOLOGY

Course title: **SPECIAL TOPICS IN NUCLEAR SCIENCE AND TECHNOLOGY**
Code: **NUC5962**
NQF level: 9
Contact hours: 28L + 21P/T
Credits: 12
Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements
Course description (content): Introduction to Nuclear law: Concept and principles of nuclear law, legislative process for nuclear law, and regulatory body and functions. Safe transportation of radioactive materials, and radioactive waste management. Accelerator physics: Historical development of accelerators, types of accelerators, applications in nuclear physics, material science, medicine, art and culture, environment and industry. Fusion reactors, neutron activation analysis and other topics of interest.

NUC5982: COMPUTATIONAL PHYSICS FOR NUCLEAR SCIENTISTS

Course title: **COMPUTATIONAL PHYSICS FOR NUCLEAR SCIENTISTS**
Code: **NUC5982**
NQF level: 9
Contact hours: 28L + 36P/T
Credits: 12
Course assessment: Continuous Assessment **(50%)** and 1 x 2-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: MSc admission requirements
Course description (content): Numerical integration and iterative methods; Monte Carlo method; Finite difference methods and finite element methods. Fourier and Laplace transformations; Special and orthogonal functions; Variation principle and optimization methods.Interpolation and approximation methods; Numerical solution of linear and non-linear systems.Eigenvalues and eigenvectors.Algorithms and software applications.

SECOND YEAR COURSE

NUC5900: THESIS

Course title:	**THESIS**
Code:	**NUC5900**
NQF level:	9
Contact hours:	N/A
Credits:	120

Course 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 courses of the first year must be completed.

Course description (content): The student will be required to undertake research activities in a selected topic of Nuclear Science 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 cannot be completed in less than two (2) years. The Diploma must be completed within three (3) years of full-time study, unless special permission is granted for this period to be exceeded.

J.1.1.3. MODE OF DELIVERY

The Diploma in Applied Statistics is a full-time programme offered in the evening, so as to allow full-time working candidates to attend lectures. The programme comprises of a total credit of 256 and it is at Namibian Qualification Framework (NQF) level 5. The year 1 courses are at NQF level 4 whereas the year 2 courses 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 courses required as indicated below:

- 3 courses (equivalent to 48 credits) by the end of the first year; 2 of these courses (equivalent to 32 credits) must be non-core.

- 8 full courses (equivalent of 128 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 courses (equivalent to a minimum of 96 credits) of the curriculum for a first year have been passed.

J.1.1.7. MAXIMUM NUMBER OF COURSES PER YEAR

Students can register for all first year courses and thereafter, no more than 10 courses in any academic year.

J.1.1.8. ARTICULATION ROUTE

After successful completion of the Diploma, students may continue to the degree programs in Statistics or Population Studies.

QUALIFICATION: DIPLOMA IN APPLIED STATISTICS (11DSST)

YEAR 1

SEMESTER	COURSE 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	MAT2432	16		None
2	Sampling concepts in Survey work	STD2452	16		None
Total Credits			128		

YEAR 2

SEMESTER	COURSE TITLE	CODE	CREDIT	PRE-REQUISITE	CO-REQUISITES
1	Basic Data Processing	STD2551	16	STD2452	None
1	Descriptive Statistics	STS3531	16		None
1	Basic Micro Economics	EMI3571	16		None
2	Introduction to Probability	STS3532	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Basic Statistical Modeling	STD2552	16	MAT2432	None
2	Basic Demography and Epidemiology	STD2512	16	STD2411	None
2	Basic Macro Economics	EMA3572	16		None
Total Credits			128		

J.1.2. DIPLOMA IN APPLIED STATISTICS: COURSES & CURRICULUM DESCRIPTION

FIRST YEAR COURSES

STD2411 THE STATISTICAL SYSTEM

Course Title: **The Statistical System**
Code: **STD2411**
NQF Level: **4**
Contact Hours: **4 lectures per week/14 weeks**
Credits: **16**
Course Assessment: Continuous assessment (at least two tests and one assignments**) 50%;** 1 x 3 hours Examination **50%**
Pre- requisite: **None**
Course 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. Basic concepts of national accounts:introduction to National Accounts, GDP statistics by activity, GDP by expenditure, National Income and the balance of payment, measuring GDP.

STD2431 BASICS OF STATISTICS

Course Title: **BASICS OF STATISTICS**
Code: **STD2431**
NQF Level: 4
Contact Hours: 4 Lectures per week for 14 weeks
Number of Credits: **16**
Course Assessment: Continuous assessment (at least two tests and one assignments) **50%;** 1 x 3 hours Examination **50%**
Prerequisites: None
Course Description: Definitions: Statistics: descriptive versus inferential; Variables: qualitative versus quantitative; Types of data: primary versus secondary; categorical versus quantitative; discrete versus continuous, Sources of data: Population versus sample; Rationale for sampling, Sampling techniques: Probability versus non-probability; use of random numbers, Scales of measurement, Computation of numerical descriptive statistics: Measures of location: the mean, median, mode, quartiles, and percentiles; Measures of absolute dispersion: range, mean absolute deviation, standard deviation; Measures of relative variation (coefficient of variation); skewness and kurtosis, Tabular descriptive statistics: frequency distributions and cross-tabulations, Graphical descriptive statistics: bar graphs (Simple, multiple and component bar graphs); pie charts; histograms; frequency polygons; ogives; stem-and-leaf plots and boxplots.

MAT2432 INTRODUCTION TO MATHEMATICS

Course Title: **INTRODUCTION TO MATHEMATICS**
Code: **MAT2432**
NQF Level: 4
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) 5**0%**; 1x3 hours Examination **50%**
Pre- requisite: Grade 12 Mathematics
Course description: Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement, Venn-diagrams (Population and application to word problems); Matrices: addition, multiplication, scalar multiplication and transpose (for up to 3x3 dimension), determinant and inverse (with emphasis on 2x2), Derivatives: definition, rules of differentiation; Integration: definitions, basic rules of integration and definite integrals**.** 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.

STD2412 INDEX NUMBERS AND TIME SERIES

Course Title: **INDEX NUMBERS AND TIME SERIES**
Code: **STD2412**
NQF Level: 4
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **50%**; 1x3 hour Examination **50%**
Pre- requisite: Grade 12 Mathematics
Course description: Introduction to index numbers; Basic theory of index number, consumer price indices, errors in index numbers, rebasing techniques, Introduction to time series; Trends in time series; seasonal components, cyclical components, irregular component decomposing a time series; moving averages, exponential smoothing, regression, forecasting and review.

STD2452 SAMPLING CONCEPTS IN SURVEY WORK

Course Title: **SAMPLING CONCEPTS IN SURVEY WORK**
Code: **STD2452**
NQF Level: 4
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **50%**; 1 x 3 hours Examination **50%**
Pre- requisite: None
Course description: Identifying data needs. Importance of examining the literature to determine existing data sources, their appropriateness and their reliability. Sampling, populations and samples, Developing objectives; Designing a sampling scheme; 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 is generalizable. 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 schemes 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.

SECOND YEAR COURSES

STD2551 BASIC DATA PROCESSING

Course Title: **BASIC DATA PROCESSING**
Code: **STD2551**
NQF Level: 5
Contact Hours: 2 theoretical lectures and 2 practical lectures per week/ 14 weeks
Number of Credits: 16
Course Assessment: Continuous Assessment (at least two tests and two assignments) **50%**, Examination **50%**. 1x3 hour Practical and theoretical Examination
Prerequisites: STD2452
Course Description: Introduction to variables and data: qualitative vs quantitative; Questionnaire design: open vs closed questions, creating variables, coding of questions; Spreadsheets: uses and limitations for data entry, organising data in a spreadsheet; Introduction to SPSS interface: Creating a database: dealing with data: creating variables, data entering, add/delete variables or cases, sort cases/variables, saving worksheet, importing data from other files e.g. Excel, efficient storage and management of databases, organising multiple response data; Data Analysis: Exploratory data analysis: creating frequency tables, graphing, descriptive statistics, crosstabulations, analysing numeric variables, presenting good tables and graphs, analysing categorical variables; Testing for relationships and associations: chis-square test, correlations; Simple regression model.

STS3531 DESCRIPTIVE STATISTICS

Course Title: **DESCRIPTIVE STATISTICS**
Code: **STS3531**
NQF Level: 5
Contact Hours: 4 lectures and 1 tutorial per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **50%**; 1x3 hour Examination **50%**
Pre- requisite: None
Course description: 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.

EMI3571 BASIC MICROECONOMICS

Course Title: **BASIC MICROECONOMICS**
Code: **EMI3571**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **50%**; 1x3 hour Examination **50%**
Pre- requisite: None
Course description: This course is aimed at introducing students to key concepts used in microeconomics and facilitates a basic understanding of the economic phenomena. The course 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 course content includes: an introduction to microeconomics, demand and supply, market structures, factor markets and introduction to international trade.

STS3532 INTRODUCTION TO PROBABILITY

Course Title: **INTRODUCTION TO PROBABILITY**
Code: **STS3532**
NQF Level: 5
Contact Hours: 4 lectures and 1 tutorial per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests, two tutorial tests and two assignments) **50%**; 1X3 hour Examination **50%**
Pre- requisite: None
Course 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.

STD2552 BASIC STATISTICAL MODELLING

Course Title: **BASIC STATISTICAL MODELLING**
Code: **STD2552**
NQF Level: 5
Contact Hours: 2 theoretical lectures and 2 practical lectures per week
Number of Credits: 16
Course Assessment: Continuous Assessment (at least two tests and two assignments)**50%**, 1x3 hour Examination **50%**.
Prerequisites: STD2432
Course 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.

STD2512 BASIC DEMOGRAPHY AND EPIDEMIOLOGY

Course Title: **BASIC DEMOGRAPHY AND EPIDEMIOLOGY**
Code: **STD2512**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **50%**; 1 x 3 hours Examination **50%**
Pre- requisite: STD2411
Course description: Meaning of Demography; demographic data sources: census, vital registration, surveys and secondary sources; the need for large samples; data collection problems: sampling frame; non-response and measurement errors; concepts in demographic data collection: e.g. household, family and migration; the need for use of age-groups and conventional age-groupings; absolute versus relative numbers: ratios, proportions and rates; fertility, mortality and migration measures; meaning of Epidemiology; sources of data in the study of epidemiology: routine data, cross-sectional surveys, longitudinal and sentinel site studies; incidence and prevalence; risk factors; cohort and case-control studies.

EMA3572 BASIC MACROECONOMICS

Course Title: **BASIC MACROECONOMICS**
Code: **EMA3572**
NQF Level: 5
Contact Hours: 4 lectures per week/14 weeks,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **50%**; 1x3 hour Examination **50%**
Pre- requisite: None
Course description: This course 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.1.3 DIPLOMA MODULE EQUIVALENTS

Old Courses		**New Courses**	
STD2431	Basics of Statistics	STD2431	Basics of Statistics
STD2411	The Statistical System	STD2411	The Statistical System
STD2412	Index Numbers and Time series	STD2412	Index Numbers and Time series
STD2432	Introduction to Mathematics	MAT2432	Introduction to Mathematics
STD2452	Sampling concepts in Survey work	STD2452	Sampling concepts in Survey work
STD2551	Basic Data Processing	STD2551	Basic Data Processing
STD2531	Probability	STD3532	Introduction to Probability
STD2511	Statistical Methods and Techniques	STS3531	Descriptive Statistics
STD2532	Statistical Modeling	STD2552	Basic Statistical Modeling
STD2512	Basic Demography and Epidemiology	STD2512	Basic Demography and Epidemiology

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.2.1.2. 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.2.1.3. 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 courses that have these components.

J.2.1.4. 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.2.1.5. 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 courses as indicated below:

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

J.2.1.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the courses 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 courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for courses that require prerequisites.

J.2.1.7. MAXIMUM NUMBER OF COURSES PER YEAR

A part-time student can only register for 75% of the prescribed courses in any given academic year. Full-time students can register for all first year courses and thereafter, no more than 10 courses in any academic year.

J.2.1.8. 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 courses of the degree program. The courses are as follows:

Course 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
LEG2410English for General Communication	LCE3419English Communication & Study Skills
CLC3509Computer Literacy	CLC3509Computer Literacy
CSI3580Contemporary Social Issues	CSI3580Contemporary Social Issues

J.3. STATISTICS AND POPULATION STUDIES NEW CURRICULUM &PREREQUISITES

QUALIFICATION: B.Sc. Statistics (Honours) 11BSCS

Students opting for a Bachelor of Science in Statistics (Honours) degree must take all of the following courses:

YEAR 1

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Descriptive Statistics	STS3531	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Matrices & Complex Numbers	MAT 3521	8		None
1	Analytical Geometry	MAT3501	8		None
2	English for academic Purpose	LEA3519	16		None
2	Contemporary Social Issues	CSI 3580	8		None
2	Precalculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
2	Basic Financial Mathematics	MAF 3532	16		None
Total			**144**		

YEAR 2

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	STS3611	16	STS3532, MAT3512	None
1	Statistical Methods	STS3671	16	STS3532	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Sets and Logic	MAT3661	8	MAT3511	None
1	Numerical Methods with MATLAB	MAT3641	8	MAT3521	None
1	Financial Mathematics I	MAF 3651	16	MAF 3532	None
2	Fundamentals of Statistical Computing	STS3652	16	STS3531	None
2	Calculus II	MAT3612	16	MAT 3512	None
2	Distribution Theory	STS3692	16		STS3611 & MAT3611
2	Elementary Linear Algebra	MAT3652	16	Any full Mathematic course at first year and MAT3521	None
Total			**144**		

YEAR 3

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Non-Parametric & Categorical Statistics	STS3741	8	None	None
1	Statistical Inference	STS3771	16	STS3671	None
1	Sampling Techniques	STS3731	16	STS3531	None
1	Linear Algebra I	MAT3711	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
2	Data processing	STS3732	16	STS3652	STS3771
2	Experimental Design and Analysis of Variance	STS3752	16	STS3692	STS3771
2	Linear Algebra II	MAT3712	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
2	Research and Survey Methods	STS3702	8	None	None
2	Linear Models	STS3772	16	STS3671	STS3771
Total			**128**		

YEAR 4

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Survival Analysis	STS3871	16	STS3671	None
1	Operational research	STS3851	16	STS3772	None
1	Research Project	STS3810	16	Registered as a fourth year students and STS 3732	None
1	Stochastic Processes	STS3831	16	STS3692	None
2	Multivariate Distribution Theory	STS3812	16	STS3692, STS3771	None
2	Research Project	STS3810	16	Registered as a fourth year students and STS 3732	None
2	Time series and forecasting	STS3872	16	STS3772	None
2	Statistical Quality Control	STS3832	16	STS3692, STS3771	None
Total			**128**		

QUALIFICATION: B.Sc. in Population Studies (Honours) 11BSPO

Students opting for a Bachelor of Science (Honours) in Population Studies degree must take all of the following courses:

YEAR 1

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE3419	16		None
1	Descriptive Statistics	STS3531	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
2	English for academic Purpose	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
2	Fundamentals of Population Theory	POP3512	16		None
Total			**128**		

YEAR 2

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Official Statistics and National Statistical Systems	POP3631	16	None	None
1	Introduction to Demography	POP3611	16	None	None
1	Probability Theory	STS3611	16	STS3532, MAT3512	None
1	Statistical Methods	STS3671	16	STS3532	None
1	Social Problems: Learning to Conceptualize and Implement Research	HSOG3671	16	None	None
2	Fundamentals of Statistical Computing	STS3652	16	STS3531	None
2	Epidemiological Methods	POP3612	16	None	None
2	Sociology of Development	SOG3632	16	None	None
2	Fundamentals of Population and Development	POP3632	16	POP3512	None
Total			**144**		

YEAR 3

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Fundamentals of Data Processing	POP3731	16	STS3652	None
1	Sampling Techniques	STS3731	16	STS3531	None
1	Geographical Analysis and Techniques	HGIS3711	16	None	None
1	Non-Parametric & Categorical Statistics	STS3741	8	None	None
1	Demographic Methods I	POP3711	16	POP3611	None
2	Geographical Information System	GIS3732	16		HGIS3711 &Placement test
2	Social Research Methods	SOG3732	16	None	None
2	Demographic Methods II	POP3732	16	POP3611	POP3711
2	Linear Models	STS3772	16	STS3671	None
2	Research and Survey Methods	STS3702	8	None	None
Total			**144**		

YEAR 4

SEMESTER	COURSE	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Sociology of Gender and Sexuality	SOS3860	8	Admission to the 4th year level	None
1	Research Project	POP3810	16	Registered as a fourth year students and POP3731	None
1	Monitoring & Evaluation Techniques	POP 3831	16	None	None
1	Survival Analysis	STS3871	16	STS3671	None
2	Population Migration and Urbanization	POP 3872	16	POP 3732	None
2	Population Projections	POP 3852	16	POP 3732	None
2	Research Project	POP 3810	16	Registered as a fourth year students and POP3731	None
2	Indirect Estimation	POP3892	16	POP3731, POP3732	None
2	Sociology of Gender and Sexuality	HSOS3860	8	Admission to the 4th year level	None
Total			**128**		

J.4. STATISTICS AND POPULATION STUDIES COURSE AND CURRICULUM DESCRIPTIONS

FIRST YEAR COURSES

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

Course 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

Course 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

Course 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 COURSES

STS 3611 PROBABILITY THEORY

NQF Level	6
Notional Hours	160
NQF Credits	16
Pre-requisite	STS3532 and MATS3512
Compulsory/Elective	Compulsory
Contact hours:	4 lectures plus 1 hour tutorial per week/14 weeks

CourseDescription: 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

Course 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.

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

Course 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 3692 DISTRIBUTION THEORY

NQF Level 6
Notional Hours 160
NQF Credits 16
Co-requisite STS3611 and MAT3611
Compulsory/Elective Compulsory
Contact hours: 4 lectures plus 1 hour tutorial per week/14 weeks

Course 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

Course 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

Course 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

Course 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

Course 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

Course 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.

POP3612 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

Course 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 COURSES

STS3741 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

Course 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.

STS3731 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

Course 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.

STS3771 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

Course 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.

STS3732 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

Course 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.

STS3702 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

Course 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

Course 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.

STS3752 EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE

NQF Level	7
Notional Hours	160
NQF Credits	16
Pre/Co-requisite	Pre: STS3692 and Co:STS3771
Compulsory/Elective	Compulsory
Contact hour:	4 lectures plus 3 hour practical per week/14 weeks

Course 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.

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

Course 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

Course 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.

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

Course 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

Course 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
Pre/Co-requisite	Pre: POP3611, Co: POP3711
Compulsory/Elective	Compulsory
Contact hour:	4 lectures per week/14 weeks

Course 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

Course Description: This course 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 COURSES

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

Course 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	STS3692
Compulsory/Elective	Compulsory
Contact hour:	4 lectures plus 1 hour tutorial per week/14 weeks

Course 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

NQF Level	8
Notional Hours	320
NQF Credits	32
Pre-requisite	Registered as a fourth year students and STS3732
Compulsory/Elective	Compulsory
Contact hour:	2 lectures per week/28 weeks

Course Description::A final year project on a selected topic demonstrating the applications of relevant statistical methods culminating in a project report. The course 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.

STS3871 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

Course 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.

STS3812 MULTIVARIATE DISTRIBUTION THEORY

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite STS3692 and STS3771
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 1 hour tutorial per week/14 weeks
Course 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.

STS3872 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
Course 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.

STS3832 STATISTICAL QUALITY CONTROL

NQF Level 8
Notional Hours 160
NQF Credits 16
Pre-requisite STS3692 and STS3771
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practicall per week/14 weeks
Course 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.

POP3892 INDERECT ESTIMATION

NQF Level 8
Notional Hours 160
NQF Credits 16
Prerequisite POP3731 and POP3732
Compulsory/Elective Compulsory
Contact hour: 4 lectures plus 3 hour practical per week/14 weeks
Course 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.

SOS3860 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

Course Description: 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; 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.

POP3831 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

Course 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.

POP3852 POPULATION PROJECTIONS

NQF Level	8
Notional Hours	160
NQF Credits	16
Prerequisite	POP3732
Compulsory/Elective	Compulsory
Contact hour:	4 lecture per week/14 weeks

Course 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.

POP3872 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

Course 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.

POP3810 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

Course Description: A final year project on a selected topic demonstrating the applications of relevant demographic and statistical methods culminating in a project report. The course 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 COURSES

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
Course 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
Course 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
Course 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.

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	STS3692	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
STS3832	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

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 COURSES

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 COURSES
STM5900 MSc Thesis

J.6.1.4. EXAMINATION REGULATIONS

If a student fails the first semester course he/she may proceed to the next semester. However he/she must repeat the course in the following year. A minimum of 50% is required to pass each course.

J.6.1.5. PRACTICALS

All practicals are compulsory.

J.6.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: MSc Applied Statistics and Demography (11MSST)

YEAR 1

SEMESTER	COURSE 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	COURSE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1 & 2	MSc Thesis	STM5900	120	Passed all first year courses	None
Total Credits			**120**		

FIRST YEAR COURSES

FIRST SEMESTER

UAE5819 ADVANCED ACADEMIC WRITING FOR POST GRADUATE STUDIES

Course 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

Course Assessment: CA: (1 x 3 hour exam paper)

Prerequisites: Must be a postgraduate student.

Content: This course 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

Course 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 courses: 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:	**STM5921**
NQF Level:	9
Contact hours:	2 lectures per week for 14 weeks
NQF Credits:	12

Course 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

Course 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
Course 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
Course 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
Course 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
Course 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 courses
Course 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

K.1.1. 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 **compuls**or**y** 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 courses).

K.1.2. COMPILATION OF THE CA MARK

- Details on how the CA for each course is compiled are given under the respective courses.

K.1.3. 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

K.2.1. BACHELOR OF SCIENCE IN MILITARY SCIENCE (AERONAUTICAL, ARMY and NAUTICAL) (HONOURS)

Qualification:BSc (Honours) Military Science Army 11BMSA

Students opting for a Military Science (Army) must take all of the following courses:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16	None	None
1	Basic Mathematics	MAT3511	16	None	None
1	Computer Literacy	CLC3509	8	None	None
1	Analytic Geometry	MAT3501	8	None	None
1	Matrices and Complex Numbers	MAT3521	8	None	None
1	Physics for Physical Sciences I	PHY3511	16	None	None
1	Fundamentals of Information Technology I	CIT3521	8	None	None
2	English for Academic Purposes	LEA3519	16	None	ULCE3419
2	Contemporary Social Issues	CSI3580	8	None	None
2	Fundamentals of Information Technology II	CIT3512	16	None	SCIT3521
2	Precalculus	MAT3512	16	None	None
2	Introduction to Statistics	STS3522	8	None	None
2	Physics for Physical Sciences II	PHY3512	16	None	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Mechanics and Waves	PHY3651	16	MAT3512 &PHY3511	None
1	Human Resource Management I	ARM3641	8	None	None
1	Concepts and Techniques in Military Geography	ARM3611	8	None	None
1	Physical Environment I	ARM3601	8	None	None
2	Calculus II	MAT3612	16	None	None
2	Ordinary Differential Equations	MAT3642	8	None	None
2	Electromagnetism	PHY3612	16	None	None
2	Human Resource Management II	ARM3642	8	None	None
2	Physical Environment II	ARM3612	16	None	None
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Electrodynamics	PHY3711	16	PHY3612 & MAT3612	None
1	Military Psychology	ARM3721	8	None	None
1	Military Management	ARM3741	8	None	None
1	Military History	ARM3761	8	None	None
1	Military Conduct and Environment	ARM3711	16	ARM3612	None
2	Research Methodology	AER3732	8	STS3522	None
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612	None
2	Africa and International Political Economy	ARM3732	16	None	None
2	Geography of Sub-Saharan Africa	ARM3712	16	ARM3612	None
2	Contemporary Political Relations	ARM3772	16	None	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Research Project	ARM3810	16	AER3732	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Military Leadership	ARM3831	16	ARM3741	None
1	Economics I	ARM3851	16	ARM3732	None
1	Geographical Information Systems	ARM3811	16	ARM3711 & ARM3712	None
2	Research Project	ARM3810	16	AER3732	None
2	Nuclear Physics	PHY3802	8	PHY3752	None
2	Economics II	ARM3872	16	ARM3732	None
2	Remote Sensing	ARM3852	16	ARM3711 & ARM3712	None
Total Credits			**128**		

Qualification: BSc (Honours) Military Science Aeronautical 11BMSR

Students opting for a Military Science (Aeronautical) must take all of the following courses:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16	None	None
1	Basic Mathematics	MAT3511	16	None	None
1	Computer Literacy	CLC3509	8	None	None
1	Analytic Geometry	MAT3501	8	None	None
1	Matrices and Complex Numbers	MAT3521	8	None	None
1	Physics for Physical Sciences I	PHY3511	16	None	None
1	Fundamentals of Information Technology I	CIT3521	8	None	None
2	English for Academic Purposes	LEA3519	16	None	ULCE3419
2	Contemporary Social Issues	CSI3580	8	None	None
2	Fundamentals of Information Technology II	CIT3512	16	None	SCIT3521
2	Precalculus	MAT3512	16	None	None
2	Introduction to Statistics	STS3522	8	None	None
2	Physics for Physical Sciences II	PHY3512	16	None	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511	None
1	Fundamentals of Physical Geography	AER3631	16	None	None
1	Theory of Flight I	AER3621	8	None	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521	None
2	Electromagnetism	PHY3612	16	PHY3512 &MAT3512	None
2	Theory of Flight II	AER3612	16	None	AER3621
2	Flight Physiology	AER3642	8	None	AER3621
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Electrodynamics	PHY3711	16	PHY3612 & MAT3612	None
1	History of Aviation	AER3721	8	None	None
1	Military Management	ARM3741	8	None	None
1	Military Psychology	ARM3721	8	None	None
1	Airport Planning and Management	AER3751	16	None	None
1	Theory of Flight III	AER3711	16	AER3612 & AER3621	None
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612	None
2	Research Methodology	AER3782	8	STS3522	None
2	Aviation Management Principles	AER3702	8	None	ARM3741
2	Aviation Ethics	AER3722	8	None	ARM3721
2	Aviation Laws and Regulations	AER3742	8	None	AER3751
2	Aircraft Turbine Engine Operation	AER3762	8	None	AER3711
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Research Project	AER3810	16	AER3732	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Aviation Safety	AER3811	16	ARM3741	None
1	Advanced Aircraft Performance	AER3831	16	ARM3732	None
1	Crew Resource Management in Aviation	AER3821	8	ARM3711 & ARM3712	None
2	Research Project	AER3810	16	AER3732	None
2	Nuclear Physics	PHY3802	8	PHY3752	None
2	Aviation Navigation GPS	AER3812	16	AER3742	None
2	Aviation Leadership	AER3822	8	AER3722	None
2	Aviation-Aerospace Security Issues	AER3842	8	AER3722	None
2	Aviation Terrorism and Asymmetrical Warfare	AER3862	8	AER3811	None
Total Credits			**128**		

Qualification:BSc(Honours) Military Science Nautical - Mechanics 11BMSM

Students opting for a Military Science (Nautical - Mechanics) must take all of the following courses:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16	None	None
1	Basic Mathematics	MAT3511	16	None	None
1	Computer Literacy	CLC3509	8	None	None
1	Analytic Geometry	MAT3501	8	None	None
1	Matrices and Complex Numbers	MAT3521	8	None	None
1	Physics for Physical Sciences I	PHY3511	16	None	None
1	Fundamentals of Information Technology I	CIT3521	8	None	None
2	English for Academic Purposes	LEA3519	16	None	ULCE3419
2	Contemporary Social Issues	CSI3580	8	None	None
2	Fundamentals of Information Technology II	CIT3512	16	None	SCIT3521
2	Precalculus	MAT3512	16	None	None
2	Introduction to Statistics	STS3522	8	None	None
2	Physics for Physical Sciences II	PHY3512	16	None	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511	None
1	Propulsion	NAV3661	8	PHY3511	None
1	Seamanship	NAV3601	8	None	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521	None
2	Electromagnetism	PHY3612	16	PHY3512 &MAT3512	None
2	Ship Stability and Controls	NAV3642	8	None	NAV3601
2	Maritime History	NAV3622	8	None	AER3621
2	Telecommunications	CMP3652	16	MAT3512	None
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Military Psychology	ARM3721	16	None	None
1	Military Management	ARM3741	8	None	None
1	Navigation and Naval Operations	NAV3711	16	NAV3661 & NAV3642	None
1	Applied Thermodynamics	NAV3751	16	PHY3512	None
1	Auxiliaries Naval Engines	NAV3731	16	NAV3661	None
2	Research Methodology	AER3732	8	STS3522	None
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612	None
2	Advanced Navigation	NAV3742	8	NAV3661	None
2	Vector Analysis	MAT3742	8	MAT3612	None
2	Naval Weapon Systems	NAV3722	8	PHY3612	None
2	Ship Design	NAV3762	8	NAV3642	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Research Project	NAV3810	16	AER3732	None
1	Astro-Navigation	NAV3801	8	NAV3742	None
1	Military Leadership	ARM3831	16	ARM3741	None
1	Material Resistance	NAV3841	8	PHY3711	None
1	Process and Material Technologies	NAV3821	8	PHY3651	None
1	Ship Hydro-Statics and Stability	NAV3871	16	NAV3762	None
2	Research Project	NAV3810	16	AER3732	None
2	Nuclear Physics	PHY3802	8	PHY3752	None
2	Naval Warfare	NAV3822	8	NAV3742	None
2	Engine Automation and Controls	NAV3862	8	NAV3731	None
2	Applied Electronics	NAV3882	8	PHY3612	None
2	Corrosion and Controls	NAV3809	8	NAV3762	None
Total Credits			**128**		

Qualification: BSc(Honours) Military Science Nautical - Electronics 11BMSE

Students opting for a Military Science (Nautical - Electronics) must take all of the following courses:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16	None	None
1	Basic Mathematics	MAT3511	16	None	None
1	Computer Literacy	CLC3509	8	None	None
1	Analytic Geometry	MAT3501	8	None	None
1	Matrices and Complex Numbers	MAT3521	8	None	None
1	Physics for Physical Sciences I	PHY3511	16	None	None
1	Fundamentals of Information Technology I	CIT3521	8	None	None
2	English for Academic Purposes	LEA3519	16	None	ULCE3419
2	Contemporary Social Issues	CSI3580	8	None	None
2	Fundamentals of Information Technology II	CIT3512	16	None	SCIT3521
2	Precalculus	MAT3512	16	None	None
2	Introduction to Statistics	STS3522	8	None	None
2	Physics for Physical Sciences II	PHY3512	16	None	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511	None
1	Propulsion	NAV3661	8	PHY3511	None
1	Seamanship	NAV3601	8	None	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521	None
2	Electromagnetism	PHY3612	16	PHY3512 &MAT3512	None
2	Ship Stability and Controls	NAV3642	8	None	NAV3601
2	Maritime History	NAV3622	8	None	AER3621
2	Telecommunications	CMP3652	16	MAT3512	None
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Military Psychology	ARM3721	16	None	None
1	Military Management	ARM3741	8	None	None
1	Navigation and Naval Operations	NAV3711	16	NAV3661 & NAV3642	None
1	Electronics I	NAV3741	8	PHY3612	None
1	Electro-Techniques	NAV3761	16	PHY3612	None
1	Electrodynamics	PHY3711	16	PHY3612 & MAT3612	None
2	Research Methodology	AER3732	8	STS3522	None
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612	None
2	Advanced Navigation	NAV3742	8	NAV3661	None
2	Vector Analysis	MAT3742	8	MAT3612	None
2	Electronics II	NAV3752	16	PHY3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Research Project	NAV3810	16	AER3732	None
1	Astro-Navigation	NAV3801	8	NAV3742	None
1	Military Leadership	ARM3831	16	ARM3741	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Digital Electronics	NAV3861	8	NAV3741 or NAV3752	None
1	Digital Techniques	NAV3881	8	NAV3741 or NAV3752	None
1	Signals and Systems	NAV3809	8	NAV3741 or NAV3752	None
2	Research Project	NAV3810	16	AER3732	None
2	Nuclear Physics	PHY3802	8	PHY3752	None
2	Naval Warfare	NAV3822	8	NAV3742	None
2	Electric-Machines and Drives	NAV3812	16	NAV3752	None
2	Theory and Applications of Lasers	NAV3800	8	PHY3612	None
Total Credits			**128**		

Qualification: BSc (Honours) Military Science Nautical – Weapon Systems 11BMSW

Students opting for a Military Science (Nautical - Weapon Systems) must take all of the following courses:

YEAR 1

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	LCE 3419	16	None	None
1	Basic Mathematics	MAT3511	16	None	None
1	Computer Literacy	CLC3509	8	None	None
1	Analytic Geometry	MAT3501	8	None	None
1	Matrices and Complex Numbers	MAT3521	8	None	None
1	Physics for Physical Sciences I	PHY3511	16	None	None
1	Fundamentals of Information Technology I	CIT3521	8	None	None
2	English for Academic Purposes	LEA3519	16	None	ULCE3419
2	Contemporary Social Issues	CSI3580	8	None	None
2	Fundamentals of Information Technology II	CIT3512	16	None	SCIT3521
2	Precalculus	MAT3512	16	None	None
2	Introduction to Statistics	STS3522	8	None	None
2	Physics for Physical Sciences II	PHY3512	16	None	None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	COURSE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	MAT3512	None
1	Numerical Methods with MATLAB	MAT3621	8	MAT3521	None
1	Mechanics and Waves	PHY3651	16	MAT3512 & PHY3511	None
1	Propulsion	NAV3661	8	PHY3511	None
1	Seamanship	NAV3601	8	None	None
2	Calculus II	MAT3612	16	MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	MAT3521	None
2	Electromagnetism	PHY3612	16	PHY3512 &MAT3512	None
2	Ship Stability and Controls	NAV3642	8	None	NAV3601
2	Maritime History	NAV3622	8	None	AER3621
2	Telecommunications	CMP3652	16	MAT3512	None
Total Credits			**128**		

YEAR 3

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Military Psychology	ARM3721	16	None	None
1	Military Management	ARM3741	8	None	None
1	Navigation and Naval Operations	NAV3711	16	NAV3661 & NAV3642	None
1	Electronics I	NAV3741	8	PHY3612	None
1	Electro-Techniques	NAV3761	8	PHY3612	None
1	Naval Automation Systems	NAV3791	16	NAV3661	None
2	Research Methodology	AER3732	8	STS3522	None
2	Modern Physics	PHY3752	16	PHY3651 or PHY3612	None
2	Advanced Navigation	NAV3742	8	NAV3661	None
2	Vector Analysis	MAT3742	8	MAT3612	None
2	Electronics II	NAV3752	16	PHY3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	MODULE CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Research Project	NAV3810	16	AER3732	None
1	Astro-Navigation	NAV3801	8	NAV3742	None
1	Military Leadership	ARM3831	16	ARM3741	None
1	Signals and Systems	NAV3809	8	PHY3711	None
1	Electronic Control Systems	NAV3841	8	NAV3741 or NAV3752	None
1	Naval Weapon Systems	NAV3861	8	NAV3741 or NAV3752	None
1	Applied Sensors and Actuators	NAV3800	8	NAV3741 or NAV3752	None
2	Research Project	NAV3810	16	AER3732	None
2	Nuclear Physics	PHY3802	8	PHY3752	None
2	Naval Warfare	NAV3822	8	NAV3742	None
2	Ballistics	NAV3872	16	NAV3752	None
2	Advanced Electro-Techniques	NAV3842	8	NAV3761	None
Total Credits			**128**		

K.3. MILITARY SCIENCES CURRICULUM COURSE DESCRIPTIONS

FIRST YEAR COURSES

SECOND YEAR COURSES

ARM3641 HUMAN RESOURCES MANAGEMENT I

Course title: **HUMAN RESOURCES MANAGEMENT I**
Code: **ARM3641**
NQF Level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites:SMSC3512 OR SMSC3532
Course description: Human resources management in perspective, human resource function. Role: service, advisory and control. Environment: economic, social, political and technological. Current issues and humann resource challenges.Human resources management in South Africa and Namibia.

ARM3611 CONCEPTS AND TECHNIQUES IN MILITARY GEOGRAPHY IA

Course title: **CONCEPTS AND TECHNIQUES IN MILITARY GEOGRAPHY IA**
Code: **ARM3611**
NQF level: 6
Contact hours: 4 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: **none**
Course description: The origin, nature and traditions of geography. Impact of man on the environment.Population, cultural, political, urban, economic and military geography. Geography of natural resources, regional concept and geography of spatial behaviour.

ARM3601 PHYSICAL ENVIRONMENT I

Course title: **PHYSICAL ENVIRONMENT I**
Code: **ARM3601**
NQF level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 8
Course assessment: Continuous Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites:NONE
Course description: Earth: movements and seasons. The atmosphere: insulation, temperature, pressure, winds, moisture, flows and disturbance. Hydrosphere, Namibian weather and climate. Climatological data, synoptic weather charts and climogrammes.

ARM3642 Human Resources Management II

Course title: **Human Resources Management**
Code: **ARM3642**
NQF level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one three hour practical session per week
Credits: 8
Course assessment: Continuous Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: ARM3641
Course description: Human resource management practice: recruitment, selection and placement practice. Human resources planning: strategy, process and evaluation. Factors affecting human resource: safety and health, merger, downsizing and changes in the world population demography**.**

ARM3612 PHYSICAL ENVIRONMENT II

Course title: **PHYSICAL ENVIRONMENT II**
Code: **ARM3612**
NQF Level: 6
Contact hours: 4 lecture periods per week for 14 weeks, 3 hours practical per week for 14 weeks
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Pre-requisites: Co-requisite: ARM3611 & ARM3601
Course description: Internal structure of the earth: endogenesis of continental, sub-continental and regional scale. exogenetic processes: weather, mass wasting, fluvial, ground water and karst topography and wind in arid regions. Ocean processes: tides, waves, sea currents, coastal and landform. South African/Namibian geomorphology: landscape, terrain and contour. Stream orders, profiles, slopes and aerial photos.

AER3631 FUNDAMENTALS OF PHYSICAL GEOGRAPHY

Course title: **FUNDAMENTALS OF PHYSICAL GEOGRAPHY**
Code: **AER3631**
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
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: **NONE**
Course description: The earth, basic facts and mappings. The varieties of surface form: how surface form develops, plains, surfaces rougher than plains, the margins of the land. Introduction to climate: air temperature and solar energy, the circulation of the atmosphere, winds and pressure, precipitation. Atmospheric disturbances: air masses and fronts. Classification of climates and their distribution: the tropical humid climates, the dry climates, humid mesothermal climates, humid microthermal, polar, and highland climates. Water and the seas: the waters of the land. Natural vegetation and soils.

AER3621 THEORY OF FLIGHT I

Course title: **THEORY OF FLIGHT I**
Code: **AER3621**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: **NONE**
Course description: Principles of flight: subsonic aerodynamics and transonic aerodynamics. Air navigation: basics of navigation, mass and balance, aircraft performance, flight planning and monitoring. Radio navigation: radio aids, basic radar principles, self-contained and external-referenced navigation systems. Flight instruments: air data instruments, gyroscopic instruments, magnetic compass, power plant and system monitoring instruments. Aviation Meteorology: the atmosphere, wind, thermodynamics, clouds and fog, precipitation, air masses and fronts, pressure systems, climatology, flight hazards and meteorological information.

AER3612 THEORY OF FLIGHT II

Course title: **THEORY OF FLIGHT I I**
Code: **AER3612**
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
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: None
Co-requisite: ARM3621
Course description: Airframe and systems, power plants, aircraft Nationality and Registration, airworthiness of aircraft and Namibian legislation, security: ICAO Annex 17, Air Defence Identification Zones, Aircraft Accidents and Incidents, Air Service Operations, navigation charts, flight instruments, radio navigation, basic Radar principles, route navigation, area navigation systems.

AER3642 FLIGHT PHYSIOLOGY

Course title: **FLIGHT PHYSIOLOGY**
Code: **AER3642**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: AER3621
Course description: Atmospheric physics, human physiology, the circulatory system, oxygen and respiration. The Nervous system: ear, hearing and balance, eye and vision. Gas law: hypoxia, illusions and disorientation. Flying and Health: sleep and fatigue. High altitude and speed flight. Drugs, alcohol and human stresses.

MILITARY SCIENCE MECHANICS, ELECTRONIC AND WEAPON SYSTEMS (NAUTICAL)

NAV3661 PROPULSION

Course title: **PROPULSION**
Code: **NAV3661**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: PHY3511
Course description: Fundamentals of aircraft piston and gas turbine engines, subsonic and supersonic inlets for jet engines. Working cycles of gas turbine engine.classification of combustion chambers. Nozzles, compressors: operation, velocity diagrams, concept of prewhirl, blade design and performance characteristics.

NAV3601 SEAMANSHIP

Course title: **SEAMANSHIP**
Code: **NAV3601**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: **NONE**
Course description: Seamanship skills and ship handling. Roles and Characteristics of warships, international and inland navigational rules and rules of the road.Maritime background, sea laboratories on 42m Patrol vessel (PV), shore-based bridge simulator laboratories and ship maneuvering.

NAV3642 SHIP STABILITY AND CONTROLS

Course title: **SHIP STABILITY AND CONTROLS**
Code: **NAV3642**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: NAV3601
Course description: Drydocking: metacentric height, MM' and GG' methods. Critical period, GM at critical instant. Intact condition: IMO standard, simplified data, curves of Righting Levers. Inclining Experiment: theory and practice, density and hydrostatic information.Stability characteristics and problems.Vessel rolling and damage stability. Longitudinal stress: buoyancy, shear, load, and bending moment curves. Manoeuvrability: frictional resistance, shallow water, ship to ship and ship to shore interactions. Angle of heel and draft when turning at speed.

NAV3622 MARITIME HISTORY

Course title: **MARITIME HISTORY**
Code: **NAV3622**
NQA level: 6
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NONE
Course description: Atmospheric physics, human physiology, the circulatory system, oxygen and respiration. The Nervous system: ear, hearing and balance, eye and vision. Gas law: hypoxia, illusions and disorientation. Flying and Health: sleep and fatigue. High altitude and speed flight. Drugs, alcohol and human stresses.

YEAR 3

MILITARY SCIENCE ARMY

ARM3721 MILITARY PSYCHOLOGY

Course title: **MILITARY PSYCHOLOGY**
Code: **ARM3721**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: **NONE**
Course description: Personality theory and war: role of personality and personality theory of Jung, adjustment psychology: maladjustment and adolescent, transition in military training. Operational psychology: psychological effects of combat, post-traumatic stress disorder. Peacekeeping psychology: model to support soldiers and their dependants, stressors and prisoner of war. Psychological warfare: ethics in war operations.

ARM3741 MILITARY MANAGEMENT

Course title: **MILITARY MANAGEMENT**
Code: **ARM3741**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: **NONE**
Course description: Management: general, environment and diversity. Planning: skills, creative problem solving, strategy and operational processes and organising skills. Organising and delegation; management of change; Leadership skills; group and team development, power, conflict and stress, control of human resources and finance controls in organization.

ARM3761 MILITARY HISTORY

Course title: **MILITARY HISTORY**
Code: **ARM3761**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: **NONE**
Course description: South African defence force from 1957 – 1994, South African defence and imperial defence, integration and transformation of the SANDF since 1994, the NDF since 1990, the South African/ Namibian military historiography, history and establishment of the Union Defence Force, internal conflict between Voortrekers, Matebele and the Zulus, military power and white supremacy/hegemony, rise of black resistance in the twenty centaury.

ARM3711 MILITARY CONDUCT AND ENVIRONMENT

Course title: **MILITARY CONDUCT AND ENVIRONMENT**
Code: **ARM3711**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3612
Course description: Military actions. Environment: theories and systems. Environmental: management, resources, conflict, urban and related problems. Law: South African and Namibian. Data capturing techniques: sampling techniques, questionnaires and workshops. Data processing and interpretation. Procedure for the environmental impact assessment

ARM3732 AFRICA AND INTERNATIONAL POLITICAL ECONOMY

Course title: **AFRICA AND INTERNATIONAL POLITICAL ECONOMY**
Code: **ARM3732**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NONE
Course description: Political economy: characteristics of the world economic system, the evolution of the international political economy, Africa's contemporary economic history. Internal and external causes of economic decline in Africa, the NEPAD strategy, successful states in the Developing World, U.S.A. foreign aid after September 11, war economies: the U.S.A, China and Africa in contemporary-political economic context. The role of natural resource conflict: Sudan, Angola and Sierra Leone.

ARM3712 GEOGRAPHY OF SUB-SAHARAN AFRICA

Course title: **GEOGRAPHY OF SUB-SAHARAN AFRICA**
Code: **ARM3712**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3612
Course description: Landscape: physical and polilical. Geography: population, medical and urban. Historical background: culture, conflict and change. Agriculture development, human impact on the environment, natural resources, Geographical report writing about the region.

ARM3712 GEOGRAPHY OF SUB-SAHARAN AFRICA

Course title: **GEOGRAPHY OF SUB-SAHARAN AFRICA**
Code: **ARM3712**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3612
Course description: Landscape: physical and polilical. Geography: population, medical and urban. Historical background: culture, conflict and change. Agriculture development, human impact on the environment, natural resources, Geographical report writing about the region.

SARM3772CONTEMPORARY POLITICAL RELATIONS

Course title: **CONTEMPORARY POLITICAL RELATIONS**
Code: **SARM3772**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: **NONE**
Course description:foreign policy, decision making, models of foreign policy, international crises, theory of foreign policy, of cultures and political arrangement on the outcomes of foreign policies.

AER3721HISTORY OF AVIATION

Course title: **HISTORY OF AVIATION**
Code: **AER3721**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: **NONE**
Course description: Aviation timeline, aviation myths and legends, balloons, ornithopters or early helicopters, aviation pioneers, the Wright Brothers, aviation before and during World War One, aviation during and after World War Two, barnstormers and racers, first flights across the Atlantic, the pathfinders of aviation, the era of the jet aircraft, space exploration, airships, the history of airlines, history of national air forces, flying boats, aviation technology and development.

AER3751AIRPORT PLANNING AND MANAGEMENT

Course title: **AIRPORT PLANNING AND MANAGEMENT**
Code: **AER3751**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: **NONE**
Course description: Airport organization and public relations management. The economic, political and social role of airports.Airport privatization, revenues and costs. Airport requirements: master plan, site selection, layout, land use, airfield facilities, terminal area and building design. Airport financial management: financing methods and planning.

AER3711THEORY OF FLIGHT III

Course title: **THEORY OF FLIGHT III**
Code: **AER3711**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: AER3612 & AER3621
Course description: Flight performance and planning: multi-engine gas turbine, take-off, cruise, descent, landing, weight and balance, flight planning and monitoring. Meteorology: the atmosphere, clouds and precipitation, motion of the atmosphere, visibility, ice accretion, air-masses and frontal analysis, synoptic charts and upper level weather charts. Human factors: altitude flying, respiration and blood circulation, human information processing, human behavior, flying and health, threat & error management.

AER3782 RESEARCH METHODOLOGY

Course title: **RESEARCH METHODOLOGY**
Code: **AER3782**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: STS3522
Course description: Various philosophy of science, research proposals (guidance to write 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, skill required to communicate research findings to a broader audience, presentations, (oral and written). Peer reviewing, refereed Journals, ethics and legal issues (e.g. Plagiarism). Basic quantitative research (concerned with the tabulation or numeric relevance of various kinds of behavior (measuring). Basic of qualitative research.

AER3702 AVIATION MANAGEMENT PRINCIPLES

Course title: **AVIATION MANAGEMENT PRINCIPLES**
Code: **AER3702**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: ARM3741
Course description: Air transportation, aviation law, airline management, aviation safety and accident investigation. Principles of macro and micro economics, principles of management, financial and managerial accounting.Human capital, business statistics, public policy and labour laws. Collective bargaining, dispute resolution and labour relations environment.

AER3722AVIATION ETHICS

Course title: **AVIATION ETHICS**
Code: **AER3722**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: ARM3721
Course description: Ethical theories: dilemmas, decision-making, rights and character. Capitalism and its critics, the business of aviation, issues in responsibility and whistle-blowing in aviation. Racial discrimination against pilots: race, gender and age. Economic favouritism.

AER3742 AVIATION LAWS AND REGULATIONS

Course title: **AVIATION LAWS AND REGULATIONS**
Code: **AER3742**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: SAER3751
Course description: Aviation rules: administration, aircraft, personnel, airspace**,** carriage of dangerous goods, aerodrome traffic and noise, aircraft registration and parachuting. Certification: air operators, adventure aviation, large and medium aeroplanes, aeronautical information services organisations, agricultural aircraft operations, aviation training organisations, aircraft maintenance, design, manufacturing and recreation organisations. Aerodromes, aeronautical telecommunication, air traffic and instrument flight procedures. Aviation meteorological service organisations and foreign air transport operators.

AER3762 AIRCRAFT TURBINE ENGINE OPERATION

Course title: **AIRCRAFT TURBIN ENGINE OPERATION**
Code: **AER3742**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite: SAER3711
Course description: The gas turbine cycle. Basic principles, performance and efficiency of gas turbine.Effects of turbine temperature, atmospheric conditions on gas turbine. Engine sections, compressor stall and surge in gas turbine.

NAV3711 NAVIGATION AND NAVAL OPERATIONS

Course title: **NAVIGATION AND NAVAL OPERATIONS**
Code: **NAV3711**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3661 & NAV3642
Course description: Piloting, ship handling skills, basic navigation and rules of the nautical road. Visual and electronic navigation aids, magnetic and gyro compasses and global positioning system satellites. Fundamentals: standing and underway replenishment. Command and control, navigation and naval operation accidents.Voyage planning, contact tracking on maneuvering boards. Charts: navigation and concepts of coordinates. Distances: measurements, calculations, speeds, times and directions.

NAV3751APPLIED THERMODYNAMICS

Course title: **APPLIED THERMODYNAMICS**
Code: **NAV3751**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3661 & NAV3642
Course description:1st and 2nd Law of thermodynamics, irreversibility and availability, vapor and combined power cycles, gas power cycles, thermodynamic property relations, Gas-vapor mixtures and air conditioning, chemical reactions and phase equilibrium, flow through nozzles and diffusers.

NAV3731 AUXILIARIES NAVAL ENGINES

Course title: **AUXILIARIES NAVAL ENGINES**
Code: **NAV3731**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3661
Course description: Refrigeration and air conditioning techniques. Governing systems, electric power generation on shipboard, components and characteristics of marine auxiliary machines. Heat Exchangers, air compressors, oil water separators and piping systems, ventilation and air conditioning. Lifesaving and firefighting systems, deck machinery and cargo handling equipment.

NAV3741 ELECTRONICS I

Course title: **ELECTRONICS I**
Code: **NAV3741**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: SPHY3612
Course description: Semiconductor : p-type, n-type, and p-n junction. Diodes, BJT, transistor construction , the Common-Base (CB) , the Common-Emitter (CE) , the Common-Collector (CC) configurations. JFET: the junction field-effect transistor. MOSFET: the enhancement, depletion, inverter and logic gates.Small signal amplifiers, CE, CC, CB transistor amplifiers, hybrid model of the transistor, CS, CD, CG Fet amplifiers, cascade amplifiers, negative feedback, negative feedback-circuits analysis, response of the high frequency amplifers, Bode diagrams, operational amplifers.

NAV3761 ELECTRO-TECHNIQUES

Course title: **ELECTRO-TECHNIQUES**
Code: **NAV3761**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: SPHY3612
Course description: Direct current engines, asynchronous motors, synchronous engines and alternators. Electrical measurements, tests and safety. Rectifiers: half-bridge, full-bridge and controlled rectifier. Maximum reverse voltage and current, commutation problems, power factor and harmonic distortion.Electric distribution, protection and AC engines. Alternators: voltage regulation, synchronization, load sharing and external characteristics.

NAV3791 NAVAL AUTOMATION SYSTEMS

Course title: **NAVAL AUTOMATION SYSTEMS**
Code: **NAV3791**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3661
Course description: Naval automation, control engineering, solution strategies, process information, innovation, Heating, ventilation, refrigeration and air condition systems. Voltage and frequency control, cargo and ballast systems, ship information systems, digital control principles, bridge control systems and ship integrated system.

NAV3742 ADVANCED NAVIGATION

Course title: **ADVANCED NAVIGATION**
Code: **NAV3742**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3661
Course description:vessel bridge resource management, vessels' shore stations, formal safety assessment (FSA) of vessels, traffic separation schemes and marine accidents.

NAV3712NAVAL WEAPON SYSTEMS

Course title: **NAVAL WEAPON SYSTEMS**
Code: **NAV3712**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: PHY3612
Course description: Weapons system overview, energy, radar principles and systems, automatic tracking systems, Track-While-Scan (TWS), electronic scanning and phased array, USS Vincennes, electronic warfare, C4ISR and information warfare. Principles of underwater sound, detection and tracking systems.Military explosives and warheads, fuzing, guidance and control principles.Weapon propulsion and Architecture.Officer of the Day (OOD) Midwatch, launching systems, fire control, mine warfare and aircraft mishap.

NAV3762SHIP DESIGN

Course title: **SHIP DESIGN**
Code: **NAV3762**
NQA level: 7
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3642
Course description: Ship dimension, safety, controls and production steps. Constructional arrangements: general cargo, bulk carriers, combination carriers, container, ro/ro, passenger and war ships. General arrangement: holds, engine-room, peak tanks, double-bottom tanks, hatchways, bulk heats, cargo tanks, deck plating, frames, brackets, transverse frames, deck beams, shell plating, tank tops, stringers, stiffeners bow and stern, fore castle, aft castle, deck hauses, bilges, top-side tanks, hatchcovers, fairleads, mooring bitts, pipes arrangement, fore and aft perpendicular, propeller, shaft, freeboard and draught marks.

NAV3752ELECTRONICS II

Course title: **ELECTRONICS II**
Code: **NAV3752**
NQA level: 7
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: PHY3612
Course description: Circuits and op-amps applications. Oscillators: Sinusoidal wave generators, negative and positive feedback concepts, Berkhausen Criteria, Oscillator design methods, Colpitts and Hartley Oscillators, Wien Bridge Oscillators. Square wave and Triangle Wave generators. Multivibrators: Monostable, Bistable and Astable circuits, Schmitt Triggers, Timer circuits and 555 IC, Active filters, Butterworth and Chebishev active filters. Power Amplifiers: A, AB, C and D class, UJT Transistors. Electronics circuit design, Thrystor, triac and diac elements.

YEAR 4

ARM3810RESEARCH PROJECT

Course title: RESEARCH PROJECT
Code: ARM3810
NQA level: 8
Contact hours: 2 consultation periods per week for 14 weeks
Credits: 32
Course assessment: Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%)
Prerequisites: AER3732
Course description: Identification of research topic; literature review, data collection, analysis, proposal development, presentation, evaluation and report writing.

ARM3831MILITARY LEADERSHIP

Course title: MILITARY LEADERSHIP
Code: ARM3831
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3741
Course description: Leadership ethics, types and style of leadership, roles and ethics of commander, obedience and order, application of military ethics, code of conduct of the NDF and the Constitution of Namibia.

ARM3851ECONOMICS I

Course title: ECONOMICS I
Code: ARM3851
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3732

Course description:Micro-economics: Overview of economic systems. **The**ory**:**demand and supply. **Elasticity:** price, income, demand and supply. **Background:** utility, consumer equilibruim, budget line. **Production the**ory **and cost**: basic cost and profit cost, long run and short run cost. **Market structure**: monopoly, oligopoly, comparison of monopoly imperfect and perfect competition. Government intervention. **Macro-economic**: policy objectives and economic analytical models. **Public sect**or: role of goverment in economy, government intervention and market failure, spending and taxation. **Monetary policies**: money, financial intermediaries, demand and supply of money, instrument of monetary policy. **Defence economics**: functions of the defence industry, national and defence budgets, economic warfare, labour economics. **Economic systems and thoughts**: capitalism, socialism, mixed economy, pre-clasical and neo-clasical thought.

ARM3811GEOGRAPHICAL INFOR**MATION SYSTEMS**

Course title: GEOGRAPHICAL INFOR**MATION SYSTEMS**
Code: ARM3811
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3711 & ARM3712
Course description: Overview of geographic information systems (GIS). Fundamental geographical concepts for GIS-Science.Geographic information system technology in the military. Digital geographical data: capturing, storing, retrieval, manipulation, querying and displaying of data.

ARM3872ECONOMICS II

Course title: ECONOMICS II
Code: ARM3872
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3732
Course description:linternational trade: comperative and absolute advantage. Instrument of trade policy: tariffs, quatas, subsidies, administrative policies, antidumping, local content requirements, goverment intervention. Balance of payment accounts: current and financial. Exchange: foreign markets, foreign exchange policy or regimes, goverment intervention. International finace and debts crisis. Terms of trade: ratio of import and export price. Economic development: measurement of economic growth, business cycle and sources of economic growth.

ARM3852REMOTE SENSING

Course title: REMOTE SENSING
Code: ARM3852
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: ARM3711 & ARM3712
Course description: Electromagnetic energy, remote sensing, sensors and platform. Radiometric correction and geometric aspects of remote sensing. Image enhancement and visualisation.Visual image interpretation and digital classification.

AER3811AVIATION SAFETY

Course title: AVIATION SAFETY
Code: AER3811
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: AER3702
Course description: Flight safety: regulatory bodies, flight safety statistics, air traffic control, mechanical and human factors analysis. Accident investigation procedures, managing flight safety, organizational roles, institutional roles and cockpit resource management. Ground safety: aviation ground operations environment, aircraft mishaps, aircraft hazards, ground support equipment and hazardous material. Systems management: human factors concerns, risk management theory, preventative accident methodology and safety reporting systems.

AER3831ADVANCED AIRCRAFT PERFOR**MANCE**

Course title: ADVANCED AIRCRAFT PERFOR**MANCE**
Code: AER3831
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: AER3762
Course description: Weight and balance, aerodynamic, engine and propeller performance of aircrafts. Aeroplane trim, flight envelopes, take-off and field performance. Climb, cruise, descent and landing performance of aircrafts. Manoeuvre, thermo-structural and environmental performance.Mission analysis. Aircraft noise: sources, propagation and flight trajectories.

AER3821CREW RESOURCE MANAGEMENT IN AVIATION

Course title: CREW RESOURCE MANAGEMENT IN AVIATION
Code: AER3821
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: AER3742
Course description:Human error **and reliability** in crew resource management in aviation**:** types of error, human factor mishap, and threat. Error management: error chain, prevention and detection, safety culture, standing operation procedures (SOPs) and organizational factors. **Stress:** acute stress responses, workload and fatigue. **Situational awareness:** detection, processing, action, complacency, risk management, situational awareness and automation management. **Decision making:** skill based, rule based and knowledge based decisions. **Effective communications:** inquiry, advocacy and assertiveness. Conflict resolution, feedback and critique.**Leadership, team behavi**or **and synergy.**

AER3812AVIATION NAVIGATION GPS

Course title: AVIATION NAVIGATION GPS
Code: AER3812
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: AER3742
Course description: Principles and components of the GPS system: architecture and control, aircraft GPS equipment and triangulation. GPS navigation system performance: Technical Standard Order (TSO) and non TSO units, random autonomous integrity monitoring (RAIM), GPS errors and limitations. Integrated VFR flight planning and operations with a GPS: Standard VFR flight planning; Flight route entry into GPS; Standard VFR flight plan cross-checks with GPS; In flight VFR - GPS cross-checks (planned points). VFR-GPS assisted check flight: flight plan, GPS installation, unit modes and operations. GPS data interpretations: CDI bar, track, heading, range, groundspeed and time.

AER3822AVIATION LEADERSHIP

Course title: **AVIATION LEADERSHIP**
Code: **AER3822**
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: AER3722
Course description: History of air transport, airlines' organizational structure and economics, airline management, marketing, scheduling and pricing. Fundamentals of air cargo transportation, basics fleet selection and financing, aviation career planning and development. Leadership: in Army, Air Force and Navy.

AER3842AVIATION-AEROSPACE SECURITY ISSUES

Course title: **AVIATION-AEROSPACE SECURITY ISSUES**
Code: **AER3842**
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: AER3722
Course description: Security techniques: definition of security, concept of security risk, technologies and security measures at airports.ICAO and Namibia DCA regulations: history, application, ICAO standards, treaties and international obligations. Terrorism: terrorist activities and philosophies, hijacking and piracy. Improvised explosive devices: types and effect, searching for IEDs and management of threat.Dangerous goods.Quarantine and customs.

AER3862AVIATION-AEROSPACE SECURITY ISSUES

Course title: **AVIATION-AEROSPACE SECURITY ISSUES**
Code: **AER3862**
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: Co-requisite:AER3811
Course description: Air forces strategies in modern military. Aerial intelligence: threat analysis methodology and air power challenges. **Air force components:** air defence, space and the UAV's.**Operational aspects**. Air force missions and capabilities: internet and air warfare, principles of attack cycle, air force budgeting and aviation terrorism. **Asymmetric warfare and the war against terr**or: command and control in asymmetric air warfare, ethics and morals.

NAV3810RESEARCH PROJECT

Course title: **RESEARCH PROJECT**
Code: **NAV3810**
NQA level: 8
Contact hours: 2 consultation periods per week for 14 weeks
Credits: 32
Course assessment: Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%)
Prerequisites: AER3732
Course description: Identification of research topic; literature review, data collection, analysis, proposal development, presentation, evaluation and report writing.

NAV3801ASTRO-NAVIGATION

Course title: **ASTRO-NAVIGATION**
Code: **NAV3801**
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: AER3742
Course description: Celestial Navigation theory, cartography and astronomy, Bowditch, Sextant, index error, star-finder, navigationalstars and planets, electronic navigation, celestial measurements**,** the Nautical Almanac, sight reduction tables, Pilot and Great Circle charts.

NAV3841MATERIAL RESISTANCE

Course title: MATERIAL RESISTANCE
Code: NAV3841
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: PHY3711
Course description: Material micro and macro deformation, impulsive and impact loads, damage, beams and plates. Waves in rods: elastic and plastic stress, longitudinal, torsional and flexure waves and shock. Continuum modelling of structures. Numerical analyses of impact problems: explicit time integration, penalty and constraint contact methods, under-integrated element formulations, hourglass control, finite element models. Patterns of Energy absorption rate.

NAV3821PROCESS AND MATERIAL TECHNOLOGIES

Course title: PROCESS AND MATERIAL TECHNOLOGIES
Code: NAV3821
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: PHY3651
Course description: Mechanical properties, measurement techniques, physical properties of materials Miller indices of crystal planes, atomic bonding in crystals and heat treatment of metals and alloys

NAV3871SHIP HYDRO-STATICS AND STABILITY

Course title: SHIP HYDRO-STATICS AND STABILITY
Code: NAV3871
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3762
Course description: Ship dimensions, coefficients of form, forces and moments, laws of flotation, transverse stability, righting lever GZ, center of gravity, meta-centric heights, stiff and tender ships, statical stability diagram, stability cross curves, inclining experiment, grain cargo and its heeling moments, Bonjean curves, longitudinal stability, trim, trim calculations.

NAV3861DIGITAL ELECTRONICS

Course title: DIGITAL ELECTRONICS
Code: NAV3861
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3741 &NAV3752
Course description: Electronic Components and Circuits: Resistors, capacitors, diodes, transistors, CMOS logic gates, Ohm's and Kirchhoff's Laws. Logic Circuits and gates: AND, OR, NAND, NOR, NOT, Truth tables , Adders, Shift registers , Boolean Algebra, Laws of Commutation, Association, Duality, De Morgan, Fan-in and Fan-out. Number Systems:Decimal, Binary, Hexadecimal, Octal Conversion, ASCII and BCD. Registers: RS, D-Type, Single Byte and Byte transfer. MUX/DE-MUX : Multiplexer logic and truth tables, Use in registers, De-multiplexer logic and truth tables, Use in registers and Tri-state. Data Conversion: A/D and D/A techniques. Microcontrollers: The PIC as an example, Types of computer, Stored Program Control, Arithmetic and Logic Unit, Input/Output, Memory, Control Unit and Clock.

NAV3881DIGITAL TECHNIQUES

Course title: DIGITAL TECHNIQUES
Code: NAV3881
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3741 &NAV3752
Course description: Number systems, codes, combinational logic, sequential logic, MSI circuits,sequential circuits, digital arithmetic and circuits,schematic entry and programming of PLDs, J-K flip-flops, monostable circuit, astable multi-vibrator, binary synchronous and asynchronous counters.

NAV3809SIGNALS AND SYSTEMS

Course title: SIGNALS AND SYSTEMS
Code: NAV3809
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3741 &NAV3752
Course description: Circuit analysis, transmission of signals, linear systems and natural frequencies. Pole-zero diagrams: governing system equations and transform techniques. Systems analysis: continuous-time and discrete-time systems. Computer software and modeling.

NAV3841SIGNALS AND SYSTEMS

Course title: SIGNALS AND SYSTEMS
Code: NAV3841
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3741 &NAV3752
Course description: Signal conditioning, transmission, and interface circuits. Switches, relays and semiconductors. Temperature and sensors control. Feedback control principles: proportional, integral and derivative modes. Analog PID controllers. Motors: permanent magnet, DC control circuits, brushless DC and steppers.

NAV3861NAVAL WEAPON SYSTEMS

Course title: NAVAL WEAPON SYSTEMS
Code: NAV3861
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3741 &NAV3752
Course description: Weapons system overview, energy, radar principles and systems, automatic tracking systems, Track-While-Scan (TWS), electronic scanning and phased array, USS Vincennes, electronic warfare, C4ISR and information warfare. Principles of underwater sound, detection and tracking systems.Military explosives and warheads, fuzing, guidance and control principles.Weapon propulsion and Architecture.Officer of the Day (OOD) Midwatch, launching systems, fire control, mine warfare and aircraft mishap.

NAV3800APPLIED SENSORS AND ACTUATORS

Course title: APPLIED SENSORS AND ACTUATORS
Code: NAV3800
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3741 &NAV3752
Course description: Sensors: measuring of displacement, force, mechanical entities and temperature. Transducers: parameters, thermal, mechanical, liquid environment measurements, optical, chemical, physical, gas and pressure. Gas sensors and bio-sensors.Optical sensors and liquid media.

NAV3822NAVAL WARFARE

Course title: NAVAL WARFARE
Code: NAV3822
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3742
Course description: Review of military history, age of Galley Warfare, age of sail, war evolution, age of the battleship. Naval Warfare up to World War II.Propulsion and technological advances: weapon systems, nuclear power and missiles. Art and science of naval warfare, doctrine and amphibious operations.

NAV3862ENGINE AUTOMATION AND CONTROLS

Course title: ENGINE AUTOMATION AND CONTROLS
Code: NAV3862
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3731
Course description: Automation and control: feed-forward, feed-back strategies, dynamics, stability and loop. Dynamical systems and mathematical modelling.Distribution and lump parameter systems.Digital simulation, linearization of nonlinear mathematical model.Nyquist criterion. Controllers: linear PID, discrete-points and control, prime mover and parallel operation. Physical (pneumatic) and algorithmic (software).

NAV3882APPLIED ELECTRONICS

Course title: APPLIED ELECTRONICS
Code: NAV3882
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: PHY3612
Course description: Amplification, resistance and bandwidth. Amplifiers: ideal, practical operation, Bode diagrams, differential, BJT, power, negative feedback and stability. Semiconductor: components, diode, transistors and BJT switches. Computer simulation, power supplies and regulators.

NAV3809CORROSION AND CONTROLS

Course title: CORROSION AND CONTROLS
Code: NAV3809
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3762
Course description: General corrosion and thermodynamics of corrosion. Cells, electrochemical series, galvanic, Nernst equation, pourbaix diagram and cathodic reactions. Corrosion kinetics: polarisation diagrams, practical measurements and passivity. Corrosion Mechanisms: Effects of oxygen and carbon dioxide, Galvanic corrosion, pitting and crevice corrosion, mechanical interactions, microbial corrosion, Corrosion of welds, Stress corrosion cracking, Hydrogen embrittlement and effects of H_2S, high temperature corrosion. Corrosion controls: Paints, cathodic protection, Corrosion resistant alloys, corrosion monitoring, control by design.

NAV3812ELECTRIC-MACHINES AND DRIVES

Course title: ELECTRIC-MACHINES AND DRIVES
Code: NAV3812
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3752
Course description: Electrical Machinery Power Systems. Machines: direct current (DC), induction, electrical, synchronous, harmonic, losses and Residual Flux. Single and three phase transformers.Park transformation, simulation of the electrical machines with MATLAB/Simulink and effects of saturation.

NAV3800THEORY AND APPLICATIONS OF LASERS

Course title: THEORY AND APPLICATIONS OF LASERS
Code: NAV3800
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: PHY3612
Course description:applications of lasers, lasers in photonics technology, basic operation of laser oscillators, laser theories, operational characteristics of lasers and properties of lasers.

NAV3872BALLISTICS

Course title: BALLISTICS
Code: NAV3872
NQA level: 8
Contact hours: 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 16
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x3 hour theory paper
Prerequisites: NAV3752
Course description: Nitrocellulose, single and multi-based propellants, gas production and flame temperature, propellant ballistic parameters, vulverability ammunition propellants. Resal's energy equation, form functions, propellant grain shapes, equation of motion in gun barrel, heat transfer equations, measurement and computer modelling of gun barrel temperature, gun barrel erosion, Self-ignition of propellants and explosives.

NAV3842ADVANCED ELECTRO-TECHNIQUES

Course title: ADVANCED ELECTRO-TECHNIQUES
Code: NAV3842
NQA level: 8
Contact hours: 2 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.
Credits: 8
Course assessment: Continuous assessment **50%**: Examination **50%**: 1x2 hour theory paper
Prerequisites: NAV3762
Course description: programmable logic controllers, interface and sequence controls, industrial sensors, automate relays, A.C/D.C motors and generators

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 (3rd and 4th year students only for detailed course descriptions refer to 2013 Faculty Prospectus)

M.1. EXAMINATION REGULATIONS

For detailed examination and promotion rules seetheGeneral 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.2. RE-ADMISSION INTO THE FACULTY OF SCIENCE

M.2.1. 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.2.2. PASSREQUIREMENTS

M.2.2.1. 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.2.2.2. 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 Min**or **11BEGL**

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
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
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
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
2	Stratigraphy & Geological Mapping	GLY3612	16	GLY3521	None
Total Credits			**128**		

NB: IN 2014 Statistics for Life Sciences I STS3621 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics I BLG3621
Statistics for Life Sciences II STS3622 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics II BLG3622

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
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
2	Sedimentology & Palaeontology	GLY3731	16	GLY3521 & GLY3612	None
Total Credits			**144**		

All Students must register for Excursion GES3799 is compulsory for the completion of Geography and Environmental Studies at NQF level 7.

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
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
Total Credits			***136***		

QUALIFICATION: Environmental Biology Major **and Geography Minor 11BEGH**

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
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
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
1	Climatology **<u>and</u>**	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
2	Social Geography	GHE3682	8	GHE3582	None
2	Pedology <u>or</u> Hydrology	GHE3662 <u>or</u> GPE3622	8	None None	GHE3601 GHE3621
Total Credits			**144**		

NB: IN 2014 Statistics for Life Sciences I STS3621 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics I BLG3621
Statistics for Life Sciences II STS3622 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics II BLG3622

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
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
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
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
Total Credits			***144***		

N.2. MICROBIOLOGY

N.2.1. MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: Microbiology Major and Biochemistry Minor 11BMIB

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
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
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
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
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 OR CHM3532 & BLG3511	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total credits			**152**		

NB: IN 2014 Statistics for Life Sciences I STS3621 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics I BLG3621
Statistics for Life Sciences II STS3622 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics II BLG3622

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
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	MBL3731
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
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
2	Medical Microbiology	MIC3822	8	MBL3632 & MBL3711	None
2	Environmental And Industrial Microbiology	MIC3812	16	MBL3711, MBL 3731	None
2	Virology	MIC3832	16	MBL3711	None
2	Parasitology	MIC3802	8	MBL3711	MBL3811
Total credits			***128***		

QUALIFICATION: **Microbiology Major and Chemistry Minor 11BMIC**

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
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
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
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
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total credits			***144***		

NB: IN 2014 Statistics for Life Sciences I STS3621 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics I BLG3621
Statistics for Life Sciences II STS3622 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics II BLG3622

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
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	MBL3731
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
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
2	Medical Microbiology	MIC3822	8	MBL3711& MBL3632	None
2	Environmental And Industrial Microbiology	MIC3812	16	MBL3711 & MBL3731	None
2	Virology	MIC3832	16	MBL3711	None
2	Parasitology	MIC3802	8	MBL3711	MBL3811
Total credits			***128***		

N.3. MOLECULAR BIOLOGY

N.3.1. MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

QUALIFICATION: Molecular Biology Major **and Biochemistry Min**or **11BMOB**

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
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
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
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
2	Biochemistry II	CHB3612	16	CHM3511 & CHM3512 OR CHM3532 & BLG3511	None
2	Organic Chemistry I	CHM3612	16	CHM3511 & CHM3512	None
Total credits			**144**		

NB: IN 2014 Statistics for Life Sciences I STS3621 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics I BLG3621
Statistics for Life Sciences II STS3622 **IS PHASING OUT. THE EQUIVALENT IS** Biometrics II BLG3622

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
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	MBL3631	MBL3731
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research methodology	BLG3702	8	STS3621 & STS3622	None
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 & MBL3732	MBL3831
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
Total credits			***128***		

QUALIFICATION: **B.Sc. (Honours) Molecular Biology Major and Chemistry Minor 11BMOC**

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
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
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
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
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
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	MBL3631	MBL3731
2	Genetics	MBL3732	16	MBL3632 & MBL3631	None
2	Research Methodology	BLG3702	8	STS3621 & STS3622	None
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 & MBL3732	MBL3831
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
Total credits			**128**		

N.4. 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 supplementaryexamination, 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 Min**or **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 & Complex Numbers	MAT3521	8		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication & Study Skills	LCE3419	16		None
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
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
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
2	Modern Physics I	PHY3602	8	PHY3511, PHY3512, MAT3511, MAT3512	None
Total Credits			**152**		

IN 2014
Organic Chemistry I CHM3612 **IS PHASING OUT. THE EQUIVALENT IS** CHM3651 Organic Chemistry I
Waves and Optics PHY3631 **IS PHASING OUT. THE EQUIVALENT IS** PHY3601: Optics **&**PHY3651: Mechanics & Waves

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
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
2	Modern Physics II	PHY3732	16	PHY3602	None
Total Credits			**144**		

Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB

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 &2	Research Projects	CHM3810	16	All third year chemistry modules	None
1	Physical Inorganic Chemistry	CHM3841	8	CHM3701	None
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
Total Credits			**144**		

QUALIFICATION: Chemistry Major **and Biology Min**or **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
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
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	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
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
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
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
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
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 & Study Skills	LCE3419	16		None
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
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
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
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
1	Coal, Petroleum & Gas	GLY3701	8	GLY3521	None
1	Regional Geology of Namibia	GLY3761	8	GLY3521	None
1	Mineralogy	GLY3711	16	CHM3512& GLY3632	None
1&2	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
2	Exploration Geochemistry & Geostatistics	GLY3782	8	GLY3642; GLY3600 (co-requisite)	None
2	Hydrogeology I	GLY3702	8	GLY3621 & GLY3642	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
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
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
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
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
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
2	Introduction to Microbiology	MBL3632	16	BLG3511, BLG3512	None
Total Credits			**144**		

YEAR 3

SEMESTER		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
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
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
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
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
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
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
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
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
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
Total Credits			**128**		

O.4. CHEMISTRY AND BIOCHEMISTRY MODULE EQUIVALENTS

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		CHM3811	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/ CHB3810	Research Projects		CHM3810/ CHB3810	Research Projects

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 Inf**or**mation Technology Min**or **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		None
1	Fundamentals of Digital Electronics	CMP3521	8		None
1	Introduction to Information Technology	CME3511	16		None
2	English for Academic Purposes	LEA3519	16		LCE3419
2	Contemporary Social Issues	CSI3580	8		None
2	Programming Fundamentals II	CMP3512	16	CMP3511	None
2	Computer Organization	CMP3532	16		None
2	Introduction to Statistics	STS3522	8		None
2	Introduction to Web Design	CME3512	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Introduction to Database Systems	CMP3611	16	CMP3511	None
1	Object Oriented Programming	CMP3631	16	CMP3511	None
1	Software Engineering I	CMP3641	8	CMP3511	None
1	Mathematics for Computer Science I	CMP3671	16	MAT3511	None
1	Telecommunications	CME3611	16	CMP3521	None
2	Advanced Databases	CMP3622	8		CMP3611
2	Data Structures and Algorithms	CMP3612	8		CMP3631
2	Foundations of Data Communications	CMP3632	16	CMP 3532	None
2	Software Engineering II	CMP3652	16		CMP3641
2	Mathematics for Computer Science II	CMP3672	16		CMP3671
2	Networking and Emerging Technologies	CME3612	16	CME3511	CME3611
Total Credits			**152**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Computer Networks	CMP3721	8	CMP3632	None
1	Computer Theory	CMP3741	8	CMP3672	None
1	Computer Architecture	CMP3761	8	CMP3532 CMP3521	None
1	Artificial Intelligence	CMP3771	16	CMP3511	None
1	Research Methodology I	CMP3701	8	STS3522 OR STS3531	None
1	Introduction to Network Security	CME3731	16	CME3612	None
2	Operating Systems	CMP3722	8	CMP 3532 OR CMP 3612	None
2	Human Computer Interaction and Computer Ethics	CMP3742	8	CMP 3652	None
2	Computer Graphics	CMP3762	8	CMP 3612	None
2	Internet Technologies and Applications	CMP3712	16		CMP 3721
2	Research Methodology II	CMP3702	8		CMP 3701
2	Advanced Web Programming	CME3732	16	CME 3512 CMP 3512	None
Total Credits			**176**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDITS	PRE-REQUISITES	CO-REQUISITES
1	Network Systems Security	CMP3821	8	CMP 3721	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3721	None
1	Software Project Management	CMP3819	16	CMP 3742	None
1	Operations Research	CMP3831	16	CMP3672 OR EEM3672	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 Min**or **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		None
1	Fundamentals of Digital Electronics	CMP3521	8		None
1	Analytical Geometry, Complex Numbers and Matrices	MAT3531	16		None
2	English for Academic Purposes	LEA3519	16		LCE3419
2	Contemporary Social Issues	CSI3580	8	University Entry Requirements	None
2	Programming Fundamentals II	CMP3512	16	CMP3511	None
2	Computer Organization	CMP3532	16		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	None
1	Object Oriented Programming	CMP3631	16	CMP3511	None
1	Software Engineering I	CMP3641	8	CMP3511	None
1	Mathematics for Computer Science I	CMP3671	16	MAT3511	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		CMP3611
2	Data Structures and Algorithms	CMP3612	16		CMP3631
2	Foundations of Data Communications	CMP3632	16	CMP3532	None
2	Software Engineering II	CMP3652	16	Co-Requisite: CMP3641 Software Engineering I	None
2	Mathematics for Computer Science II	CMP3672	16		CMP3671
2	Elementary Linear Algebra	MAT3652	16	Any two full modules of first year Mathematics	None
Total Credits			**160**		

MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Computer Networks	CMP3721	8	CMP3632	None
1	Computer Theory	CMP3741	8	CMP3672	None
1	Computer Architecture	CMP3761	8	CMP3532 CMP3521	None
1	Artificial Intelligence	CMP3771	16	CMP3511	None
1	Research Methodology I	CMP3701	8	STS3522 OR STS3531	None
1	Linear Algebra I	MAT3711	16	MAT3601 MAT3652	None
2	Operating Systems	CMP3722	8	CMP3532 OR CMP3612	None
2	Human Computer Interaction & Computer Ethics	CMP3742	8	CMP3652	None
2	Computer Graphics	CMP3762	8	CMP3612	None
2	Internet Technologies & Applications	CMP3712	16		CMP3721
2	Research Methodology II	CMP3702	8		CMP3701
2	Linear Algebra II	MAT3712	16	MAT3601 MAT3652	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Network Systems Security	CMP3821	8	CMP 3721	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3721	None
1	Software Project Management	CMP3819	16	CMP 3742	None
1	Operations Research	CMP3831	16	CMP3672	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	None
2	Real Time Multimedia	CMP3812	16	CMP3742	None
2	Database Programming	CMP3872	16	CMP3512 CMP3622	None
Total Credits			**128**		

P.2.3. COMPUTER SCIENCE MAJOR & STATISTICS MINOR

QUALIFICATION: Computer Science Major **and Statistics Min**or **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		None
1	Fundamentals of Digital Electronics	CMP3521	8		None
1	Descriptive Statistics	STS3531	16		None
2	English for Academic Purposes	LEA3519	16		LCE3419
2	Contemporary Social Issues	CSI3580	8		None
2	Programming Fundamentals II	CMP3512	16	CMP3511	None
2	Computer Organization	CMP3532	16		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	None
1	Object Oriented Programming	CMP3631	16	CMP3511	None
1	Software Engineering I	CMP3641	8	CMP3511	None
1	Mathematics for Computer Science I	CMP3671	16	MAT3511	None
1	Probability Theory	STS3611	16	STS3532 MAT3512	None
2	Advanced Databases	CMP3622	8		CMP3611
2	Data Structures and Algorithms	CMP3612	16		CMP3631
2	Foundations of Data Communications	CMP3632	16	CMP 3532	None
2	Software Engineering II	CMP3652	16		CMP3641
2	Mathematics for Computer Science II	CMP3672	16		CMP3671
2	Statistical Inferences	STS3632	16	STS 3532	None
Total Credits			**160**		

YEAR 3

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Computer Networks	CMP3721	8	CMP 3632	None
1	Computer Theory	CMP3741	8	CMP3672	None
1	Computer Architecture	CMP3761	8	CMP3532 CMP3521	None
1	Artificial Intelligence	CMP3771	16	CMP3511	None
1	Research Methodology I	CMP3701	8	STS3522 or STS3531	None
1	Sampling Methods	STS3731	16	STS3531	None
2	Operating Systems	CMP3722	8	CMP3532 or CMP3612	None
2	Human Computer Interaction and Computer Ethics	CMP3742	8	CMP3652	None
2	Computer Graphics	CMP3762	8	CMP3612	None
2	Internet Technologies and Applications	CMP3712	16		CMP3721
2	Research Methodology II	CMP3702	8		CMP3701
2	Nonparametric and Categoral Data Analysis	STS3712	16	STS 3632	None
Total Credits			**128**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Network Systems Security	CMP3821	8	CMP 3721	None
1	Wireless and Mobile Computing	CMP3841	8	CMP 3721	None
1	Software Project Management	CMP3819	16	CMP 3742	None
1	Operations Research	CMP3831	16	CMP3672 or EEM3672	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	None
2	Real Time Multimedia	CMP3812	16	CMP3742	None
2	Database Programming	CMP3872	16	CMP3512 CMP3622	None
Total Credits			**128**		

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 **&**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	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	GLY3662	8	GLY3521	None
Total credits			**144**		

NB: In 2014 PHY3631 *Waves & Optics* is phasing out, the equivalent for **11BGLY degree is PHY3601*Optics***
In 2014 GLY3652 *Introduction to Petrology* is phasing out, the equivalent for **11BGLY degree is GLY3662 *Introduct***o*ry* ***Petrology***

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	Sedimentology & Palaeontology	GLY3731	16	GLY3612 **&** GLY3652	None
1	Regional Geology of Namibia	GLY3761	8	GLY3521	None
1	Environmental & Engineering Geology I	GLE3771	16	GLY3642 **&** MAT3512; GLY3621	None
2	Ordinary Differential Equations*	MAT3642 *	8	MAT3521 **&** MAT3512	None
2	Hydrogeology I	GLY3702	8	GLY3621**&** GLY3642	None
2	Structural Geology I	GLY3712	16	GLY3612; MAT3612**&** 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, GLY3642 **&** GLY3600	None
Total credits			**184**		

YEAR 4

SEMESTER	MODULE NAME	CODE	CREDIT	PRE- REQUISITES	CO-REQUISITES
1&2	Field Geology III	GLY3800	8	GLY3700	GLY3810
1	Environmental and Engineering Geology II*	GLE3801 *	8	GLE3771	
1	Industrial Minerals and Gemstones*	GLY3801 *	8	GLY3641**&** GLY3711;	
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;	
1&2	Research Project	GLY3810	32	All third and second year modules	GLY3800
2	Exploration Geology and Geophysics	GLY3832	16	GLY3712 **&** GLY3782, PHY3631 or PHY3601; GLY3700	
2	Remote Sensing & GIS	GLY3852	16	GLY3712;	
2	Structural Geology II	GLY3862	8	GLY3712 **&** GLY3700	
Total credits			**152**		

***Elective course**

Q.4. GEOLOGY DEPARTMENT: COURSE EQUIVALENTS

11BGLY Old BSc Geology (Honours) Courses (2008-2012)		11BSCG New BSc Geology (Honours) Courses (2013-2016)	
Course Name	**Code**	**Course Name**	**Code**
Introduction to Physical Geology & Surface Processes	GLY3521	Introduction to Physical Geology & Surface Processes	GLY3521
Introduction to Earth Systems	GLY3502	Introduction to Earth Systems	GLY3502
Field Geology I	GLY3600	Field Geology I	GLY3600
Stratigraphy & Geological Mapping	GLY3612	Stratigraphy & Geological Mapping	GLY3612
Introduction to Hydrology	GLY3621	Introduction to Hydrology	GLY3621
Earth Resources	GLY3641	Introduction to Earth Systems	GLY3502
Introduction to Geochemisty	GLY3642	Introduction to Geochemisty	GLY3642
Introduction to Petrology	GLY3652	Introductory Petrology	GLY3662
Field Geology II	GLY3700	Field Geology II	GLY3700
Coal, Petroleum & Gas	GLY3701	Coal, Gas & Petroleum	GLY3811
Hydrogeology I	GLY3702	Hydrogeology I	GLY3702
Mineralogy	GLY3711	Mineralogy	GLY3711
Structural Geology I	GLY3712	Structural Geology I	GLY3712
Plate Tectonics	GLY3721	Plate Tectonics	GLY3721
Sedimentology & Palaeontology	GLY3731	Sedimentology	GLY3751
Igneous Petrology	GLY3722	Igneous & Metamorphic Petrology	GLY3732
Metamorphic Petrology	GLY3742		
Regional Geology of Namibia	GLY3761	Regional Geology of Namibia	GLY3761
Research Methology	GLY3762	Research Methology	GLY3762
Environmental and Engineering Geology I	GLE3771	Environmental & Engineering Geology I	GLE3701
Exploration Geochemistry & Geostatistics	GLY3782	Exploration Geochemistry & Geostatistics	GLE3742
Field Geology III	GLY3800	Field Geology III	GLY3800
Environmental and Engineering Geology II	GLE3801	Environmental & Engineering Geology II	GLE3821
Industrial Minerals & Gemstones	GLY3801	Industrial Minerals & Gemstones	GLY3801
Research Project	GLY3810	Research Project	GLY3810
		Field Geology for Research	GLY3820
Hydrogeology II	GLY3812	Hydrogeology II	GLY3812
Economic Geology	GLY3831	Economic Geology	GLY3831
Exploration Geology & Geophysics	GLY3832	Exploration Geology & Geophysics	GLY3832
Igneous Petrogenesis	GLY3821	Igneous & Metamorphic Petrogenesis	GLY3871
Metamorphic Petrogenesis	GLY3841		
Remote Sensing & GIS	GLY3852	Remote Sensing	GLY3822
		GIS	GLY3741
Structural Geology II	GLY3862	Structural Geology II	GLY3862

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 Min**or **11BMAS**

This qualification shall be completely phased out in 2016. It is being replaced by 11BSMS BSc Mathematics (Honours) – Statistics Stream on a year-by-year basis beginning 2013. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

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
1	Descriptive Statistics	STS3531	16		None
1	Programming Fundamentals I	CMP3511	16		None
1	Fundamentals of Digital Electronics	CMP3531	16		None
2	English for Academic Purposes	LEA3519	16		LCE3419
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
2	Programming Fundamentals II	CMP3512	16	CMP3511	None
Total Credits			**176**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 **&**MAT3512] or [MAT3531 &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	STS 3532 **&** MAT3512	None
1	Statistical Estimation	STS3631	16	STS3532	None
1	Software Engineering I	CMP3641	8	CMP3511	None
2	Calculus II	MAT3612	16	[MAT3511 **&** MAT 3512] or [MAT3531**&** MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 **&** MAT 3512] or [MAT3531 &MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two following modules: MAT3511, MAT3531, MAT3512	None
2	Statistical Inference	STS3632	16	STS3532	
2	Introduction to Statistical Computing	STS3612	16	STS3531	
Total Credits			**144**		

NB: IN 2014 MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB
STS3631 STATISTICAL ESTIMATION IS PHASING OUT. THE EQUIVALENT IS STS3671: STATISTICAL METHODS
STS3612 Introduction Statistical Computing **IS PHASING OUT. THE EQUIVALENT IS** STS3652 Fundamentals of Statistical Computing

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	[MAT3611 or MAT3612] **&** MAT3601	
1	Linear Algebra I	MAT3711	16	MAT3601 **&**MAT3652	
1	Numerical Analysis I	MAT3701	8	[MAT3611 **&** MAT3621] or [MAT3612 **&** MAT 3621]	
1	Set Theory	MAT3721	8	MAT3601	
1	Partial Differential Equations	MAT3741	8	[MAT3611 or MAT3612], MAT3621 **&** MAT 3642	
1	Sampling Techniques	STS3731	16	STS3531	
1	Distribution Theory	STS3721	8	STS3611, MAT3611 **&** MAT3612	
2	Real Analysis II	MAT3732	16	[MAT3611 or MAT3612] **&** MAT3601	
2	Linear Algebra II	MAT3712	16	MAT3601 **and** MAT3652	
2	Vector Analysis	MAT3622	8	[MAT3611 or MAT3612] **&** MAT3601	
2	Number Theory	MAT3722	8	MAT3601	
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] **&** [MAT3711 or MAT 3712]	
2	Category Theory	MAT3802	8	All Mathematics modules up to third year	
2	Numerical Analysis II	MAT3832	16	MAT3611, MAT3612 **&** MAT3701	
2	Complex Analysis II	MAT3852	16	MAT3731 or MAT3732	
Total Credits			**96**		

QUALIFICATION: **B.Sc. (Honours) Mathematics Maj**or **and Computer Science Min**or **Min**or **11BMAC**

This qualification shall be completely phased out in 2016. It is being replaced by 11BSMC BSc Mathematics (Honours) – Computer Science Stream on a year-by-year basis beginning 2013. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

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
1	Programming Fundamentals I	CMP3511	16		None
1	Fundamentals of Digital Electronics	CMP3531	16		None
2	English for Academic Purposes	LEA3519	16		LCE3419
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
2	Programming Fundamentals II	CMP3512	16	CMP3511	None
2	Computer Organization	CMP3532	16		None
Total Credits			**176**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 **&** MAT 3512] or [MAT3531 &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	Introduction to Database Systems	CMP3611	16	CMP3532 **&** 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 **&**MAT 3512] or [MAT3531 **&** MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 **&**MAT 3512] or [MAT3531 **&** MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two following modules: MAT3511, MAT3531, MAT3512	None
2	Data Structure and Algorithms	CMP3612	16		CMP3631
2	Foundations of Data Communications	CMP3632	16	CMP 3532	None
Total Credits			**144**		

MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB
Foundations of Data Communications CMP3632 **IS PHASING OUT. THE EQUIVALENT IS** Computer Networks II CIT3612

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	[MAT 3611 or MAT 3612] **&** MAT 3601	None
1	Linear Algebra I	MAT3711	16	MAT 3601 **&** MAT 3652	None
1	Numerical Analysis I	MAT3701	8	[MAT 3611 **&** MAT 3621] or [MAT 3612 **&** MAT3621]	None
1	Set Theory	MAT3721	8	MAT 3601	None
1	Partial Differential Equations	MAT3741	8	[MAT 3611 or MAT 3612], MAT 3621 **&**MAT 3642	None
1	Artificial Intelligence	CMP3771	16	CMP 3511	None
2	Real Analysis II	MAT3732	16	[MAT 3611 or MAT 3612] **&**MAT 3601	None
2	Linear Algebra II	MAT3712	16	MAT 3601 **&** MAT 3652	None
2	Vector Analysis	MAT3622	8	[MAT 3611 or MAT 3612] **&** MAT 3601	None
2	Number Theory	MAT3722	8	MAT 3601	None
2	Operating Systems	CMP3722	8	CMP3532 or CMP3612	None
2	Advanced Databases	CMP3622	8	CMP3511	CMP3611
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 MAT3732] & [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 **&**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

This qualification shall be completely phased out in 2016. It is being replaced by 11BSCM BSc Mathematics (Honours) – Physics Stream on a year-by-year basis beginning 2013. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

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
1	Physics for Physical Sciences I	PHY3511	16		None
2	English for Academic Purposes	LEA3519	16		LCE3419
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Introduction to Probability	STS3532	16		None
2	Physics for Physical Science II	PHY3512	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Calculus I	MAT3611	16	[MAT3511 **&** MAT 3512] **or** [MAT3531 **&** 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 **&**MAT3512	None
1	Waves and Optics	PHY3631	16	PHY3511 & PHY3512	None
1	Classical Mechanics	PHY3611	16	MAT3512, PHY3511 **&** MAT3511	None
2	Calculus II	MAT3622	8	[MAT3511 **&** MAT3512] **or** [MAT3531 **&** MAT3512]	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 **&** MAT 3512] **or** [MAT3531 **&** MAT3512]	None
2	Elementary Linear Algebra	MAT3652	16	Any two following modules: MAT3511, MAT3531, MAT3512	None
2	Electromagnetism	PHY3612	16	MAT3511, MAT3512 **&**PHY3512	None
2	Modern Physics I	PHY3602	8	MAT3511, MAT3512, PHY3511 **&** PHY3512	None
Total Credits			**136**		

MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB

YEAR 3

SEMESTER	MODULE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Real Analysis I	MAT3731	16	[MAT3611 **or** MAT3612] **&** MAT3601	None
1	Linear Algebra I	MAT3711	16	MAT3601 **&**MAT3652	None
1	Numerical Analysis I	MAT3701	8	[MAT3611 **&**MAT3621] or [MAT3612 **&** MAT 3621]	None
1	Set Theory	MAT3721	8	MAT3601	None
1	Partial Differential Equations	MAT3741	8	[MAT3611 **or** MAT3612], MAT3621 **&** MAT 3642	None
1	Electrodynamics	PHY3711	16	MAT3612 **&**PHY3612	None
2	Real Analysis II	MAT3732	16	[MAT3611 **or** MAT3612] **&**MAT3601	None
2	Linear Algebra II	MAT3712	16	MAT3601 **&**MAT3652	None
2	Vector Analysis	MAT3622	8	[MAT3611 **or** MAT3612] **&**MAT3601	None
2	Number Theory	MAT3722	8	MAT3601	None
2	Theoretical Mechanics	PHY3712	16	PHY3611, MAT3621, MAT3642 **&**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] & [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 **&** MAT3701	None
2	Complex Analysis II	MAT3852	16	MAT3731 **or** MAT3732	None
Total Credits			**128**		

R.1.2 MATHEMATICS: COURSE EQUIVALENTS

OLD COURSES (Started in 2008)	NEW COURSES (Revised in 2012)
MAT3511: Basic Mathematics MAT3580: Basic Mathematics A	MAT3511: Basic Mathematics MAT3580: Basic Mathematics A
MAT3531: Analytic Geometry, Complex Numbers and Matrices	MAT3501: Analytic Geometry MAT3521: Matrices and Complex Numbers
MAT3590: Analytic Geometry, Complex Numbers and Matrices A	MAT3520: Analytic Geometry A MAT3540: Matrices and Complex Numbers A
MAT3512: Precalculus MAT3570: Precalculus A	MAT3512: Precalculus MAT3570: Precalculus A
MAT3601: Sets and Numbers	MAT3661: Sets and Logic
MAT3611: Calculus I	MAT3611: Calculus I
MAT3621: Numerical Methods	MAT3641: 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	MAT3781: 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

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		None
1	Computer Literacy	CLC3509	8		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry, Matrices & Complex Numbers	MAT3531	16		None
1	Programming Fundamentals I	CMP3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Physics for Physical Sciences II	PHY3512	16		None
2	Precalculus	MAT3512	16		None
2	Programming Fundamentals II	CMP3512	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	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
1	Object Oriented Programming	CMP3631	16	CMP3511	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	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	COURSE	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
1	Linear Algebra I	MAT3711	16	MAT3601, MAT3652	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	PHY3612	None
2	Vector Analysis	MAT3622	8	MAT3601 and one of the courses MAT3611 **or** MAT3612	None
2	Number Theory	MAT3722	8	MAT3601	None
2	Real Analysis II	MAT3732	16	[MAT3611 **or** MAT3612] **and** MAT3601	None
Total Credits			**144**		

A student may replace the full course MAT3732 (Real Analysis II) with the combination of <u>two</u> half courses (MAT3622) Vector Analysis <u>and</u> MAT3722 (Number Theory).

YEAR 4

SEMESTER	COURSE	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	Quantum Mechanics	PHY3811	16	PHY3712, PHY3732	None
1	Statistical Mechanics	PHY3831	16	PHY3611, PHY3701	None
1&2	Research Project	PHY3810	16	PHY3711, PHY3712	None
1	Advanced Electrodynamics	PHY3809	8	PHY3711	None
1	Plasma Physics	PHY3821	8	PHY3711	None
2	Solid State Physics	PHY3812	16	PHY3701, PHY3732	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
					None
Total Credits			**168**		

QUALIFICATION: B.Sc. Honours Physics Major **and GeologyMin**or **11BPHG**

Students opting for a major in **Physics** (with Geology minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	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	Physics for Physical Science I	PHY3511	16		None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
1	Introduction to Physical Geology and surface processes	GLY3521	8		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Pre-calculus	MAT3512	16		None
2	Physics for Physical Science II	PHY3512	16		None
2	Introduction to Probability	STS3532	16		None
2	Introduction to Earth systems	GLY3502	8		None
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	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 courses: MAT3511; MAT3531; MAT3512	None
1	Numerical Methods	MAT3621	8	Any two of the following courses: MAT3511; MAT3531; MAT3512	None
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 courses: MAT3511; MAT3531; MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 **&** MAT 3512] **or** [MAT3531 **&** MAT3512]	None
2	Geological Mapping and Stratigraphy	GLY3612	16	GLY3521	None
Total Credits			**160**		

MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB

YEAR 3

SEMESTER	COURSE	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 MAT3601	None
1	Coal, Petroleum and Gas	GLY3701	8	GLY3521	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
2	Structural Geology I	*GLY3712*	16	GLY3612 **&** MAT3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	COURSE	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
1	Plasma Physics	PHY3821	8	PHY3711	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
2	Nuclear Physics	PHY3802	8	PHY3732	None
2	Optics and Laser Physics	PHY3822	8	PHY3631; PHY3711	None
2	Astrophysics	PHY3842	8	PHY3732	None
Total Credits			**144**		

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 courses:

YEAR 1

SEMESTER	COURSE	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		None
1	Basic Mathematics	MAT3511	16		None
1	Analytic Geometry, Matrices & Complex Numbers	MAT3531	16		None
1	Programming Fundamentals I	CMP3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Physics for Physical Sciences II	PHY3512	16		None
2	Precalculus	MAT3512	16		None
2	Programming Fundamentals II	CMP3512	16		CMP3511
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	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
1	Object Oriented Programming	CMP3631	16	CMP3511	
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
2	Data Structures & Algorithms	CMP3612	16	CMP3631	None
Total Credits			**160**		

MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB

YEAR 3

SEMESTER	COURSE	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
1	Artificial Intelligence	CMP3771	16	CMP3511	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	PHY3612	None
2	Real Analysis II	MAT3732	16	MAT3601 and one of the courses MAT3611 **or** MAT3612	None
2	Vector Analysis	MAT3622	8	MAT3601 and one of the courses MAT3611 **or** MAT3612	None
2	Number Theory	MAT3722	8	MAT3601	None
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 course MAT3732 (Real Analysis II) with the combination of two half courses (MAT3622) Vector **Analysis and MAT3722 (Number The**or**y).**

YEAR 4

SEMESTER	COURSE	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
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
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 courses:

YEAR 1

SEMESTER	COURSE	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	Physics for Physical Science I	PHY3511	16		None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
1	Chemistry 1A	CHM3511	16		None
2	English for Academic Purposes	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Pre-calculus	MAT3512	16		None
2	Physics for Physical Science II	PHY3512	16		None
2	Chemistry 1B	CHM3512	16		None
Total Credits			**160**		

YEAR 2

SEMESTER	COURSE	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 courses: MAT3511; MAT3531; MAT3512	None
1	Numerical Methods	MAT3621	8	Any two of the following courses: MAT3511; MAT3531; MAT3512	None
1	Physical Chemistry I	CHM3631	16	CHM 3511, CHM3512,, MAT3511, MAT3512	None
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 courses: MAT3511; MAT3531; MAT3512	None
2	Ordinary Differential Equations	MAT3642	8	[MAT3511 **&** MAT 3512] **or** [MAT3531 **&** MAT3512]	None
2	Organic Chemistry I	CHM3612	16	CHM3511 **&** CHM3512	None
Total Credits			**152**		

IN 2014 MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC
Numerical Methods MAT3621 **IS PHASING OUT. THE EQUIVALENT IS MAT3641** Numerical Methods with MATLAB

YEAR 3

SEMESTER	COURSE	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.** MAT3611**or** MAT3612 MT3612 **2.** MAT3601	None
1	Organic Chemistry II	CHM3711	16	CHM3612	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	PHY 3722	8	PHY3612	None
2	Physical Chemistry II	CHM3712	16	CHM3631,MAT3611 **&** MAT3612	None
Total Credits			**128**		

YEAR 4

SEMESTER	COURSE	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
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
Total Credits			**144**		

S.2. PHYSICS SERVICE COURSES

SEMESTER	COURSE	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	PHE3642	PHY3512, MAT3511, MAT3512
I	Modern Physics for Educators	PHE3751	PHY3511, PHY3512, MAT3511, MAT3512

T. DEPARTMENT OF STATISTICS AND POPULATION STUDIES

T.1 DIPLOMA PROGRAMME

QUALIFICATION: DIPLOMA IN APPLIED STATISTICS (11DSST)

YEAR 1

SEMESTER	COURSE 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	COURSE 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	EMI3571	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	EMA3572	16		None
Total Credits			128		

T.2 DIPLOMA COURSE EQUIVALENTS

Old Courses		New Courses	
STD2431	Basics of Statistics	STD2431	Basics of Statistics
STD2411	The Statistical System	STD2411	The Statistical System
STD2412	Index Numbers and Time series	STD2412	Index Numbers and Time series
STD2432	Introduction to Mathematics	**MAT2432**	**Introduction to Mathematics**
STD2452	Sampling concepts in Survey work	STD2452	Sampling concepts in Survey work
STD2551	Basic Data Processing	STD2551	Basic Data Processing
STD2531	Probability	**STD3532**	**Introduction to Probability**
STD2511	Statistical Methods and Techniques	**STS3531**	**Descriptive Statistics**
STD2532	Statistical Modeling	**STD2552**	**Basic Statistical Modeling**
STD2512	Basic Demography and Epidemiology	STD2512	Basic Demography and Epidemiology

QUALIFICATION: B.Sc. (Honours) Statistics Major and Computer Science Minor 11BSTC

This qualification shall be completely phased out in 2016. It is being replaced by 11BSCS BSc Statistics (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Statistics** (with Computer Science minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	CREDIT	CODE	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		
1	Descriptive Statistics	16	STS3531		
1	Computer Literacy	8	CLC3509		None
1	Basic Mathematics	16	MAT3511		
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		
1	Programming Fundamentals I	16	CMP3511		
2	English for academic Purpose	16	LEA3519		
2	Contemporary Social Issues	8	CSI3580		
2	Precalculus	16	MAT3512		
2	Introduction to Probability	16	STS3532		
2	Programming Fundamentals II	16	CMP3512	CMP3511	
Total Credit		**160**			

NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531normal mode or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 normal mode** or(Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	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
1	Introduction to Database Systems	16	CMP3611	CMP3511	None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Calculus II	16	MAT3612	MAT3512	None
2	Statistical Inference	16	STS3632	STS3532	None
2	Advanced Databases	8	CMP3622	CMP3611	None
Total Credit		**128**			

IN 2014 STS3631 STATISTICAL ESTIMATION IS PHASING OUT. THE EQUIVALENT IS STS3671:STATISTICAL METHODS STS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING

MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMETER	COURSE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	Linear Models	16	STS3711	STS3611, STS3632	None
1	Distribution Theory	8	STS3721	MAT3611, MAT3612, STS3611	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Research and Survey Methods	8	STS3701	None	None
1	Artificial Intelligence	16	CMP3771	CMP3511	None
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3632	STS3711
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
2	Database Programming	16	CMP3872	CMP3512 &CMP3622	None
Total Credit		**128**			

YEAR 4

SEMESTER	COURSE	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	STS3732	None
Total Credit		**128**			

QUALIFICATION: B.Sc. (Honours) Statistics Major and Population Studies Minor 11BSTP

This qualification shall be completely phased out in 2016. It is being replaced by 11BSCS BSc Statistics (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Statistics** (with Population Studies minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		None
1	Descriptive Statistics	16	STS3531		None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511		None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		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		None
2	Introduction to Probability	16	STS3532		None
2	Basics of Sociology	16	SOG3532		None
Total Credit		**160**			

NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531normal mode or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 normal mode** or (Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	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
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
2	Social Demography	16	SOG3652		None
Total Credit		**136**			

IN 2014 STS3631 STATISTICAL ESTIMATION IS PHASING OUT. THE EQUIVALENT IS STS3671:STATISTICAL METHODS
STS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING
MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMESTER	COURSE	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
1	Demographic Methods I	16	POP3711		None
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3632	STS3711
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
2	Demographic Methods II	16	POP3732		None
Total Credit		**128**			

YEAR 4

SEMESTER	COURSE	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 &Application	16	STS3852		STS3801
2	Statistical Quality Control	16	STS3832	STS3732	None
Total Credit		**128**			

QUALIFICATION: B.Sc. (Honours) Statistics Major and Mathematics Minor (11BSTM)

This qualification shall be completely phased out in 2016. It is being replaced by 11BSCS BSc Statistics (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Statistics** (with Mathematics minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	Credit	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		None
1	Descriptive Statistics	16	STS3531		None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511		None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		None
1	Programming Fundamentals I	16	CMP3511		None
2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI 3529		None
2	Precalculus	16	MAT3512		None
2	Introduction to Probability	16	STS3532		None
2	Programming Fundamentals II	16	CMP3512		CMP3511
Total Credit		**160**			

NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531nor**mal mode** or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 n**or**mal mode** or (Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	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 **&** MAT 3512]**or** [MAT3531 **&** MAT3512]	None
1	Sets and Numbers	8	MAT3601	any two following courses: MAT3511 MAT3531,MAT3512	None
1	Numerical Methods	8	MAT3621		None
2	Introduction to Statistical Computing	16	STS3612	STS3531	None
2	Calculus II	16	MAT3612	[MAT3511 **&**MAT 3512] **or** [MAT3531 **&** MAT3512]	None
2	Statistical Inference	16	STS3632	STS3532	None
2	Elementary Linear Algebra	16	MAT3652	Any two following courses: MAT3511 MAT3531,MAT3512	None
Total Credit		**128**			

IN 2014 STS3631 STATISTICAL ESTIMATION IS PHASING OUT. THE EQUIVALENT IS STS3671: STATISTICAL METHODS
STS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING
MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMESTER	COURSE	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
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	STS3632	STS3711
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
2	Linear Algebra II	16	MAT3712	MAT3601 MAT3652	None
Total Credit		**128**			

YEAR 4

SEMESTER	COURSE	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	STS3732	None
Total Credit		**128**			

QUALIFICATION: B.Sc. (Honours) Statistics Major and Economics Minor 11BSTE

This qualification shall be completely phased out in 2016. It is being replaced by 11BSCS BSc Statistics (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Statistics** (with Economics minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		None
1	Descriptive Statistics	16	STS3531		None
1	Computer Literacy	8	CLC3509		None
1	Basic Mathematics	16	MAT3511		None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		None
1	Basic Microeconomics	16	EMI3571		None
2	English for academic Purpose	16	LEA3519		None
2	Contemporary Social Issues	8	CSI 3580		None
2	Precalculus	16	MAT3512		None
2	Introduction to Probability	16	STS3532		None
2	Basic Macroeconomics	16	EMA3572		None
Total Credit		**160**			

NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531normal mode or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 normal mode** or (Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	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
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
2	Intermediate Microeconomics II	16	EMI3672		None
Total Credit		**136**			

IN 2014 STS3631 STATISTICAL ESTIMATION IS PHASING OUT. THE EQUIVALENT IS STS3671:STATISTICAL METHODS
STS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING
MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Linear Models	16	STS3711	STS3611, STS3632	None
1	Distribution Theory	8	STS3721	MAT3611,MAT3612, STS3611	None
1	Sampling Techniques	16	STS3731	STS3531	None
1	Research and Survey Methods	8	STS3701	None	None
1	Econometrics I	16	ETM3771		None
2	Data processing	16	STS3732	STS3632, STS3612	None
2	Experimental Design and Analysis of Variance	16	STS3752	STS3632	STS3711
2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
2	Econometrics II	16	ETM3772		None
Total Credit		**128**			

YEAR 4

SEMESTER	COURSE	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		STS3801
2	Statistical Quality Control	16	STS3832	STS3732	None
Total Credit		**128**			

QUALIFICATION: B.Sc. Population Studies (Honours) **Population Studies** Major and Geography Minor **11BPGE**

This qualification shall be completely phased out in 2016. It is being replaced by 11BSPO BSc Population studies (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Population Studies** (with Geography) minor must take all of the following courses:

YEAR 1

SEMESTER	COURSE	CODES	CREDIT	PRE-REQUISITES	CO-REQUISITES
1	English Communication and Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Basic Mathematics	MAT3511	16		None
1	Fundamentals of Physical Geography	GHE3581	8		None
1	Descriptive statistics	STS3531	16		None
1	Analytic Geometry, Complex Numbers and Matrices	MAT3531	16		None
2	English for academic Purpose	LEA3519	16		None
2	Contemporary Social Issues	CSI3580	8		None
2	Precalculus	MAT3512	16		None
2	Fundamentals of Human Geography	GHE3582	8		None
2	Introduction to Probability	STS3532	16		None
Total Credit			**136**		

NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531nor**mal mode** or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 n**or**mal mode** or (Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	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&2	Community Health	16	NCH3630	None	None
1	Sets and Numbers	8	MAT3601	any two following courses: 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	Statistical Inference	16	STS3632	STS3532	None
2	Biogeography	8	GHE3642		None
Total Credit		**144**			

NB:
STS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING
MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMESTER	COURSE	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	POP3611	POP3711
2	Regional Geography	16	GHE3752		None
1&2	Excursion	compulsory	GES3799		
Total Credit		**144**			

All Students must register for **Excursion GES3799 is compuls**ory **f**or **the completion of Geography and Environmental ` Studies at NQF level 7.**

YEAR 4

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Epidemiological Methods	16	POP3811		None
1&2	Environmental Management and Governance	8	GSP3800		None
1&2	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	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 Min**or **11BPST**

This qualification shall be completely phased out in 2016. It is being replaced by 11BSPO BSc Population studies (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Population Studies** (with Statistics minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	English Communication & Study Skills	16	LCE3419		None
1	Descriptive Statistics	16	STS3531		None
1	Computer Literacy	8	CLC3509	None	None
1	Basic Mathematics	16	MAT3511		None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		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		None
2	Introduction to Probability	16	STS3532		None
2	Basics of Sociology	16	SOG3532		None
Total Credit		**160**			

NB: IN 2013 Foundation of Sociology SOG3511 EQUIVALENCE WILL BE Foundation of Sociology SOG3581and SOG3532: BASICS OF SOCIOLOGY, EQUIVALENCE WILL BE SOG3582:BASICS OF SOCIOLOGY

NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531nor**mal mode** or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 n**or**mal mode** or (Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Probability Theory	16	STS3611	STS3532, MAT3512	None
1	Statistical Estimation	16	STS3631	STS3532	None
1&2	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	Statistical Inference	16	STS3632	STS3532	None
Total Credit		**152**			

IN 2014 TS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING
MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMESTER	COURSE	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	POP3611	POP3711

2	Non-parametric and Categorical Statistics	16	STS3712	STS3632	None
Total Credit		**136**			

YEAR 4

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Epidemiological Methods	16	POP3811		None
1&2	Advanced Sociology of Namibian Society	8	SOS3840		None
1&2	Sociology of Gender and Sexuality	8	SOS3860		None
1&2	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	Forecasting Methods and Application	16	STS3852		None
Total Credit		**136**			

QUALIFICATION: B.Sc. Population Studies (Honours) Population Studies Major **and Sociology Min**or **11BPSO**

This qualification shall be completely phased out in 2016. It is being replaced by 11BSPO BSc Population studies (Honours) –. In the transition process, students should be aware of course-equivalents in each of the concerned departments.

Students opting for a major in **Population Studies** (with Sociology minor) must take all of the following courses:

YEAR 1

SEMESTER	COURSE	CREDIT	CODES	PRE/CO-REQUISITES	CO-REQUISITES
1	English Communication and Study Skills	16	LCE3419		None
1	Computer Literacy	8	CLC3509		None
1	Basic Mathematics	16	MAT3511		None
1	Foundation of Sociology	16	SOG3511		None
1	Descriptive statistics	16	STS3531		None
1	Analytic Geometry, Complex Numbers and Matrices	16	MAT3531		None
2	English for academic Purpose	16	LEA3519		None
1&2	Contemporary Social Issues	8	CSI3580		None
2	Precalculus	16	MAT3512		None
2	Basics of Sociology	16	SOG3532		None
2	Introduction to Probability	16	STS3532		None
Total Credit		**160**			

IN 2013 SOG3532: BASICS OF SOCIOLOGY, EQUIVALENCE WILL BE SOG3582: BASICS OF SOCIOLOGY
NB: Analytic Geometry, Complex Numbers and Matrices(MAT3531nor**mal mode** or MAT3590 slow mode) **Equivalences will be Analytic Geometry MAT3501and Matrices and Complex Numbers MAT3521 n**or**mal mode** or (Slow mode)MAT3520: Analytic Geometry A and MAT3540: Matrices and Complex Numbers A

YEAR 2

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Social problems: learning to conceptualize and implement social research	16	SOG3671		None
1&2	Community Health	16	NCH3630	None	None
1	Sets and Numbers	8	MAT3601	any two following courses: 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	Statistical Inference	16	STS3632	STS3532	None
2	Classical sociological Theory	16	SOG3612		None
Total Credit		**152**			

IN 2014
STS3612: INTRODUCTION TO STATISTICAL COMPUTING IS PHASING OUT. THE EQUIVALENT IS STS3652: FUNDAMENDALS OF STATISTICAL COMPUTING
MAT3601: SETS AND NUMBERS IS PHASING OUT. THE EQUIVALENT IS MAT3661: SETS AND LOGIC

YEAR 3

SEMESTER	COURSE	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	POP3611	POP3711
2	Sociology of Namibian society	16	SOG3772		None
Total Credit		**136**			

YEAR 4

SEMESTER	COURSE	CREDIT	CODES	PRE-REQUISITES	CO-REQUISITES
1	Epidemiological Methods	16	POP3811		None
1&2	Advanced Sociology of Namibian Society	8	SOS3840		None
1&2	Sociology of Gender and Sexuality	8	SOS3860		None
1&2	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	Forecasting Methods and Application	16	STS3852		None
Total Credit		**136**			

T.3. STATISTICS AND POPULATION STUDIES COURSE EQUIVALENTS

Old Course		New/Revised Course	
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	STS3692	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
STS3832	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.