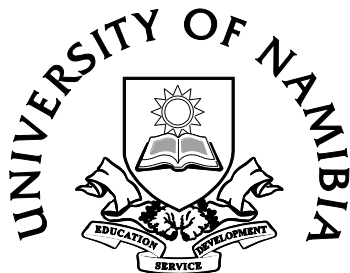


# FACULTY PROSPECTUS 2012

## FACULTY OF SCIENCE



— Inspiring minds & shaping the future —

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## NOTE

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Regulations and curricula for 2012 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 2011.

The fact that particulars of a specific course or field of study have been included in this Faculty Prospectus does not necessarily mean that such programme, subject, or module will be offered in 2012 or any consecutive year.

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

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## FACULTY PREAMBLE

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

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

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

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## ACADEMIC YEAR 2012

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### **FIRST SEMESTER**

|                          |   |
|--------------------------|---|
| 09 January               | University opens  |
| 10 January               | 2 <sup>nd</sup> Opportunity Examinations commence (2011 Examinations)     |
| 19 January               | Academic staff resumes office duties                                      |
| 26 January               | 2 <sup>nd</sup> Opportunity Examinations end                              |
| 30 January – 17 February | Registration – All campuses (Last day for Late Registration: 22 February) |
| 20 February              | Lectures commence for FIRST SEMESTER                                      |
| 06 April                 | EASTER BREAK start  |
| 16 April                 | Lectures resume after Easter Break  |
| 01 June                  | Lectures end for FIRST SEMESTER   |
| 05 June                  | 1 <sup>st</sup> Opportunity Examinations commence (Semester I modules)    |
| 26 June                  | 1 <sup>st</sup> Opportunity Examinations end                              |
| 27 June – 03 July        | 2 <sup>nd</sup> Opportunity Examinations                                  |
| 03 July                  | End of 1 <sup>st</sup> Semester   |
| 09 – 13 July             | Mid-year recess   |

### **SECOND SEMESTER**

|                 |  |
|-----------------|--|
| 23 July         | Lectures commence for SECOND SEMESTER  |
| 10 September    | SPRING BREAK starts  |
| 17 September    | Lectures resume after Spring Break   |
| 02 November     | Lectures end for SECOND SEMESTER   |
| 06 November     | 1 <sup>st</sup> Opportunity Examinations commence (Semester II & Double modules) |
| 27 November     | 1 <sup>st</sup> Opportunity Examinations end                                     |
| 28 Nov – 04 Dec | 2 <sup>nd</sup> Opportunity Examinations   |
| 04 December     | End of 2 <sup>nd</sup> Semester  |
| 18 December     | Academic Year ends & University closes (until 14 January 2013)                   |
| 14 January 2013 | University opens (2013 academic year)  |
| 24 January 2013 | Academic staff resume office duties  |

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## DUE DATES FOR THE 2012 ACADEMIC YEAR

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### (i) GENERAL

|   |             |
|---|-------------|
| Last day for application of retention of continuous assessment mark .....   | 17 February |
| Last day for application for exemption(s) .....   | 17 February |
| Last day for Late Registration ( <i>Late fee payable</i> ) .....  | 22 February |
| Last day for approval of exemption(s) .....   | 22 February |
| Last day for approval of retention of continuous assessment mark .....  | 22 February |
| Last day for approval of module(s) & qualification changes .....  | 22 February |
| Last day to change Examination Centres at Regional Centres (Semester I modules) .....   | 27 April    |
| Last day for appeals (First Opportunity Examinations) (Semester I) .....  | 27 July     |
| Last day to submit outstanding documentation .....  | 17 August   |
| Last day to change Examination Centres at Regional Centres (Semester II modules – 1 <sup>st</sup> & 2 <sup>nd</sup> Opportunity Examinations) ..... | 21 Sept     |
| Last day to cancel enrolment .....  | 28 Sept     |
| Last day for submission of Theses and Dissertations for examination .....   | 16 Nov      |

### (ii) CANCELLATIONS

#### Semester I modules

Last day to cancel Semester I modules .....

*Semester II modules*

Last day to cancel Semester II modules .....

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

Last day to cancel Double modules .....

### (iii) FINANCE

#### Semester I modules

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

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

*Semester II modules*

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

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

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

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

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

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## **A. STRUCTURE AND PERSONNEL OF THE FACULTY**

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### **A.1. OFFICE OF THE DEAN**

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**Dean**

Prof E M R Kiremire, B.Sc.(Hons), University of East Africa, Makerere University College) Ph.D. (Uni. of New Brunswick, Canada)

**Deputy Dean**

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

**Faculty Officer**

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

**Faculty Secretary**

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

**Typist**

Vacant

**Cleaner:**

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

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



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## A.2. ACADEMIC DEPARTMENTS

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### DEPARTMENT OF BIOLOGICAL SCIENCES

☎ (+264 61) 206 3423 ☎ (+264 61) 206 3791 ✉ rbock@unam.na ✉ Private Bag 13301, Windhoek, Namibia

|                            |  |
|----------------------------|--|
| Head of Department:        | Dr. R. Böck  |
| Professor:                 | Vacant   |
| Associate Professor:       | Prof. I. Mapaure: B.Sc.Hons, MSc, Ph.D (Univ of Zimbabwe)  |
| Senior Lecturer:           | Vacant   |
| Senior Lecturer:           | Dr. J.K.E .Mfune: B.Sc.B.Sc.Hons (Malawi) M.Sc, Ph.D (Aberdn, U.K)   |
| Senior Lecturer:           | Dr. P.M. Chimwamurombe: B.Sc.Biochemistry, MSc. Biotechnology (UZ),<br>PhD Plant Biotechnology (Univ of Pretoria, RSA)   |
| Senior Lecturer:           | Mr. K.C. Chinsembu: B.Sc. (Zambia), MSc. (Brussels), PhD (UNAM)  |
| Lecturer:                  | Dr. R. Böck: M.Sc. (Saarbrücken/Germany), Ph.D (Oklahoma State/USA)  |
| Lecturer:                  | Dr. E.M. Julies: B.Sc.B.Sc.Hons (Rhodes Univ), PGDE (UNAM), M.Sc. (Univ of Ghent, Belgium),<br>Dr. rer. nat. (Max Planck Inst. for Marine Microbiology, Bremen, Germany)   |
| Lecturer:                  | Dr. N. Shiponeni: B.Sc. (UNAM), M.Sc (Stellenbosch), PhD (Cape Town)   |
| Lecturer:                  | Mr. B. Kaonjua: B.Sc. (State Univ of New York) M.Sc. (University of Brussels)  |
| Lecturer:                  | Mr. A. Faul: B.Sc.Hons, MSc Conservation Ecology (Stellenbosch)  |
| Lecturer:                  | Mr. V.M Haakuria: B.Sc. (UNAM), BSc Hons. (Rhodes Univ), M.Sc. (Wits Univ)   |
| 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<br>Humboldt Universität zü Berlin)  |
| Lecturer:                  | Mr. Marius Hedimbi: B.Sc. MSc. Applied Biology (UNAM)  |
| Quest Lecturer:            | Dr. D. Mumbengegwi: B. Sc (Hons) Biological Sciences (Univ of Zimbabwe), M.Sc.<br>Biotechnology and Molecular Biology (University of Hull, U.K), PhD. Pharmaceutical Sciences<br>(University of Manchester, U.K) |
| Assistant Lecturer:        | Mr. A.H. Du Plesis: BSc. (Education) (University of Western Cape)  |
| Assistant Lecturer:        | Mrs. C. Deelie: BSc. (UNAM), BEd Hons (UNISA), HDE postgraduate diploma (UNAM)   |
| Assistant Lecturer /Tutor: | Ms. C Amoo: B.Sc. Biology and Chemistry, M.Sc. Biochemistry (UNZA)   |
| Reseacher:                 | Ms. P. Kadhila-Muandingi B.Sc.(China), MSc Applied biology (UNAM)  |
| Tutor:                     | Vacant   |
| Technologist:              | Mr. A. Hijarunguru: B.Sc. (US)   |
| Technologist:              | Mr. JD Uzabakiriho: B.Sc. M.Sc. (NUR)  |
| Technologist:              | Ms. M. A Morkel: B.Sc. (Humboldt, USA) [on study leave]  |
| 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**

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

Professor: Prof E M R Kiremire: B.Sc. (Hons), University of East Africa, Makerere University College) Ph.D. (Univ. of New Brunswick, Canada) **(Dean)**

Associate Professor: Vacant

Senior Lecturer: Prof Wang: M. Eng (China)

Senior Lecturer: Dr H R Loffy El -Sayed: B.Sc., MSc, PhD. (Mansaoura University- RPI, USA)

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

Lecturer: Dr ERT Elago: B.Sc. (UDW) PGDE (UNAM) B.Sc. Hons, MSc (UPE), PhD (NMMU)

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

Lecturer: Dr R Hans: B.Sc. (UNAM), MSc (University of Botswana), PhD (University of Cape Town)

Lecturer: Dr G Kahaka: B.Sc. (UNAM), MSc & PhD (Nottingham University, UK)

Lecturer: Ms C V Raidron: B.Sc., HED (UNAM), MPhil (Murdoch University, Australia)

Lecturer: Mr V Uahengo: B.Sc. (UNAM), MSc. (Wuhan. Univ, China), Staff Development Fellow

Lecturer: Ms T Thomas B.Sc. (UNAM), MSc. (UCT)

Lecturer: Mr G Uiseb: B.Sc.(UNAM), MSc (Loughborough University, UK)

Researcher: Ms N Pogori B.Sc. (UNAM), MSc. (Jiangnan University, China)

Senior Technologist: Mr W Song: B. Eng. (South East University. China)

Technologist, Ms C Mukakalisa: B.Sc. (UNAM), MSc (UNAM)

Technologist, MSc Student: Mr T Ndunge: B.Sc. (UNAM)

Technologist, MSc Student: Mr N Gariseb B.Sc. (UNAM)

Technologist, MSc Student: Ms S Potgieter: B.Sc. PGDE, Hon Science Education

Technologist, MSc Student: Ms M Nyambe (UNAM), Hons (Stellemenbosch)

Technologist: Ms A Shiimi: B.Sc. (UNAM), B. Sc Hons (UCT), MSc (UCT)

Technologist: Ms N Shifeta B.Sc. (UNAM)

Technologist: Ms H Hakwenye B.Sc. (UNAM)

Technologist: Ms C Tjiurutue B.Sc. (UNAM) Staff Development Fellow

Technologist: Mr D Likius: BSc (UNAM), MSc (UNAM) Staff Development Fellow

Assistant Technician: Mr T Manuel

## DEPARTMENT OF COMPUTER SCIENCE

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Head of Department: Dr. J. Mbale Ph.D. (HIT, China), M.Sc. (Shanghai, China), B.A. (UNZA), Dip.Ed. (TVTC), CCAI, CISCO IT-Essentials: PC Hardware and Software

Professor: Vacant

Senior Lecturer: Dr. J. Mbale: Ph.D. (HIT, China), M.Sc. (Shanghai, China), B. A. (UNZA), Dip.Ed. (TVTC), CCAI, CISCO IT-Essentials: PC Hardware and Software

Senior Lecturer: Mr. E. L. Mkusa: B.Sc. (Mech Eng) MBA (UDSM) M.Sc. (OR, Lancaster) M.Sc. (IT. Strathclyde)

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

Lecturer: Mrs. N. Suresh: BE (Eng), MTech (India)

Lecturer: Mr J. J. Magenya: HND (ENG), (ESSEX, UK), M.Sc. (UNAM)

Lecturer: Mr Frans David: M.Sc. (China); (*On Study Leave*)

Lecturer: Mr James Mutuku: B.Sc.(Hons)(Nairobi), PGDE(UNAM), HDipCS (Wits), MSc (UCT)

Lecturer: Dr. V. Hashiyana: PhD. (Saint-Petersburg University of Information Technologies Mechanics and Optics, Russia)

Lecturer: Vacant

Tutor: Ms. S.R. Mwatilifange: B.Sc.(Strayer, USA)

Tutor: Mr. S.P. Shihomeka: MBA (SA), B.Ed. (UNAM), ICDL (SA)

Tutor: Ms. Theodora Mukaya: B.Sc. (UNAM)

Tutor: Mr . F. Da Silva: B.Sc.Eng (HIMEE – Varna, Bulgaria)

Tutor: Mr. P.K. Hangulah: B.Eng (HW, Scotland)

Technologist: Mr. J. M. Mutonga: MCSE, CCNA 1, Computer Network Engineering and Management Certificate

Technologist: Mr. Nyambe: MCSE, CCNA 4,A+ and N+ Certificates.

## DEPARTMENT OF GEOLOGY

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|                        |  |
|------------------------|--|
| Head of Department:    | Dr A.F. Kamona   |
| Professor:             | Vacant   |
| Senior Lecturer:       | Dr F Kamona: B.Sc. (UNZA), MMinSc (UNZA), PhD (Aachen, Germany).         |
| Senior Lecturer:       | Dr B.S. Mapani: B.Sc. (UNZA), MSc. (Nancy), PhD (Melbourne)              |
| Lecturer:              | Dr.A. Macuvele, B.Sc. (Edward Mondlane), PhD (Aachen, Germany)           |
| Lecturer:              | Dr. A. Wanke: Diplom Arbeit/MSc (Göttingen), PhD (Würzburg).             |
| Lecturer:              | Dr. H. Wanke: Diplom Arbeit/MSc (Kiel), PhD (Würzburg).                  |
| Lecturer:              | Vacant   |
| Lecturer: (Part-time): | Dr B Corner: B.Sc.Hons, M.Sc, Ph.D. (Wits)                               |
| Lecturer: (Part-time): | Mr. M. Siyambango, B.Sc. (UNAM), M.Sc (Exeter, Camborne School of Mines) |
| Tutor:                 | Mr. A. Vatuva B.Sc. (UNAM) on study leave                                |
| Tutor:                 | Ms. S. Uugulu; BSc (UNAM) on study leave                                 |
| Tutor:                 | Mr. F. Maske;  |
| Technologist:          | Ms. J. Kaluwapa: Nat. Dipl (Mech. Eng), Polytechnic of Namibia           |
| Technologist:          | Mr. G. Nghikongelwa: Nat. Dipl (Mech. Eng), Polytechnic of Namibia       |

## DEPARTMENT OF MATHEMATICS

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Professor: Vacant  
Associate Professor: Vacant  
Senior Lecturer: Dr F Gideon: B.Sc. (UNAM), BSc-Hons, MSc (Rhodes Univ), Ph.D (University of North West)  
Senior Lecturer: Vacant  
Lecturer: Mr A Shikongo B.Sc. (UNAM) BSc-Hons (University of Pretoria), M.Sc. (UWC), On study leave for PhD studies  
Lecturer: Dr M M Mugochi B.Sc.Hons (UZ), Mphil (UZ), PhD (UNISA)  
Lecturer: Mr D Iiyambo: B.Sc., PGDE (UNAM), BSc-Hons, (UCT), M.Sc (UCT)  
Lecturer: Dr Z Mushaandja: B.Sc. (UNAM) B.Sc.-Hons (UCT) M.Sc. (UCT) Ph.D (UCT)  
Lecturer: Mr. Vijayakumar Kandaswamy, B.Sc. (BDU, India), M.Sc (BDU, India), PGDCS (Central University, Hyderabad, India)  
Lecturer: Mr D Elago: B.Sc. (UNAM) PGDE (UNAM), MSc (UWC)  
Lecturer: Dr O Shuungula B.Sc. (UNAM) BSc-Hons, M.Sc. (UCT), PhD (WITS)  
Tutor: Ms B B Nambahu: BSc (UNAM)  
Staff Development Fellow: Mr P Haihambo: BSc (UNAM)  
Tutor: Ms C Amakutsi: B.Sc. (UNAM) PGDE (UNAM)  
Tutor: Mr L Komomungondo B.Sc. (UNAM)  
Tutor: Mr J. Lichela: BSc (UNAM)

**DEPARTMENT OF PHYSICS**

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|                           |  |
|---------------------------|--|
| Head of Department:       | Prof J A Oyedele   |
| Professor:                | Prof J A Oyedele: B.Sc.(Ife), M.Sc., PhD (Mc Master, Canada)           |
| Associate Professor:      | Prof S Singh M.Sc. PhD. (India)  |
| Senior Lecturer:          | Dr R Steenkamp: Ph.D. (Potchefstroom)                                  |
| Senior Lecturer:          | Mr W Liu: B.Sc. (Harbin), M.Sc. (Heilongjiang, China)                  |
| Lecturer:                 | Ms P Dobreva: M.Sc. (Sofia, Bulgaria)                                  |
| Lecturer:                 | Mr. I Davids: B.Sc., PGDE (UNAM), BSc.-Hons, M.Sc (North West, RSA)    |
| Staff Development Fellow: | Mr. A. Chatu B.Sc.(UNAM), B.Sc.Hons. (WITS, RSA)                       |
| Tutor:                    | Ms. Q Auala: B.Sc. (UNAM)  |
| Tutor:                    | Mr. S Shimboyo: B.Sc. (UNAM)   |
| Laboratory Technologist:  | Mr O Mutenda: B.Sc. (UNAM)   |
| Laboratory Technologist:  | Mr H C Hofmann: National Certificate N3 (RSA), Trade Diploma (Namibia) |
| Technical Assistant:      | Ms E Shilongo: Diploma in Education (Mutare, Zimbabwe)                 |

**DEPARTMENT OF STATISTICS**

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

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## **B. QUALIFICATIONS OFFERED BY THE FACULTY**

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The Faculty may award the following Undergraduate and Postgraduate degrees:

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### **B.1. UNDERGRADUATE PROGRAMMES**

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| <b>CODE</b>   | <b>DIPLOMA/DEGREE</b>                               | <b>MINIMUM DURATION</b> |
|---------------|---|-------------------------|
| <b>11DSST</b> | Diploma in Applied Statistics                       | 2 years full-time       |
| <b>11BSCI</b> | Bachelor of Science                                 | 4 years full-time       |
| <b>11BSCD</b> | Bachelor of Science Population Studies (Honours)    | 4 years full-time       |
| <b>11BSCH</b> | Bachelor of Science (Honours)                       | 4 years full-time       |
| <b>11BFMA</b> | Bachelor of Science Financial Mathematics (Honours) | 4 years full-time       |

**POSTGRADUATE PROGRAMMES** (For detailed information refer to the School Postgraduate Studies Prospectus for postgraduate studies)

| <b>CODE</b>   | <b>DEGREE</b>  | <b>MINIMUM DURATION</b> |
|---------------|--|-------------------------|
| <b>11MSCB</b> | Master of Science Biodiversity Management & Research | 2 years full-time       |
| <b>11MSCC</b> | Master of Science Chemistry                          | 2 years full-time       |
| <b>11MSCI</b> | Master of Science Information Technology             | 2 years full-time       |
| <b>11MSPH</b> | Master of Science Physics                            | 2 years full-time       |
| <b>11MSCM</b> | Master of Science Mathematics                        | 2 years full-time       |
| <b>11MSST</b> | Master of Science Applied Statistics and Demography  | 2 years full-time       |
| <b>11MASC</b> | Master of Science (by Thesis only)                   | 2 years full-time       |
| <b>11DPSC</b> | Doctor of Philosophy (by Thesis only)                | 3 years full-time       |

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## **C. REGULATIONS PERTAINING TO UNDERGRADUATE STUDIES IN THE FACULTY**

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### **C.1. ADMISSION REQUIREMENTS**

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To register for a B.Sc. undergraduate degree programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification.

English is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol.

In addition to the above, admission to the B.Sc. course of study requires at least a symbol C on NSSC or equivalent qualification in Mathematics.

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

The Faculty reserves the right to interview students before admission.

Certain modules, subjects or programmes may require special written entry tests for screening candidates before admission is considered. Candidates who do not meet the requirements for admission to such modules, subjects or programmes may, however, register for any other modules, subjects or programmes to which they are admitted subject to relevant University and Faculty of Science regulations.

Admission can also be considered for persons who qualify through the Mature Age Entry CHEme upon successful completion of the relevant examinations as set out in the (**General Information and Regulations Prospectus**). A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is considered.

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

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### **C.2. DURATION OF STUDY**

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

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#### **C.2.1. TWO MODES OF STUDY FOR FIRST YEAR MATHEMATICS**

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All new students enrolling into the Faculty of Science are required to register for Basic Mathematics (MAT 3511) and Precalculus (MAT 3512). 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 after the first four weeks of classes. Any student who scores a mark of 40% or higher, in the said test, shall proceed with the current mode of study, which enables such student to complete the first year mathematics courses in the first academic year of registration. The student who scores a mark below 40% shall proceed to a special mode in which the current content of first year mathematics is taught over a period of two years. The Two Modes module are Basic Mathematics A (MAT 3580), Analytic Geometry, Matrices & Complex Numbers A (MAT 3590) and Precalculus A (MAT 3570).

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### **C.3. EXEMPTIONS**

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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.

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### **C.4. CLASS ATTENDANCE**

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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**.

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### **C.5. PRACTICALS**

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Attendance of practical classes is compulsory.



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## C.6. CURRICULUM

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### C.6.1. MODULES, CREDITS AND CONTACT HOURS

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One contact hour is equivalent to one (1) lecture period on the timetable of the Faculty of Science.

A full semester module carries 16 credits and is taught at four (4) contact hours per week over one semester, i.e. 56 contact hours per semester.

A half-module carries 8 credits and is taught at two (2) contact hours per week over one semester, i.e. 28 contact hours per semester. A half-module counts as one half (0.5) of a *module*.

A double-module carries 32 credits and is taught at four (4) contact hours per week over the full academic year (both semesters), i.e. 112 contact hours per academic year. A double-module is equivalent to two (2) *modules*.

Refer to the relevant programmes (to determine the credits and contact hours of any particular module).

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### C.6.2. CURRICULUM COMPILATION

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To be awarded a Bachelor's degree by the Faculty, a student must pass all the modules prescribed for each Major / Minor combination.

In the BSc degree programme a student may compile his/her curriculum by selecting the major subjects and minor subjects offered by a specific department, in accordance with Faculty and department regulations. For the B.Sc Geology programme set curricula are prescribed, although Geology departments allow some of their modules as minors to certain departments options within the Faculty curriculum. Refer to the relevant degree programmes for detailed information.

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### C.6.3. STUDENT REGISTRATION

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#### C.6.3.1. UNIVERSITY CORE CURRICULUM

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All students will take the equivalent of three (4) modules (48 credits) in the University Core Curriculum in the first year of study as part of their curriculum (i.e. as part of the equivalent of eleven (10) first year level modules to be passed at first year level.

All students register for the following two (2) half-modules:

| SEMESTER | CODE    | MODULE NAME                              |
|----------|---------|--|
| 2        | CSI3529 | Contemporary Social Issues (half-module) |
| 1        | CLC3509 | Computer Literacy (half-module)          |

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

Students with any one of the following qualifications in English will apply to be **credited** for LCE3519 English Communication and Study Skills and will register for the module below: (a) a pass (minimum grade 4) in English First Language at NSSC Higher Level or the equivalent; (b) grade 1, 2 or 3 in English Second Language at NSSC Higher Level or the equivalent.

| SEMESTER | CODE    | MODULE NAME                            |
|----------|---------|--|
| 1        | LCE3519 | English Communication and Study Skills |
| 2        | LEA3519 | English for Academic Purposes          |

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

| SEMESTER | CODE     | MODULE NAME  |
|----------|----------|--|
| 1 & 2    | LEG 2410 | English for General Communication ( <i>double-module</i> ) |

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#### C.6.3.2. UNIVERSITY CORE CURRICULUM MODULE DESCRIPTIONS

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##### LCE3519 ENGLISH COMMUNICATION & STUDY SKILLS

4L/week

|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>ENGLISH COMMUNICATION AND STUDY SKILLS</b>   |
| <b>Code:</b>              | <b>LCE3519</b>  |
| <b>NQF Level:</b>         | 4   |
| <b>Contact hours:</b>     | 4 hours per week for 14 weeks   |
| <b>Credits:</b>           | 16  |
| <b>Module Assessment:</b> | Continuous assessment (60%):two tests (reading and writing), two reading assignments, one oral presentation Examination (40%): one three hour examination paper |
| <b>Pre-requisites:</b>    | None  |

**Module description:** This module is aimed at assisting students in the development of their reading, writing and speaking and listening skills, in order to cope with studying in a new academic environment and in a language which may not be their first language. The module also focuses on study skills that students need throughout their academic careers and beyond. The module serves as an introduction to university level academics, where styles of teaching and learning differ from those at secondary schools in that more responsibility is placed on the student. The module therefore, focuses on the skills that students need throughout their academic careers and beyond.

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

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

| <b>CSI3529 CONTEMPORARY SOCIAL ISSUES</b> |  | <b>2L/week</b> |
|---|--|----------------|
| <b>Module Title:</b>                      | <b>CONTEMPORARY SOCIAL ISSUES</b>  |                |
| <b>Code:</b>                              | <b>CSI 3529</b>  |                |
| <b>NQF:</b>                               | 4  |                |
| <b>Contact Hours:</b>                     | 2 periods per week for 14 weeks  |                |
| <b>Credits:</b>                           | 8  |                |
| <b>Module Assessment:</b>                 | Continuous assessment (50%): test or assignment<br>Examination (50%): 1x2 hours paper  |                |
| <b>Prerequisite:</b>                      | None   |                |
| <b>Module Description:</b>                | The module raises awareness on the need for a personal, national and global ethics. The main objectives of the course is to help students reflect on the social moral issues; to discover themselves in a learner-centered, contextual, religious and life related setting. It also stimulates students for critical thinking and help them to appreciate their values, standards and attitudes. Furthermore it orientates students with regards to the epidemiology of HIV/AIDS; the prevalence of the disease on Namibia, Africa and Internationally. It also informs students on the psycho social and environmental factors that contribute to the spread of the disease, the impact of HIV/AIDS on their individual lives, family and communities at large. The unit further seeks to enhance HIV/AIDS preventive skills among students by means of paradigm shift and behavior change and also to impart general introductory knowledge on gender, to make students aware, as well as sensitize them towards gender issues and how they affect our society, Sub-Region and continent at large. |                |

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**C.6.3.3. FACULTY CORE CURRICULUM**

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

MAT 3511 Basic Mathematics  
MAT 3512 Precalculus

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**C.6.3.4. FACULTY CORE CURRICULUM MODULE DESCRIPTIONS**

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**MAT3511 BASIC MATHEMATICS** 4L/week

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

**Module description:** Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement. Algebraic expressions: simplification, expansion, polynomials, remainder 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.

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**MAT3512 PRECALCULUS** 4L/week

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

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

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### **C.6.3.5. MAJORS AND MINORS**

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The choice of the major and the minor, if applicable, determines the compilation of the curriculum.

**Each student must choose one major and minor from the following list:**

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#### **C.6.3.5.1. DEPARTMENT OF BIOLOGICAL SCIENCES**

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##### **Bachelor of Science (Honours)**

Environmental Biology Major and Geology Minor  
Environmental Biology Major and Geography Minor  
Micro Biology and Chemistry Minor  
Micro Biology and Biochemistry Minor  
Molecular Biology and Chemistry Minor  
Molecular Biology and Biochemistry Minor

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#### **C.6.3.5.2. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY**

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##### **Bachelor of Science (Honours)**

Chemistry Major and Physics Minor  
Chemistry Major and Biology Minor  
Chemistry Major and Geology Minor  
Biochemistry Major and Biology Minor  
Biochemistry Major and Chemistry Minor

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#### **C.6.3.5.3. DEPARTMENT OF COMPUTER SCIENCE**

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##### **Bachelor of Science (Honours)**

Computer Science Major and Information Technology Minor  
Computer Science Major and Mathematics Minor  
Computer Science Major and Statistics Minor

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#### **C.6.3.5.4. DEPARTMENT OF GEOLOGY**

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##### **Bachelor of Science (Honours)**

Geology Single Major

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#### **C.6.3.5.5. DEPARTMENT OF MATHEMATICS**

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##### **Bachelor of Science (Honours)**

Mathematics Major and Statistics Minor  
Mathematics Major and Computer Science Minor  
Mathematics Major and Physics Minor

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#### **C.6.3.5.6. DEPARTMENT OF PHYSICS**

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##### **Bachelor of Science (Honours)**

Physics Major and Mathematics Minor  
Physics Major and Geology Minor  
Physics Major and Computer Science Minor  
Physics Major and Chemistry Minor

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#### **C.6.3.5.7. DEPARTMENT OF STATISTICS**

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##### **Bachelor of Science (Honours)**

Statistics Major and Computer Science Minor  
Statistics Major and Population Studies Minor  
Statistics Major and Mathematics Minor  
Statistics Major and Economics Minor  
Population Studies Major and Geography Minor  
Population Studies Major and Statistics Minor  
Population Studies Major and Sociology Minor

Depending on this choice, he/she either must follow a fixed curriculum or choose major and a minor.

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## C.7. EXAMINATION REGULATIONS

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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.

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

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### C.8.1. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

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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.**

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### C.8.2. PASS REQUIREMENTS

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#### C.8.2.1. ADVANCEMENT AND PROGRESSION RULES

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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**.

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#### C.8.2.2. MAXIMUM NUMBER OF MODULES PER YEAR

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

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## C.9. MODULE RESTRICTIONS

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

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**C.10. MODULES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS**

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**D. DEPARTMENT OF BIOLOGICAL SCIENCES**

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**D.1. DEPARTMENTAL REGULATIONS**

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## COMPULSORY REQUIREMENTS

- All students must have a dissecting kit of their own. Kits can be bought from the Campus Book Store or other sources in town.
- Lab coats are compulsory for practical sessions for all students.
- Students pursuing B.Sc. (Honours) in Environmental Biology must do and pass EBL3700 Field Ecology I and EBL3800 Field Ecology II. Failure to take part in these field-based modules will disqualify students from sitting the theory examination of the specific co-requisite modules.

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**D.1.1.2 COMPILATION OF THE CA MARK**

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

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**D.1.1.3 WEIGHTING OF CA AND EXAM MARKS**

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

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**D.2. ENVIRONMENTAL BIOLOGY**

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**D.2.1. BACHELOR OF SCIENCE (HONOURS) MAJOR AND MINORS, CURRICULUM AND PREREQUISITES**

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**QUALIFICATION: B.Sc. (Honours) Environmental Biology Major and Geology Minor (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    | PRE-/COREQUISITES             |
|-----------------------|--|---------|-------------------------------|
| 1                     | Contemporary Social Issues                           | CSI3529 | University entry requirements |
| 1                     | Basic Mathematics                                    | MAT3511 | Faculty entry requirements    |
| 1                     | Computer Literacy                                    | CLC3509 | University entry requirements |
| 1                     | English Communication & Study Skills                 | LCE3519 | University entry requirements |
| 1                     | Introduction to Biology                              | BLG3511 | NSSC, Biology C               |
| <b>Geology Minor:</b> |  |         |                               |
| 1                     | Introduction to Physical Geology & Surface Processes | GLY3521 | Faculty entry requirements    |
| 1                     | Physics for Life Sciences                            | PHY3501 | Faculty entry requirements    |

| SEMESTER              | MODULE                        | CODE    | PRE-/COREQUISITES             |
|-----------------------|-------------------------------|---------|-------------------------------|
| 2                     | Pre-Calculus                  | MAT3512 | Faculty entry requirements    |
| 2                     | English for Academic Purposes | LEA3519 | University entry requirements |
| 2                     | Introduction to Statistics    | STS3522 | University entry requirements |
| 2                     | Chemistry for Life Sciences   | CHM3532 | Faculty entry requirements    |
| 2                     | Diversity of Life             | BLG3512 | NSSC, Biology C               |
| <b>Geology Minor:</b> |                               |         |                               |
| 2                     | Introduction to Earth Systems | GLY3502 | Faculty entry requirements    |

**YEAR 2**

| SEMESTER              | MODULE                              | CODE    | PRE-/COREQUISITES |
|-----------------------|-------------------------------------|---------|-------------------|
| 1                     | Animal Form and Function            | BLG3611 | BLG3511, BLG3512  |
| 1                     | Cell Molecular Biology and Genetics | MBL3631 | BLG3511, BLG3512, |
| 1                     | Statistics for Life Sciences I      | STS3621 | STS3522           |
| 1                     | Introduction to Ecology             | EBL3631 | BLG3511, BLG3512  |
| <b>Geology Minor:</b> |                                     |         |                   |
| 1                     | Earth Resources                     | GLY3641 | GLY3521           |
| 1                     | Introduction to Hydrology           | GLY3621 | GLY3521 & MAT3512 |

| SEMESTER | MODULE                       | CODE    | PRE-/COREQUISITES |
|----------|------------------------------|---------|-------------------|
| 2        | Plant Form and Function      | BLG3612 | BLG3511, BLG3512  |
| 2        | Introduction to Microbiology | MBL3632 | BLG3511, BLG3512  |

|                       |                                   |         |                  |
|-----------------------|-----------------------------------|---------|------------------|
| 2                     | Statistics for Life Sciences II   | STS3622 | STS351 1         |
| 2                     | Ecological Field Techniques       | EBL3632 | BLG3511, BLG3512 |
| <b>Geology Minor:</b> |                                   |         |                  |
| 2                     | Stratigraphy & Geological Mapping | GLY3612 | GLY3521          |

### YEAR 3

| SEMESTER              | MODULE                       | CODE    | PRE-/COREQUISITES         |
|-----------------------|------------------------------|---------|---------------------------|
| 1                     | Field Ecology I              | EBL3700 | EBL3711, EBL3712, EBL3732 |
| 1                     | Fresh Water & Marine Ecology | EBL3711 | EBL3631                   |
| 1                     | Population Ecology           | EBL3731 | EBL3631                   |
| 1                     | Plant physiology             | MBL3751 | CHM3511, CHM3512          |
| <b>Geology Minor:</b> |                              |         |                           |
| 1                     | Plate Tectonics              | GLY3721 | GLY3612                   |
| 1                     | Regional Geology of Namibia  | GLY3761 | GLY3521 None              |

| SEMESTER              | MODULE                              | CODE    | PRE-/COREQUISITES |
|-----------------------|-------------------------------------|---------|-------------------|
| 2                     | Comparative Animal Physiology       | MBL3752 | BLG3611           |
| 2                     | Ecosystem Ecology                   | EBL3712 | EBL3631           |
| 2                     | Conservation Biology & Biodiversity | EBL3732 | EBL3631, EBL3731  |
| 2                     | Research Methodology                | BLG3702 | STS3621, STS3622  |
| <b>Geology Minor:</b> |                                     |         |                   |
| 2                     | Sedimentology & Palaeontology       | GLY3731 | GLY3521 & GLY3612 |

### YEAR 4

| SEMESTER                          | MODULE                   | CODE    | PRE-/COREQUISITES         |
|-----------------------------------|--------------------------|---------|---------------------------|
| 1                                 | Field Ecology II         | EBL3800 | EBL3811, EBL3851, EBL3832 |
| 1                                 | Research Project         | BLG3810 | STS3621, STS3622, BLG3702 |
| 1                                 | Environmental Management | EBL3811 | EBL3731, EBL3712, EBL3732 |
| 1                                 | Biosystematics           | EBL3831 | EBL3632, BLG3612, BLG3611 |
| 1                                 | Biogeography             | EBL3851 | EBL3631, EBL3712          |
| <b>Geology Minor: No offering</b> |                          |         |                           |

| SEMESTER                          | MODULE                            | CODE    | PRE-/COREQUISITES         |
|-----------------------------------|-----------------------------------|---------|---------------------------|
| 2                                 | Disturbance & Restoration Ecology | EBL3802 | EBL3712, EBL3732          |
| 2                                 | Management of Natural Resources   | EBL3832 | EBL3731, EBL3712, EBL3732 |
| 2                                 | Behavioural Ecology               | EBL3812 | EBL3731                   |
| 2                                 | Parasitology                      | MIC3802 | MBL 3632                  |
| <b>Geology Minor: No offering</b> |                                   |         |                           |

### QUALIFICATION: B.Sc. (Honours) 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    | PRE-/COREQUISITES             |
|-------------------------|--------------------------------------|---------|-------------------------------|
| 1                       | Contemporary Social Issues           | CSI3529 | University entry requirements |
| 1                       | Basic Mathematics                    | MAT3511 | Faculty entry requirements    |
| 1                       | Computer Literacy                    | CLC3509 | University entry requirements |
| 1                       | English Communication & Study Skills | LCE3519 | University entry requirements |
| 1                       | Introduction to Biology              | BLG3511 | NSSC, Biology C               |
| <b>Geography Minor:</b> |                                      |         |                               |
| 1                       | Fundamentals of Physical Geography   | GHE3521 | Faculty entry requirements    |

| SEMESTER                | MODULE                          | CODE    | PRE-/COREQUISITES             |
|-------------------------|---------------------------------|---------|-------------------------------|
| 2                       | Pre-Calculus                    | MAT3512 | Faculty entry requirements    |
| 2                       | English for Academic Purposes   | LEA3419 | University entry requirements |
| 2                       | Introduction to Statistics      | STS3522 | University entry requirements |
| 2                       | Chemistry for Life Sciences     | CHM3532 | Faculty entry requirements    |
| 2                       | Diversity of Life               | BLG3512 | NSSC, Biology C               |
| <b>Geography Minor:</b> |                                 |         |                               |
| 2                       | Fundamentals of Human Geography | GHE3532 | Faculty entry requirements    |

### YEAR 2

| SEMESTER | MODULE                              | CODE    | PRE-/COREQUISITES |
|----------|-------------------------------------|---------|-------------------|
| 1        | Animal Form and Function            | BLG3611 | BLG3411, BLG3512  |
| 1        | Cell Molecular Biology and Genetics | MBL3631 | BLG3411, BLG3512, |
| 1        | Statistics for Life Sciences I      | STS3621 | STS3522           |
| 1        | Introduction to Ecology             | EBL3631 | BLG3411, BLG3512  |

| <b>Geography Minor:</b> |                                 |                           |   |
|-------------------------|---------------------------------|---------------------------|---|
| SEMESTER                | MODULE                          | CODE                      | PRE-/COREQUISITES                         |
| 1                       | Climatology <b>and</b>          | GHE3621                   | As in Respective Departmental Regulations |
| 1                       | Geomorphology OR                | GHE 3601                  | As in Respective Departmental Regulations |
| 1                       | Settlement Geography <b>and</b> | GHE 3641                  | As in Respective Departmental Regulations |
| 1                       | Economic Geography              | GHE 3661                  | As in Respective Departmental Regulations |
| SEMESTER                | MODULE                          | CODE                      | PRE-/COREQUISITES                         |
| 2                       | Plant Form and Function         | BLG3612                   | BLG3411, BLG3512                          |
| 2                       | Introduction to Microbiology    | MBL3632                   | BLG3411, BLG3512                          |
| 2                       | Statistics for Life Sciences II | STS3622                   | STS3511                                   |
| 2                       | Ecological Field Techniques     | EBL3632                   | BLG3411, BLG3512                          |
| <b>Geography Minor:</b> |                                 |                           |   |
| 2                       | Social Geography                | GHE3682                   | As in Respective Departmental Regulations |
| 2                       | Pedology <b>or</b> Hydrology    | GHE3602 <b>or</b> GHE3622 | As in Respective Departmental Regulations |

### YEAR 3

| SEMESTER                | MODULE                           | CODE    | PRE-/COREQUISITES                         |
|-------------------------|----------------------------------|---------|---|
| 1                       | Field Ecology I                  | EBL3700 | EBL3711, EBL3712, EBL3732                 |
| 1                       | Fresh Water & Marine Ecology     | EBL3711 | EBL3631                                   |
| 1                       | Population Ecology               | EBL3731 | EBL3631                                   |
| 1                       | Plant physiology                 | MBL3751 | CHM3511, CHM3512                          |
| <b>Geography Minor:</b> |                                  |         |   |
| 1                       | Geographic Analysis & Techniques | GIS3711 | As in Respective Departmental Regulations |

| SEMESTER                | MODULE                              | CODE    | PRE-/COREQUISITES                         |
|-------------------------|-------------------------------------|---------|---|
| 2                       | Comparative Animal Physiology       | MBL3752 | BLG3611                                   |
| 2                       | Ecosystem Ecology                   | EBL3712 | EBL3631                                   |
| 2                       | Conservation Biology & Biodiversity | EBL3732 | EBL3631, EBL3731                          |
| 2                       | Research Methodology                | BLG3702 | STS3621, STS3622                          |
| <b>Geography Minor:</b> |                                     |         |   |
| 2                       | Geographic Information Systems      | GIS3732 | As in Respective Departmental Regulations |

### YEAR 4

| SEMESTER                            | MODULE                   | CODE    | PRE-/COREQUISITES         |
|-------------------------------------|--------------------------|---------|---------------------------|
| 1                                   | Field Ecology II         | EBL3800 | EBL3811, EBL3851, EBL3832 |
| 1                                   | Research Project         | BLG3810 | STS3621, STS3622, BLG3702 |
| 1                                   | Environmental Management | EBL3811 | EBL3731, EBL3712, EBL3732 |
| 1                                   | Biosystematics           | EBL3831 | EBL3632, BLG3612, BLG3611 |
| 1                                   | Biogeography             | EBL3851 | EBL3631, EBL3712          |
| <b>Geography Minor: No offering</b> |                          |         |                           |

| SEMESTER                            | MODULE                            | CODE    | PRE-/COREQUISITES         |
|-------------------------------------|-----------------------------------|---------|---------------------------|
| 2                                   | Disturbance & Restoration Ecology | EBL3802 | EBL3712, EBL3732          |
| 2                                   | Management of Natural Resources   | EBL3832 | EBL3731, EBL3712, EBL3732 |
| 2                                   | Behavioural Ecology               | EBL3812 | EBL3731                   |
| 2                                   | Parasitology                      | MIC3802 | MBL 3632                  |
| <b>Geography Minor: No offering</b> |                                   |         |                           |



## D.2.2 B.Sc. (Honours) ENVIRONMENTAL BIOLOGY: MODULE EQUIVALENTS

| YEAR                     | SEMESTER | MODULE TITLE (new modules)                    | MODULE EQUIVALENT                               |
|--------------------------|----------|---|---|
| 1                        | 1        | BLG3511 Introduction to Biology               | BLG3101 Biology 1A                              |
|                          | 2        | BLG3512 Diversity of Life                     | BLG3112 Biology 1B                              |
| 2                        | 1        | BLG3611 Animal Form and Function              | BLG3212 Animal Biology                          |
|                          |          | EBL3631 Introduction to Ecology               | EBL3231 Introduction to Ecology                 |
|                          |          | MBL3631 Cell Molecular Biology and Genetics   | BLG3202 Cell and Molecular Biology              |
|                          | 2        | BLG3612 Plant Form and Function               | BLG3211 Plant Biology                           |
|                          |          | EBL3632 Ecological Field Techniques           | EBL3222 Field Biology                           |
|                          |          | MBL3632 Introduction to Microbiology          | MBL3231 Introduction to Microbiology            |
| 3                        | 1 & 2    | EBL3700 Field Ecology I                       | None  |
|                          | 1        | EBL3711 Freshwater and Marine Ecology         | EBL3331 Freshwater and Marine Ecology           |
|                          |          | EBL3731 Population Ecology                    | EBL3311 Population Ecology                      |
|                          |          | MBL3751 Plant Physiology                      | MBL3331 Plant Physiology                        |
|                          | 2        | EBL3712 Ecosystem Ecology                     | EBL3312 Ecosystem Ecology                       |
|                          |          | EBL3732 Conservation Biology and Biodiversity | EBL3332 Conservation Biology and Biodiversity   |
|                          |          | BLG3702 Research Methodology                  | None  |
|                          |          | MBL3752 Comparative Animal Physiology         | MBL3312 Comparative Animal Physiology           |
|                          | 4        | 1 & 2   | EBL3800 Field Ecology II                        |
| BLG3810 Research Project |          |   | BLG3410 Projects and advanced Skills in Biology |
| 1                        |          | EBL3811 Environmental Management              | None  |
|                          |          | EBL3831 Biosystematics                        | EBL3401 Taxonomy and Identification             |
|                          |          | EBL3851 Biogeography                          | EBL3411 Biogeography                            |
| 2                        |          | EBL3802 Disturbance and Restoration Ecology   | None  |
|                          |          | EBL3832 Management of Natural Resources       | EBL3412 Management of Natural Resources         |
|                          |          | EBL3812 Behavioural Ecology                   | None  |

## D.3. MICROBIOLOGY

### D.3.1. BACHELOR OF SCIENCE (HONOURS) MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

**QUALIFICATION: B.Sc. (Honours) 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    | PRE-/COREQUISITES             |
|----------------------------|--------------------------------------|---------|-------------------------------|
| 1                          | Contemporary Social Issues           | CSI3529 | University entry requirements |
| 1                          | Basic Mathematics                    | MAT3511 | Faculty entry requirements    |
| 1                          | Computer Literacy                    | CLC3509 | University entry requirements |
| 1                          | English Communication & Study Skills | LCE3519 | University entry requirements |
| 1                          | Introduction to Biology              | BLG3511 | NSSC, Biology C               |
| 1                          | Physics for Life Sciences I          | PHY3501 | Faculty entry requirements    |
| <b>Biochemistry Minor:</b> |                                      |         |                               |
| 1                          | Chemistry IA                         | CHM3511 | Faculty entry requirements    |

| SEMESTER                   | MODULE                        | CODE    | PRE-/COREQUISITES             |
|----------------------------|-------------------------------|---------|-------------------------------|
| 2                          | Pre-Calculus                  | MAT3512 | Faculty entry requirements    |
| 2                          | English for Academic Purposes | LEA3519 | University entry requirements |
| 2                          | Introduction to Statistics    | STS3522 | University entry requirements |
| 2                          | Diversity of Life             | BLG3512 | NSSC, Biology C               |
| <b>Biochemistry Minor:</b> |                               |         |                               |
| 2                          | Chemistry IB                  | CHM3512 | Faculty entry requirements    |

**YEAR 2**

| SEMESTER                   | MODULE                              | CODE    | PRE-/COREQUISITES            |
|----------------------------|-------------------------------------|---------|------------------------------|
| 1                          | Animal Form and Function            | BLG3611 | BLG3511,BLG3512              |
| 1                          | Cell Molecular Biology and Genetics | MBL3631 | BLG3511,BLG3512,             |
| 1                          | Statistics for Life Sciences I      | STS3621 | STS3522                      |
| <b>Biochemistry Minor:</b> |                                     |         |                              |
| 1                          | Biochemistry I                      | CHB3611 | CHM3511, CHM3512 and BLG3511 |

| SEMESTER                   | MODULE                          | CODE    | PRE-/COREQUISITES                       |
|----------------------------|---------------------------------|---------|---|
| 2                          | Plant Form and Function         | BLG3612 | BLG3511,BLG3512                         |
| 2                          | Introduction to Microbiology    | MBL3632 | BLG3511,BLG3512                         |
| 2                          | Statistics for Life Sciences II | STS3622 | STS3511                                 |
| 2                          | Human Biology*                  | MBL3652 | CHM3511,CHM3512 BLG3512                 |
| <b>Biochemistry Minor:</b> |                                 |         |   |
| 2                          | Biochemistry II                 | CHB3612 | CHM3511, CHM3512 OR CHM3532 and BLG3511 |
| 2                          | Organic Chemistry I             | CHM3612 | CHM3511,CHM3512                         |

**YEAR 3**

| SEMESTER                   | MODULE                     | CODE    | PRE-/COREQUISITES |
|----------------------------|----------------------------|---------|-------------------|
| 1                          | Plant physiology           | MBL3751 | CHM3511,CHM3512   |
| 1                          | Microbiology               | MBL3711 | MBL3632           |
| 1                          | Recombinant DNA Technology | MBL3731 | MBL3632,MBL3631   |
| <b>Biochemistry Minor:</b> |                            |         |                   |
| 1                          | Biochemistry III           | CHB3701 | CHB3612, MBL3631  |
| 1                          | Organic Chemistry II       | CHM3711 | CHM3612           |

| SEMESTER                   | MODULE                        | CODE    | PRE-/COREQUISITES |
|----------------------------|-------------------------------|---------|-------------------|
| 2                          | Comparative Animal Physiology | MBL3752 | BLG3611           |
| 2                          | Biotechnology                 | MBL3712 | MBL3632,MBL3631   |
| 2                          | Genetics                      | MBL3732 | MBL3632,MBL3631   |
| 2                          | Research Methodology          | BLG3702 | STS3621, STS3622  |
| <b>Biochemistry Minor:</b> |                               |         |                   |
| 2                          | Biochemistry IV               | CHB3712 | CHM3612,MBL3611   |

**YEAR 4**

| SEMESTER                               | MODULE                    | CODE    | PRE-/COREQUISITES         |
|--|---------------------------|---------|---------------------------|
| 1                                      | Research Project          | BLG3810 | STS3621, STS3622, BLG3702 |
| 1                                      | Immunology                | MBL3811 | MBL3711                   |
| 1                                      | Applied Molecular Biology | MBL3831 | MBL3731                   |
| 1                                      | Mycology                  | MIC3811 | MBL3711                   |
| <b>Biochemistry Minor: No offering</b> |                           |         |                           |

| SEMESTER                               | MODULE                                    | CODE    | PRE-/COREQUISITES |
|--|---|---------|-------------------|
| 2                                      | Medical Microbiology                      | MIC3822 | MBL3711           |
| 2                                      | Environmental And Industrial Microbiology | MIC3812 | MBL3711           |
| 2                                      | Virology                                  | MIC3832 | MBL3711           |
| 2                                      | Parasitology                              | MIC3802 | MBL3711           |
| <b>Biochemistry Minor: No offering</b> |   |         |                   |

**QUALIFICATION: B.Sc. (Honours) 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    | PRE-/COREQUISITES             |
|-------------------------|--------------------------------------|---------|-------------------------------|
| 1                       | Contemporary Social Issues           | CSI3529 | University entry requirements |
| 1                       | Basic Mathematics                    | MAT3511 | Faculty entry requirements    |
| 1                       | Computer Literacy                    | CLC3509 | University entry requirements |
| 1                       | English Communication & Study Skills | LCE3519 | University entry requirements |
| 1                       | Introduction to Biology              | BLG3511 | NSSC, Biology C               |
| 1                       | Physics for Life Sciences I          | PHY3501 | Faculty entry requirements    |
| <b>Chemistry Minor:</b> |                                      |         |                               |
| 1                       | Chemistry IA                         | CHM3511 | Faculty entry requirements    |

| SEMESTER                | MODULE                        | CODE    | PRE-/COREQUISITES             |
|-------------------------|-------------------------------|---------|-------------------------------|
| 2                       | Pre-Calculus                  | MAT3512 | Faculty entry requirements    |
| 2                       | English for Academic Purposes | LEA3519 | University entry requirements |
| 2                       | Introduction to Statistics    | STS3522 | University entry requirements |
| 2                       | Diversity of Life             | BLG3512 | NSSC, Biology C               |
| <b>Chemistry Minor:</b> |                               |         |                               |
| 2                       | Chemistry IB                  | CHM3512 | Faculty entry requirements    |

**YEAR 2**

| SEMESTER                | MODULE                              | CODE    | PRE-/COREQUISITES            |
|-------------------------|-------------------------------------|---------|------------------------------|
| 1                       | Animal Form and Function            | BLG3611 | BLG3511, BLG3512             |
| 1                       | Cell Molecular Biology and Genetics | MBL3631 | BLG3511, BLG3512,            |
| 1                       | Statistics for Life Sciences I      | STS3621 | STS3522                      |
| <b>Chemistry Minor:</b> |                                     |         |                              |
| 1                       | Inorganic Chemistry I               | CHM3611 | CHM3511, CHM3512             |
| 1                       | Biochemistry I                      | CHB3611 | CHM3511, CHM3512 and BLG3511 |

| SEMESTER                | MODULE                          | CODE    | PRE-/COREQUISITES         |
|-------------------------|---------------------------------|---------|---------------------------|
| 2                       | Plant Form and Function         | BLG3612 | BLG3511, BLG3512          |
| 2                       | Introduction to Microbiology    | MBL3632 | BLG3511, BLG3512          |
| 2                       | Statistics for Life Sciences II | STS3622 | STS3522                   |
| 2                       | Human Biology*                  | MBL3652 | CHM3511, CHM3512, BLG3512 |
| <b>Chemistry Minor:</b> |                                 |         |                           |
| 2                       | Organic Chemistry I             | CHM3612 | CHM3511, CHM3512          |

**YEAR 3**

| SEMESTER                | MODULE                       | CODE    | PRE-/COREQUISITES |
|-------------------------|------------------------------|---------|-------------------|
| 1                       | Plant physiology             | MBL3751 | CHM3511, CHM3512  |
| 1                       | Microbiology                 | MBL3711 | MBL3632           |
| 1                       | Recombinant DNA Technology   | MBL3731 | MBL3632, MBL3631  |
| <b>Chemistry Minor:</b> |                              |         |                   |
| 1                       | Organic Chemistry II         | CHM3711 | CHM3612           |
| 1                       | Inorganic Chemistry II       | CHM3701 | CHM3611, MAT3512  |
| 1                       | Industrial Chemistry I       | CHM3761 | CHM3611, CHM3612  |
| 1                       | Physical Inorganic Chemistry | CHM3762 | CHM3611           |

| SEMESTER                | MODULE                        | CODE    | PRE-/COREQUISITES |
|-------------------------|-------------------------------|---------|-------------------|
| 2                       | Comparative Animal Physiology | MBL3752 | BLG3611           |
| 2                       | Biotechnology                 | MBL3712 | MBL3632, MBL3631  |
| 2                       | Genetics                      | MBL3732 | MBL3632, MBL3631  |
| 2                       | Research Methodology          | BLG3702 | STS3621, STS3622  |
| <b>Chemistry Minor:</b> |                               |         |                   |

**YEAR 4**

| SEMESTER                            | MODULE                    | CODE    | PRE-/COREQUISITES         |
|-------------------------------------|---------------------------|---------|---------------------------|
| 1                                   | Research Project          | BLG3810 | STS3621, STS3622, BLG3702 |
| 1                                   | Immunology                | MBL3811 | MBL3711                   |
| 1                                   | Applied Molecular Biology | MBL3831 | MBL3731                   |
| 1                                   | Mycology                  | MIC3811 | MBL3711                   |
| <b>Chemistry Minor: No offering</b> |                           |         |                           |

| SEMESTER                            | MODULE                                    | CODE    | PRE-/COREQUISITES |
|-------------------------------------|---|---------|-------------------|
| 2                                   | Medical Microbiology                      | MIC3822 | MBL3711           |
| 2                                   | Environmental And Industrial Microbiology | MIC3812 | MBL3711           |
| 2                                   | Virology                                  | MIC3832 | MBL3711           |
| 2                                   | Parasitology                              | MIC3802 | MBL3711           |
| <b>Chemistry Minor: No offering</b> |   |         |                   |

**D.3.2 B.SC. MICROBIOLOGY MODULE EQUIVALENTS**

| NEW MODULE  | OLD MODULE                                      |
|---|---|
| BLG3511 Introduction to Biology                   | BLG3101 Biology 1A                              |
| BLG3512 Diversity of Life                         | BLG3112 Biology 1B                              |
| BLG3611 Animal Form and Function                  | BLG3212 Animal Biology                          |
| MBL3631 Cell Molecular Biology and Genetics       | BLG3202 Cell and Molecular Biology              |
| BLG3612 Plant Form and Function                   | BLG3211 Plant Biology                           |
| MBL3632 Introduction to Microbiology              | MBL3231 Introduction to Microbiology            |
| MBL3652 Human Biology*                            | BLG3231 Human Biology                           |
| MBL3751 Plant physiology                          | MBL3331 Plant Physiology                        |
| MBL3711 Microbiology                              | MBL3311 Microbiology and Molecular Genetics     |
| MBL3731 Recombinant DNA Technology                | None  |
| MBL3752 Comparative Animal Physiology             | MBL3312 Comparative Animal Physiology           |
| MBL3712 Biotechnology                             | None  |
| MBL3732 Genetics                                  | None  |
| BLG3702 Research Methodology                      | None  |
| BLG3810 Research Project                          | BLG3410 Projects and Advanced Skills in Biology |
| MBL3811 Immunology                                | MBL3411 Immunology                              |
| MBL3831 Applied Molecular Biology                 | MBL3402 Applied Molecular Biology               |
| MIC3811 Mycology                                  | None  |
| MIC3802 Parasitology                              | None  |
| MIC3822 Medical Microbiology                      | None  |
| MIC3812 Environmental And Industrial Microbiology | None  |
| MIC3832 Virology                                  | None  |
|   |   |

## D.4. MOLECULAR BIOLOGY

### D.4.1. BACHELOR OF SCIENCE (HONOURS) MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

#### QUALIFICATION: B.S.C (HONOURS) MOLECULAR BIOLOGY MAJOR AND BIOCHEMISTRY MINOR (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    | PRE-/COREQUISITES             |
|----------------------------|--------------------------------------|---------|-------------------------------|
| 1                          | Contemporary Social Issues           | CSI3529 | University entry requirements |
| 1                          | Basic Mathematics                    | MAT3511 | Faculty entry requirements    |
| 1                          | Computer Literacy                    | CLC3509 | University entry requirements |
| 1                          | English Communication & Study Skills | LCE3519 | University entry requirements |
| 1                          | Introduction to Biology              | BLG3511 | NSSC, Biology C               |
| 1                          | Physics for Life Sciences I          | PHY3501 | Faculty entry requirements    |
| <b>Biochemistry Minor:</b> |                                      |         |                               |
| 1                          | Chemistry IA                         | CHM3511 | Faculty entry requirements    |

| SEMESTER                   | MODULE                        | CODE    | PRE-/COREQUISITES             |
|----------------------------|-------------------------------|---------|-------------------------------|
| 2                          | Pre-Calculus                  | MAT3512 | Faculty entry requirements    |
| 2                          | English for Academic Purposes | LEA3519 | University entry requirements |
| 2                          | Introduction to Statistics    | STS3522 | University entry requirements |
| 2                          | Diversity of Life             | BLG3512 | NSSC, Biology C               |
| <b>Biochemistry Minor:</b> |                               |         |                               |
| 2                          | Chemistry IB                  | CHM3512 | Faculty entry requirements    |

#### YEAR 2

| SEMESTER                   | MODULE                              | CODE    | PRE-/COREQUISITES            |
|----------------------------|-------------------------------------|---------|------------------------------|
| 1                          | Animal Form and Function            | BLG3611 | BLG3511                      |
| 1                          | Cell Molecular Biology and Genetics | MBL3631 | BLG3511, BLG3512             |
| 1                          | Statistics for Life Sciences I      | STS3621 | STS3522                      |
| <b>Biochemistry Minor:</b> |                                     |         |                              |
| 1                          | Biochemistry I                      | CHB3611 | CHM3511, CHM3512 and BLG3511 |

| SEMESTER                   | MODULE                          | CODE    | PRE-/COREQUISITES                       |
|----------------------------|---------------------------------|---------|---|
| 2                          | Plant Form and Function         | BLG3612 | BLG3511, BLG3512                        |
| 2                          | Introduction to microbiology    | MBL3632 | BLG3511, BLG3512                        |
| 2                          | Statistics for Life Sciences II | STS3622 | STS3522                                 |
| 2                          | Human Biology                   | MBL3652 | CHM3511, CHM3512, BLG3512               |
| <b>Biochemistry Minor:</b> |                                 |         |   |
| 2                          | Biochemistry II                 | CHB3612 | CHM3511, CHM3512 OR CHM3532 and BLG3511 |
| 2                          | Organic Chemistry I             | CHM3612 | CHM3511, CHM3512                        |

#### YEAR 3

| SEMESTER                   | MODULE                     | CODE    | PRE-/COREQUISITES |
|----------------------------|----------------------------|---------|-------------------|
| 1                          | Plant Physiology           | MBL3751 | CHM3511, CHM3512  |
| 1                          | Microbiology               | MBL3711 | MBL3632           |
| 1                          | Recombinant DNA Technology | MBL3731 | MBL3632, MBL3631  |
| <b>Biochemistry Minor:</b> |                            |         |                   |
| 1                          | Biochemistry III           | CHB3701 | CHB3612, MBL3631  |
| 1                          | Organic Chemistry II       | CHM3711 | CHM3612           |

| SEMESTER                   | MODULE                        | CODE    | PRE-/COREQUISITES |
|----------------------------|-------------------------------|---------|-------------------|
| 2                          | Comparative Animal Physiology | MBL3752 | BLG 3611          |
| 2                          | Biotechnology                 | MBL3712 | MBL3632, MBL3631  |
| 2                          | Genetics                      | MBL3732 | MBL3632, MBL3631  |
| 2                          | Research methodology          | BLG3702 | STS3621, STS3622  |
| <b>Biochemistry Minor:</b> |                               |         |                   |
| 2                          | Biochemistry IV               | CHB3712 | CHM3612, MBL3611  |

**YEAR 4**

| SEMESTER                               | MODULE                    | CODE    | PRE-/COREQUISITES         |
|--|---------------------------|---------|---------------------------|
| 1                                      | Research Project          | BLG3810 | STS3621, STS3622, BLG3702 |
| 1                                      | Immunology                | MBL3811 | MBL3711,                  |
| 1                                      | Applied Molecular Biology | MBL3831 | MBL3731                   |
| 1                                      | Bioinformatics            | MOL3811 | MBL3631, MBL3632, MBL3732 |
| <b>Biochemistry Minor: No offering</b> |                           |         |                           |

| SEMESTER                               | MODULE                        | CODE    | PRE-/COREQUISITES  |
|--|-------------------------------|---------|--------------------|
| 2                                      | Applied Genetics              | MOL3812 | MBL3732            |
| 2                                      | Plant Growth and Development  | MOL3832 | CHM3511, CHM3512   |
| 2                                      | Animal Growth and Development | MOL3852 | BLG 3611, MBL 3732 |
| <b>Biochemistry Minor: No offering</b> |                               |         |                    |

**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    | PRE-/COREQUISITES             |
|-------------------------|--------------------------------------|---------|-------------------------------|
| 1                       | Contemporary Social Issues           | CSI3529 | University entry requirements |
| 1                       | Basic Mathematics                    | MAT3511 | Faculty entry requirements    |
| 1                       | Computer Literacy                    | CLC3509 | University entry requirements |
| 1                       | English Communication & Study Skills | LCE3519 | University entry requirements |
| 1                       | Introduction to Biology              | BLG3511 | NSSC, Biology C               |
| 1                       | Physics for Life Sciences I          | PHY3501 | Faculty entry requirements    |
| <b>Chemistry Minor:</b> |                                      |         |                               |
| 1                       | Chemistry IA                         | CHM3511 | Faculty entry requirements    |

| SEMESTER                | MODULE                        | CODE    | PRE-/COREQUISITES             |
|-------------------------|-------------------------------|---------|-------------------------------|
| 2                       | Pre-Calculus                  | MAT3512 | Faculty entry requirements    |
| 2                       | English for Academic Purposes | LEA3519 | University entry requirements |
| 2                       | Introduction to Statistics    | STS3522 | University entry requirements |
| 2                       | Diversity of Life             | BLG3512 | NSSC, Biology C               |
| <b>Chemistry Minor:</b> |                               |         |                               |
| 2                       | Chemistry IB                  | CHM3512 | Faculty entry requirements    |

**YEAR 2**

| SEMESTER                | MODULE                              | CODE    | PRE-/COREQUISITES            |
|-------------------------|-------------------------------------|---------|------------------------------|
| 1                       | Animal Form and Function            | BLG3611 | BLG3511,                     |
| 1                       | Cell Molecular Biology and Genetics | MBL3631 | BLG3511, BLG3512             |
| 1                       | Statistics for Life Sciences I      | STS3621 | STS35422                     |
| <b>Chemistry Minor:</b> |                                     |         |                              |
| 1                       | Biochemistry I                      | CHB3611 | CHM3511, CHM3512 and BLG3511 |
| 1                       | Inorganic Chemistry                 | CHM3611 | CHM3511, CHM3512             |

| SEMESTER                | MODULE                          | CODE           | PRE-/COREQUISITES         |
|-------------------------|---------------------------------|----------------|---------------------------|
| 2                       | Plant Form and Function         | BLG3612        | BLG3511, BLG3512          |
| 2                       | Introduction to Microbiology    | MBL3632        | BLG3511, BLG3512          |
| 2                       | Statistics for Life Sciences II | STS3622        | STS3522                   |
| 2                       | Human Biology                   | MBL3652        | CHM3511, CHM3512, BLG3512 |
| <b>Chemistry Minor:</b> |                                 |                |                           |
| 2                       | <b>Organic Chemistry I</b>      | <b>CHM3612</b> | <b>CHM3511, CHM3512</b>   |

**YEAR 3**

| SEMESTER                | MODULE                              | CODE           | PRE-/COREQUISITES |
|-------------------------|-------------------------------------|----------------|-------------------|
| 1                       | Plant Physiology                    | MBL3751        | CHM3511, CHM3512  |
| 1                       | Microbiology                        | MBL3711        | MBL3632           |
| 1                       | Recombinant DNA Technology          | MBL3731        | MBL3632, MBL3631  |
| <b>Chemistry Minor:</b> |                                     |                |                   |
| 1                       | <b>Inorganic Chemistry II</b>       | CHM3701        | CHM3611, MAT3512  |
| 1                       | <b>Organic Chemistry II</b>         | CHM3711        | CHM3612           |
| 1                       | <b>Industrial Chemistry</b>         | CHM3761        | CHM3611, CHM3612  |
| 1                       | <b>Physical Inorganic Chemistry</b> | <b>CHM3762</b> | <b>CHM3611</b>    |

| SEMESTER                | MODULE                        | CODE    | PRE-/COREQUISITES |
|-------------------------|-------------------------------|---------|-------------------|
| 2                       | Comparative Animal Physiology | MBL3752 | BLG 3611          |
| 2                       | Biotechnology                 | MBL3712 | MBL3632, MBL3631  |
| 2                       | Genetics                      | MBL3732 | MBL3632, MBL3631  |
| 2                       | Research Methodology          | BLG3702 | STS3621, STS3622  |
| <b>Chemistry Minor:</b> |                               |         |                   |

**YEAR 4**

| SEMESTER                            | MODULE                    | CODE    | PRE-/COREQUISITES         |
|-------------------------------------|---------------------------|---------|---------------------------|
| 1                                   | Research Project          | BLG3810 | STS3621, STS3622, BLG3702 |
| 1                                   | Immunology                | MBL3811 | MBL3711,                  |
| 1                                   | Applied Molecular Biology | MBL3831 | MBL3731                   |
| 1                                   | Bioinformatics            | MOL3811 | MBL3631, MBL3632, MBL3732 |
| <b>Chemistry Minor: No offering</b> |                           |         |                           |

| SEMESTER                            | MODULE                        | CODE    | PRE-/COREQUISITES  |
|-------------------------------------|-------------------------------|---------|--------------------|
| 2                                   | Applied Genetics              | MOL3812 | MBL3732            |
| 2                                   | Plant Growth and Development  | MOL3832 | CHM3511, CHM3512   |
| 2                                   | Animal Growth and Development | MOL3852 | BLG 3611, MBL 3732 |
| <b>Chemistry Minor: No offering</b> |                               |         |                    |

**D.4.2. B.SC. (HONOURS) MOLECULAR BIOLOGY MODULE EQUIVALENTS**

| NEW MODULE                                  | OLD MODULE                                      |
|---|---|
| BLG3511 Introduction to Biology             | BLG3101 Biology 1A                              |
| BLG3512 Diversity of Life                   | BLG3112 Biology 1B                              |
| BLG3611 Animal Form and Function            | BLG3212 Animal Biology                          |
| MBL3631 Cell Molecular Biology and Genetics | BLG3202 Cell and Molecular Biology None         |
| BLG3612 Plant Form and Function             | BLG3211 Plant Biology                           |
| MBL3632 Introduction to microbiology        | MBL3231 Introduction to Microbiology            |
| MBL3652 Human Biology                       | BLG3231 Human Biology                           |
| MBL3751 Plant physiology                    | MBL3331 Plant Physiology                        |
| MBL3711 Microbiology                        | MBL3311 Microbiology and Molecular Genetics     |
| MBL3731 Recombinant DNA Technology          | None  |
| MBL3752 Comparative Animal Physiology       | MBL3312 Comparative Animal Physiology           |
| MBL3712 Biotechnology                       | None  |
| MBL3732 Genetics                            | None  |
| BLG3702 Research methodology                | None  |
| BLG3810 Research Project                    | BLG3410 Projects and Advanced Skills in Biology |
| MBL3811 Immunology                          | MBL3411 Immunology                              |
| MBL3831 Applied Molecular Biology           | MBL3402 Applied Molecular Biology None          |
| MOL3811 Bioinformatics                      | None  |
| MOL3812 Applied Genetics                    | None  |
| MOL3832 Plant Growth and Development        | MBL3332 Plant Growth and Development            |
| MOL3852 Animal Growth and Development       | MBL3401 Animal Growth and Development None      |

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## D.5. DEPARTMENT OF BIOLOGICAL SCIENCES CURRICULUM MODULE DESCRIPTIONS

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### FIRST YEAR MODULES

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#### BLG3511 INTRODUCTION TO BIOLOGY

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**Module title:** INTRODUCTION TO BIOLOGY

**Code:** BLG 3511

**NQF level:** 5

**Contact hours:** 4 lectures/ week for 14 weeks and one 3-hour practical session per week.

**Credits:** 16

**Module assessment:** Continuous assessment (**40%**): Theory (not less than 3 tests and 2 assignments), 40% Practicals (not less than 10 marked assignment), 60% Examination (**60%**): 3 hour theory examination paper.

**Prerequisites:** NSCC (Biology C or better)

**Module description:** It will consider organization of life, chemical basis of life, carbohydrates, proteins, nucleic acids, lipids and fats, water, cell structure and function, prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell communication, mitosis, meiosis, cell reproduction, cell cycle, and cell death. The following topics will be covered: Introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdoms and the three domain system. Definitions and categories/groups within the five kingdoms, evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. Concepts such as homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered. The course content will also include genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance, linkage and cross-over, recombination, sex determination. The course content will also cover an introduction to Ecology: Definitions, history, scales in ecology, application of ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources.

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#### BLG3512 DIVERSITY OF LIFE

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**Module title:** DIVERSITY OF LIFE

**Code:** BLG 3512

**NQF level:** 5

**Contact hours:** 4 lecture periods / week for 14 weeks and one three hour practical session per week

**Credits:** 16

**Module assessment:** Continuous assessment (**40%**): Theory 50% (not less than 3 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments) Examination (**60%**): 1 x 3 hour theory paper

**Prerequisites:** NSCC (Biology C or better)

**Module description:** This module is designed to give students a detailed understanding of the diversity of life. It gives students the broader appreciation of biodiversity in the different ecological habitats. The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each Phylum shall follow a phylogenetic (evolutionary) approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted. This module prepares students to understand subsequent courses such as Introduction to Ecology and Microbiology, Population Ecology, Comparative physiology, Biogeography, Plant and Animal Form and Function. Topics covered will include viral, bacterial, fungal, algal, animal and plant diversity. It then considers the characteristics and life cycles of the following important algae, plant and animal groups: Chlorophyta, Phaeophyta, Rhodophyta, Chrysophyta, Euglenophyta, Pyrrophyta, Cryptophyta, bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniiformes, Petromyzontiformes, Placoderms, Chondrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia). Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.



## SECOND YEAR MODULES

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### BLG3611 ANIMAL FORM AND FUNCTION

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>ANIMAL FORM AND FUNCTION</b>   |
| <b>Code:</b>              | <b>BLG3611</b>  |
| <b>. NQF Level:</b>       | 6   |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks and one three hour practical session per week   |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment <b>(40%)</b> : Theory 50% (not less than 2 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments); Examination <b>(60%)</b> : 1x3 hour theory examination paper |
| <b>Prerequisites:</b>     | <b>BLG3511</b> Introduction to Biology, <b>BLG3512</b> Diversity of Life  |

**Module description:** This module intends to provide the student with a thorough understanding of the structures and functions of different body organs and systems in various animal species. Structure, types and general characteristics and functions of epithelial tissues, cell-to-cell contact, structure and function of soft and specialized connective tissues, structure and functions of skeletal, smooth and cardiac muscles, structure and functions of neurons, types of neurons, neuralgia and their functions. Mechanisms of homeostasis, positive feedback, information flow. Communication lines of vertebrate nervous systems, sodium-potassium pumps, chemical synapses and neurotransmitters. The invertebrate nervous system, the nerve net and function, the nerve cord. Functional divisions of vertebrate nervous systems, brain cavities and canals, blood – brain – barrier, the limbic system. Mechanoreceptors, thermo-receptors, pain receptors, chemo-receptors, osmo-receptors, photoreceptors. Senses of taste and smell, sense of balance. The structure and function of vertebrate eye and ear. The structure and functions of the endocrine glands. Prostaglandins-types and functions. Feedback control of hormonal secretions. Role of hormones in arthropod metamorphosis. Integumentary system, vertebrate skin and structure and its functions. Bone structure and functions, skeletal joints, skeletal muscular system. The vertebrate and invertebrate circulatory systems, links with lymphatic system, functions of blood, blood volume and composition, the heart and dorsal vessel-structure and functions, blood pressure, cardiovascular disorders, the defense system – barrier to infection, specific and non-specific responses, inflammation, control of immune response, cell-mediated and antibody mediated responses, immunoglobulins and lymphocytes. Gas exchange, factors influencing gas exchange, gas transport pigments, vertebrate lungs and structures, breathing mechanisms, respiratory cycle, oxygen and carbon dioxide transport, chemoreceptors (carotid bodies and aortic bodies), respiratory systems of mammals, fish, birds and arthropods. Reproduction in vertebrates and invertebrates. Temperature regulation.

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### EBL3631 INTRODUCTION TO ECOLOGY

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>INTRODUCTION TO ECOLOGY</b>  |
| <b>Code:</b>              | <b>EBL3631</b>  |
| <b>NQF level:</b>         | 6   |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks and one three hour practical session per week   |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous Assessment <b>(40%)</b> : Practicals 50% (no less than 5 assessed practicals), Theory 50% (3 tests, 1 assignment) Examination <b>60%</b> : 1 x 3 hr theory paper |
| <b>Prerequisites:</b>     | <b>BLG3511</b> Introduction to Biology  |

**Module description:** This module provides solid background knowledge on the various sub-disciplines of Ecology while providing sound explanations of the basic terminology and definitions in Ecology. This module lays the foundation for environmental studies at higher level. The module starts by revising topics covered in Introduction to Biology and then proceed to the following sub-disciplines of Ecology: Population Ecology- Characteristics of populations: birth, death, movement, size, age structure, and sex ratios. Community Ecology- Patterns in conditions and resources, measuring biodiversity, biomes. Ecosystem ecology- Primary productivity, flux of matter and trophic structures, food chains and food webs, biogeochemical cycles (hydrological-, carbon-, nitrogen-, and sulfur and phosphorous- cycles. Conservation Ecology and Biodiversity- Definitions of biodiversity, distribution of the world's and Namibia's biodiversity; the current human caused mass extinction. History, concepts and definitions of Conservation Biology. Aquatic Ecology- The physical properties of water, Stream Ecology, Lake Ecology, Oceans, Coasts, Estuaries.

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**MBL3631 CELL MOLECULAR BIOLOGY AND GENETICS**

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**Module title:** CELL MOLECULAR BIOLOGY AND GENETICS**Code:** MBL3631**NQF level:** 6**Contact hours:** 4 lecture periods per week for 14 weeks and one three hour practical session per week**Credits:** 16**Module assessment:** Continuous assessment (**40%**): Theory - minimum of 2 tests and 1 assignment; Practicals – no less than 10 marked practicals Examination (**60%**): 3 hour theory paper**Prerequisites:** **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life

**Module description:** An introduction to the chemical basis of cellular processes: important elements, compounds and molecules as well as chemical bonds and their importance and roles in biochemical reactions are being looked at. The organization of the chloroplast and mitochondrion and their principal metabolic pathways are also reviewed. An introduction to cancer starting with the distinction between normal and abnormal cell division as well as studying at the genetic basis of cancer. There will be an overview of Mendelian & non-Mendelian Genetics: chromosomal theory of inheritance, sex determination & sex-linked genes, basic genetic linkage and chromosome mapping, and the Genetic Code. Structure and function of eukaryotic chromosomes and mutations as the basis for genetic variations. This leads to the study of macromolecules such as proteins, enzymes and nucleic acids and their roles in cellular organization. This unit also examines the organization and control of genetic information in the production of proteins. The structure of DNA and genome size and complexity will be described in the course as the foundation for Molecular Biology. An introduction to nucleic acid processes such as DNA replication covering the unit of replication (replicon), apparatus for DNA replication (primosomes and replisomes). An outline of Eukaryotic transcription and RNA processing: transcription complex including promoters, transcription factors, RNA polymerase and the description of mechanisms of RNA splicing. An outline of Prokaryotic gene expression: control at initiation, RNA polymerase-promoter interactions, panology of operons and control at termination. Translation of Proteins through successive steps (initiation, elongation and termination) exploiting tRNA as the translational adaptor and ribosomes as the translational factory. The practical content in this will focus on: isolation of DNA from whole blood and tissues, introduction to gel electrophoresis and introduction to PCR.

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**BLG3612 PLANT FORM AND FUNCTION**

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**Module title:** PLANT FORM AND FUNCTION**Code:** BLG3612**NQF level:** 6**Contact hours:** 4 lecture periods per week for 14 weeks and one three hour practical session per week**Credits:** 16**Module assessment:** Continuous assessment (**40%**): Theory 50% (not less than 2 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments)  
Examination (**60%**): 1 x 3 hour theory paper (70%); 1x2 hour practical paper (30 %)**Prerequisites:** **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life

**Module description:** This is a full course for one semester where a survey of vascular plants using evolutionary and ecological principles to interpret patterns of diversity in vascular plant form and function. Topics include morphological adaptations of plants, the genetic properties of plant populations, plant reproduction and mating system variation, a survey of biotic and abiotic ecological interactions important to flowering plants. The focus of the course is on the anatomy and functional morphology of photosynthetic organisms in both aquatic and terrestrial systems. Laboratory work will include a survey of flowering plant taxonomy and plant forms and functions. Laboratory projects will demonstrate methods used for establishing evolutionary relationships, assessing genetic structure in natural populations, and identifying adaptive features of plant form and function.

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**EBL3632 ECOLOGICAL FIELD TECHNIQUES**

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**Module title:** ECOLOGICAL FIELD TECHNIQUES**Code:** EBL3632**NQF Level:** 6**Contact hours:** 4 lecture periods per week for 14 weeks, 3 hours practical per week for 14 weeks**Credits:** 16**Module assessment:** Continuous assessment **40%** (at least 5 assessed practicals (35%); 3 tests (35%); specimen collecting and preservation mini-project (30%)) Examination **60%**: 1 x 3 hrs theory paper**Pre-requisites:** **BLG3512** Diversity of Life

**Module description:** This module will emphasize the practical field component where students should learn more hands-on practice and experience. In addition to other important aspects, the module places emphasis on the Scientific Method and specimen identification. This module lays the foundation for biodiversity studies at higher level.

Introduction and definitions; scientific method; important considerations in planning ecological research; important considerations in field sampling (objectives of sampling, type and behaviour of organism, habitat considerations, equipment requirements, selection of appropriate method, sampling design and strategy, data recording and storage, sampling regime); methods of sampling terrestrial vascular plants; methods of surveying fungi, lichens and mosses; methods of sampling aquatic macrophytes and algae; methods of sampling invertebrates in the field; methods of inventorying small mammals; methods of surveying large mammals; methods of sampling reptiles; methods of sampling birds and bats; methods of sampling fish and other aquatic animals. All the discussions on methods must include their applicability, advantages and disadvantages of in every case. Preserving organisms for natural history collections (killing jars and their uses, herbarium specimens, 'spirit' collections, dry mounts, various agents of preservation and their advantages and disadvantages); simple dichotomous keys and their uses (parallel keys, indented keys, flow-chart keys only); methods of assessing abiotic variables, data analysis methods (include basic statistics).

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**MBL3632 INTRODUCTION TO MICROBIOLOGY**

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>INTRODUCTION TO MICROBIOLOGY</b>   |
| <b>Code:</b>              | <b>MBL3632</b>  |
| <b>NQA level:</b>         | 6   |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks and one 3-hour practical session per week for 14 weeks.   |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment ( <b>40%</b> ): Theory 50% (not less than 2 tests and 2 assignments); Practicals 50% (not less than 10 marked assignments) Examination ( <b>60%</b> ): 1 x 3-hour theory paper. |
| <b>Prerequisites:</b>     | <b>BLG3511</b> Introduction to Biology, <b>BLG3512</b> Diversity of Life.   |

**Module description:** The course will include principles of microbiology, importance of microorganisms, microorganisms as cells, microorganisms and their natural environments, impacts of microorganisms on humans, and pathways of discovery in microbiology. It will also give an overview of microbial life, cell structure and evolutionary history, physiological diversity of microorganisms, prokaryotic diversity, and eukaryotic microorganisms. Other topics are microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and chemotaxis, staining techniques, microbial nutrition, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, microbial evolution and systematics, Eubacteria, Archae, eukaryotic microorganisms, viruses, bacteriophages, prions, diversity of microbial metabolism, microbial ecology, and methods in microbial ecology.

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**MBL3652 HUMAN BIOLOGY**

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>HUMAN BIOLOGY</b>  |
| <b>Code:</b>              | <b>MBL3652</b>  |
| <b>NQF Level:</b>         | 6   |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks, 1P/week for 14 weeks   |
| <b>Credits:</b>           | 16  |
| <b>Module Assessment:</b> | Continuous assessment: <b>40%</b> (3 tests – 60% + at least 10 practical marks – 40%); Examination: <b>60%</b> (1 x 3h examination paper) |
| <b>Prerequisite:</b>      | <b>CHM3532</b> Chemistry for Life Sciences, <b>BLG3512</b> Diversity of Life  |

**Module description:** This module intends to provide the student with a thorough understanding of the structures and functions of different human body organs and systems, various diseases afflicting humans, e.g. Cancer, Stress and HIV/AIDS as well as the harmful effects of narcotic drugs. It will cover the following topics: Organs and accessory organs of the digestive system and their functions, digestion, absorption and nutrition of carbohydrates, proteins, lipids and, digestive enzymes, minerals and vitamins. The cardiovascular system, the structure and functions of the heart, blood vessels and cells. The pulmonary circuit and systemic circuit. Functions of blood, blood clotting mechanism and blood groups. The lymphatic system, structures of the lymphatic vessels and organs. The structures and functions of the respiratory system, external, internal and cellular respiration. Lung volumes. Exchange of gases in the alveoli. The functions of the respiratory epithelium and the mucus blanket. Factors affecting pulmonary ventilation. Kidney structure and functions. Glomerular filtration, tubular reabsorption and secretion. The role of juxtaglomerular apparatus in blood pressure regulation. The role of kidneys in electrolyte and acid base balance and homeostasis. The structure and functions of the peripheral nervous system, cranial and spinal nerves, action and resting potentials. Impulse transmission across synapses and neurotransmitters. The neuroglia and their functions. The somatic and autonomic systems. The sympathetic and parasympathetic systems. The reflex arch. The structure and functions of the central nervous system. The structures and functions of the eye and the ear. The chemoreceptors and olfactory cells. The structure of the endocrine glands, their hormones and functions. Structures and functions of the male and female reproductive organs. The formation of male and female gametes. The role of hormones in reproduction. Human development and aging. Human population growth and pollution. Sexually-transmitted diseases including HIV/AIDS. Causes and prevention of cancers. Carcinogens, heredity and immunodeficiency. Characteristics of cancer cells and classification of cancers. Stress and the role of hormones in stress development. Drug Abuse: alcohol, nicotine, marijuana, cocaine, heroine, and their effects on body systems

### THIRD YEAR MODULES

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#### EBL3700 FIELD ECOLOGY I

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>FIELD ECOLOGY I</b>   |
| <b>Code:</b>              | <b>EBL3700</b>   |
| <b>NQF level:</b>         | 7  |
| <b>Contact hours:</b>     | 4 weeks (up to) field trip for all modules combined  |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment: <b>100%</b> (Field reports)   |
| <b>Co-requisites:</b>     | <b>EBL3711</b> Freshwater & Marine Ecology (1st semester), <b>EBL3712</b> Ecosystem Ecology and <b>EBL3732</b> Conservation Biology & Biodiversity (both 2nd semester) |

**Module description:** Students must carry out compulsory field courses for the modules EBL3711 Freshwater and Marine Ecology (1st semester), EBL3712 Ecosystem Ecology and EBL3732 Conservation Biology & Biodiversity (both 2nd semester). The field courses will be conducted in various localities, either jointly or separately and tasks may vary from year to year depending on the issues at hand.

**Any student who does not take part in the field course will NOT be allowed to sit the examinations of the respective modules.**

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#### EBL3711 FRESHWATER AND MARINE ECOLOGY

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>FRESHWATER AND MARINE ECOLOGY</b>   |
| <b>Code:</b>              | <b>EBL3711</b>   |
| <b>NQF Level:</b>         | 7  |
| <b>Contact hours:</b>     | 4 lectures / week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> : Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination <b>60%</b> : 1 x 3 hours theory paper |
| <b>Prerequisites:</b>     | <b>EBL3631</b> Introduction to Ecology   |

**Module description:** Aquatic ecosystems cover more than 70% of the Earth's surface and play an important role in global geochemical cycles, which affect the global climate. In addition, Namibia is an arid country with a limited amount of surface water. It is also a country with a highly productive coastline, because of upwelling processes. The study of freshwater and marine ecology is therefore crucial to provide the students a basis for further studies that will allow proper management of our wetland ecosystems. Any student who does not take part in the field course in EBL3700 Field Ecology I will NOT be allowed to sit the examination. Freshwater Ecology: Ecology of lakes and dams (lentic ecosystems); Thermal stratification of lentic systems and its effects on primary production; Seasonal lake turnover and its effect on primary production and the ecology of lentic systems; Energy flow and food webs in lentic systems; Eutrophication and algal blooms. Ecology of rivers and streams (lotic ecosystems); Distinguishing characteristics of rivers; The river continuum concept; Ephemeral river dynamics; floodplain dynamics; Energy flow and food webs in lotic systems. Freshwater wetland systems of Namibia. Principles of freshwater aquaculture (Aquaculture in Namibian state dams, aquaculture in traditional settings, general problems experienced in aquaculture). Marine Ecology: Physical and chemical Oceanography (the extent and depth of the oceans, Ocean currents, Temperature, Pressure, Illumination, Gases, chemical composition of seawater). Ocean circulation; the great conveyor system in the Ocean; the physics of waves in the ocean. The generation of tides – physical processes. Upwelling: Physical processes involved in upwelling – Ekman drift; the importance of upwelling in productivity; The Namibian upwelling system as one of the most productive upwelling systems in the world. Organic production in the marine environment (Nutrients, Plankton, Red tides, Sulfur eruption on the Namibian coast, Energy flow and food webs in the pelagic marine environment). Intertidal zone ecology – Rocky shores and sandy shores. Life in the deep oceans (adaptations of organisms). Aquatic biogeochemistry and ecology: The carbon, nitrogen, sulfur and iron cycles in freshwater and marine aquatic environments. Discuss the difference between these cycles in the sediment and in the water column of aquatic systems. Define what is meant by fluxes out of the sediment and its importance in the biogeochemical cycles. The measurement and calculation of biogeochemical rates and fluxes in sediments. The use of radioactive and stable isotopes in biogeochemistry. Extreme Marine environments (Hydrothermal vents, Hypersaline aquatic environments, cold seeps, sea ice). Ocean fertilization and its effect on the biogeochemical cycles in aquatic systems.

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**EBL3731 POPULATION ECOLOGY**

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**Module title:** POPULATION ECOLOGY

**Code:** EBL3731

**NQF Level:** 7

**Contact hours:** 4 lecture periods per/ week; 3 hours practical per week for 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%** (1 x 3 hr theory paper)

**Pre-requisites:** **EBL3631** Introduction to Ecology

**Module description:** This module is designed to equip students with the necessary understanding of population dynamics. This forms the basis of understanding concepts of interactions among different species and between species and their environment. This will enable them to fully understand the importance of these issues with respect to managing these species and their environments. It also prepares students for later modules in conservation biology, behavioural ecology, natural resources management and others.

Introduction and definitions; Properties of populations (population density, population dispersion, age structure, sex ratios); Mortality, natality and survivorship; Population growth (density-dependent, density-independent, population fluctuations and cycles, key factor analysis, extinction); Population regulation (mechanisms of population regulation, intra-specific competition, dispersal, social interactions); Life history patterns (mating systems, types of sexual reproduction, reproductive effort, r- and k-selection, sexual selection); Inter-specific competition (competitive exclusion principle, resource partitioning, differential resource utilization); Predation (models of predation, classical predator-prey systems, plant-herbivore interactions, functional response, numerical response, foraging theory, cannibalism); Parasitism (classes of parasites, hosts as habitats, parasite population dynamics, evolutionary aspects of parasitism, social parasitism – kleptoparasitism and brood parasitism); Population genetics (genetic variation, natural selection, inbreeding, genetic drift); Mutualism (definitions, types and examples of mutualism); Pest control and management (definitions, chemical control, biological control, genetic control, integrated pest management).

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**MBL3751 PLANT PHYSIOLOGY**

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**Module title:** PLANT PHYSIOLOGY

**Code:** MBL3751

**NQF level:** 7

**Contact hours:** 4 lecture periods per week for 14 weeks, 3 hour practicals per week for 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment: **40%** (at least 2 tests and 8 practical marks) Examination: **60%** (1 x 3h theory paper)

**Prerequisites:** **CHM3511** Chemistry 1A OR **CHM3512** Chemistry 1B OR **CHM3532** Chemistry for Life Sciences

**Module description:** This module intends to provide students with a sound knowledge of plant metabolism and water relations, with emphasis on how physiological adaptations contribute to the ecological success of plants. The module will introduce the concept of energy and its use by plants energy transformations and the role of electron carriers and ATP. The process of photosynthesis will be examined by discussing aspects such as the leaf as a photosynthetic machine, photochemical reactions, the regulation of energy distribution, photoinhibition of photosynthesis, the PCR cycle and its regulation. This leads to an explanation of C4 and CAM photosynthesis and the ecological advantages of these adaptations. Aerobic and anaerobic respiration as well as the alternative electron transport pathways found in plants and their ecological implications will be discussed in detail. The module will further consider biological nitrogen fixation, nitrogen assimilation and nitrogen cycling. Water & solute uptake by plant cells will be discussed against the background of the concept of water potential, and principles and energetics of solute absorption. The soil as main source of mineral nutrition, as well as ways in which plants supplement this nutrition through bacterial and fungal interactions will be investigated. The module will conclude with a discussion of the photosynthesis-transpiration compromise, the cohesion theory of transpiration, cavitations and the vulnerability of the xylem, hydraulic lift, source-sink relationships, the Münch pressure flow model, as well as phloem loading and unloading.

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**EBL3712 ECOSYSTEM ECOLOGY**

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**Module title:** ECOSYSTEM ECOLOGY

**Code:** EBL3712

**NQF level:** 7

**Contact hours:** 4 hours lectures / week, 3 hrs practicals per week

**Credits:** 16

**Module assessment:** Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%** (1x3 hours theory paper)

**Prerequisites:** EBL3631 Introduction to Ecology

**Module description:** This module will provide an insight into the structure and function of nature at the community, ecosystem and biome levels of biological organization. Students will be introduced to the science of ecosystem ecology, a study of communities of plants and animals and how they interact with each other and their physical environment. Applied aspects of ecology such as deforestation and desertification will also form an important component of the module. Any student who does not take part in the field course in EBL3700 Field Ecology I will NOT be allowed to sit the examination.

Basic components of ecological systems, essential processes of ecological systems: Photosynthesis and decomposition. Nature of ecosystem energetics. Primary production; environmental factors facilitating and / or limiting primary production. Secondary production; environmental factors facilitating and / or limiting, food chains and food webs; trophic levels and ecological pyramids, Food chains and poisons in the environment, models of energy flow in ecosystems. Biogeochemical cycles: Gaseous cycles (oxygen cycle, carbon cycle, nitrogen cycle) Sedimentary cycles (phosphorous cycle, sulphur cycle). What is a community? Physical (vertical and horizontal) structure, biological structure (species dominance, species diversity); species diversity hypotheses, species abundance, edge communities, community population interactions, community patterns in space and time. Theory of island biogeography, habitat fragmentation, habitat corridors, applications of island biogeography theory to design of protected areas. ecological disturbance? Characteristics of ecological disturbance (intensity, frequency and scale), Causes of disturbance, impacts of disturbance on nutrient cycling, Responses of animals to disturbance, disturbance and community stability. What is community succession? Process of ecological community succession, Types of succession; primary and secondary succession, Causes of succession; models of succession, climax succession state; climax community, theories of climax succession, fluctuations in climax communities, attributes of succession during succession, time and direction in succession, changes in ecosystem attributes, time and direction of succession, succession and animal life, degradative succession. Definition and classification of biomes. Desert biome, Tropical savanna biome, Tropical rain forest biome, grassland biome. For each biome, shall cover: geographic location, climate, soils, life forms, and human activities. Classification of biomes of Namibia. Desert biome, savanna biome, woodland biome, Karroo biome, Coastal and marine biome, wetland biome, land use practices in terrestrial and aquatic biomes of Namibia. What are arid environments? Causes and classification of arid ecosystems, characteristics of arid ecosystems; water (surface and ground), floods, Humidity, temperature, wind and wind erosion, soils, dust & dust storms, adaptations of organisms to arid environments. What is desertification? Causes of desertification (proximate and ultimate causes), manifestations of desertification, action to combat desertification, What is deforestation? Causes of deforestation (proximate and ultimate causes), Effects of deforestation; deforestation in Namibia, possible solutions to deforestation.

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**EBL3732 CONSERVATION BIOLOGY AND BIODIVERSITY**

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| <b>Module title:</b>      | <b>CONSERVATION BIOLOGY AND BIODIVERSITY</b>  |
| <b>Code:</b>              | <b>EBL3732</b>  |
| <b>NQF level:</b>         | 7   |
| <b>Contact hours:</b>     | 4 lecture period per week for 14 weeks, 3 hours practical per week for 14 weeks   |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous Assessment <b>40%</b> : Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination <b>60%</b> : 1 x 3 hr theory paper |
| <b>Prerequisites:</b>     | <b>EBL3631</b> Introduction to Ecology  |

**Module description:** Any student who does not take part in the field course in EBL3700 Field Ecology I will NOT be allowed to sit the examination. Students will study in depth: Global patterns, distribution and measurement of biodiversity with special emphasis on Namibian biodiversity; Biodiversity inventories; rapid biodiversity assessment. Environmental ethics, Ecological Economics (valuation of biodiversity) with emphasis on the direct use value, indirect use value, option value, and existence value. Threats to biological diversity and extinction with special emphasis on the causes of extinction (habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease) as well as species vulnerability to extinction; Applying the Island Biogeography model to estimation of extinction rates. Conservation at the population and species level: Species categories (keystone, indicator, flagship, umbrella and economically important species), Essential concepts and problems of small populations, Applied population biology: Studying populations, population viability analysis, metapopulations, establishing new populations, Ex Situ conservation, Conserving biological communities: Prioritising, establishing and classifying protected areas, Reserve design and conservation networks, SLOSS model, managing protected areas. Restoration Ecology. Biodiversity conservation agreements.

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**BLG3702 RESEARCH METHODOLOGY**

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| <b>Module title:</b>      | <b>RESEARCH METHODOLOGY</b>  |
| <b>Code:</b>              | <b>BLG3702</b>   |
| <b>NQF level:</b>         | 7  |
| <b>Contact hours:</b>     | 2 lecture session per week, 3 hour practical every other week for 14 weeks                       |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment <b>100%</b> (5 assessed assignments, 1 test)                               |
| <b>Prerequisites:</b>     | <b>STS3621</b> Statistics for Life Sciences I and <b>STS3622</b> Statistics for Life Sciences II |

**Module description:** This module is designed to provide students with understanding of the general theoretical aspects of scientific principles that are followed in order to conduct research and communicate scientific results. The scientific method will form the basis of discussion in this module. In the module, students will acquire relevant skills in planning, developing as well as conducting scientific research. Overview of research. Ethics of research. The scientific method: logic and the scientific, natural observations, asking questions and formulation of hypothesis, predictions. Types of hypotheses; null, alternative, research. Biological variation, populations and sampling. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance. Testing hypotheses. Experimental (research study /project) design. Data collection & keeping / documenting research data & other records. Presentation of data in the scientific reports/ theses / dissertation. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review. Report writing. Giving a good oral presentation (including use of power point).

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**MBL3752 COMPARATIVE ANIMAL PHYSIOLOGY**

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| <b>Module title:</b>      | <b>COMPARATIVE ANIMAL PHYSIOLOGY</b>  |
| <b>Code:</b>              | <b>MBL3752</b>  |
| <b>NQF Level:</b>         | 7   |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks, 1 practical session per week for 14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment: <b>40%</b> (3 tests – 60% + at least 10 practical marks – 40%); Examination: <b>60%</b> (1 x 3h examination paper) |

**Pre-requisites:** **CHM3511** Chemistry 1A and **CHM3512** Chemistry 1B; OR **CHM3532** Chemistry for Life Sciences

**Module description:** This module intends to provide the student with a thorough understanding of the functioning of different animal species and their adaptations that enable them to survive in different environments. It will cover the following topics: Cellular and animal energetics, physico-chemical effects of temperature, avenues for heat exchange between animals and their environments, patterns of thermoregulation in various animal groups. Metabolism in hibernating animals. Membrane physiology and solute regulation by cells and electrophysiology of cells. Physiology of excitable cells (sensory physiology and nervous systems). Animal movement by means of cilia, flagella and muscular contractions, animal locomotion in water, land and air. Control of various body functions e.g. growth and regeneration, reproduction, iono- and osmoregulation, cellular metabolism and color by neurohormonal and classic hormonal systems. Aquatic and aerial respiration and how physical principles involved in gas exchange apply to various gas exchange structures e.g. body surface, gills, lungs and tracheal system. Structures and functions of circulatory system. Physiological role of water and solute regulation in terrestrial and aquatic animals. Structures and functions of specific excretory organs, e.g. coelomoducts, nephrons, Malpighian tubules, etc. Structures and functions of respiratory systems (lungs, gills, skin, tracheae, etc). Feeding mechanisms, cell secretion and movement (secretion and peristalsis by gut tube), cellular biochemistry (digestive enzymes and biochemistry of hydrolysis of various organic substrates) and nutrition (role of vitamins). Adaptations to low and high temperatures and altitude.

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**MBL3711 MICROBIOLOGY**

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**Module title:** MICROBIOLOGY  
**Code:** MBL3711  
**NQF level:** 7  
**Contact hours:** 4 lecture periods / week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment **40%** (minimum of 2 tests and 2 Assignments), Examination **60%** (1 x 2 hour examination paper)

**Prerequisites:** **MBL3632** Introduction to Microbiology

**Module description:** Identification of bacteria: Microscopy, culture characteristics, biochemical tests, rapid methods. Bacterial photosynthesis: oxygenic photosynthesis, anoxygenic photosynthesis. Microbial metabolism: chemolithotrophy,, reduction of inorganic molecules, Generation of energy: Breakdown of glucose to pyruvate, Embden-Meyerhof-Parnas pathway, Entner-Doudoroff pathway, Pentose-phosphate pathway. Aerobic and anaerobic respiration, fermentations. Oxidation of inorganic molecules, methanogenesis, acetogenesis. Microbial genetics and genetic engineering: Organization and replication of prokaryotic DNA. Mutations: point mutations, base-pair substitution, frameshift mutations, pyrimidine dimmers. Causes of mutations: UVlight/radiation, chemical base analogues, mutagenesis. Mutation repair mechanisms: SOS repair, post-transcription repair, base excision repair. Conjugation, transformation and transduction. Isolation, specific cleavage and synthesis of DNA. Vectors, Transformation, Identifying recombinants. Good microbiology laboratory practice, techniques in microbiology.

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**MBL3752 COMPARATIVE ANIMAL PHYSIOLOGY**

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**Module title:** COMPARATIVE ANIMAL PHYSIOLOGY  
**Code:** MBL3752  
**NQF Level:** 7  
**Contact hours:** 4L/week for 14 weeks + 1P/week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%); Examination: **60%** (1 x 3h examination paper)

**Pre-requisites:** **CHM3511** Chemistry 1A and **CHM3512** Chemistry 1B; OR **CHM3532** Chemistry for Life Sciences

**Module description:** This module intends to provide the student with a thorough understanding of the functioning of different animal species and their adaptations that enable them to survive in different environments. It will cover the following topics: Cellular and animal energetics, physico-chemical effects of temperature, avenues for heat exchange between animals and their environments, patterns of thermoregulation in various animal groups. Metabolism in hibernating animals. Membrane physiology and solute regulation by cells and electrophysiology of cells. Physiology of excitable cells (sensory physiology and nervous systems). Animal movement by means of cilia, flagella and muscular contractions, animal locomotion in water, land and air. Control of various body functions e.g. growth and regeneration, reproduction, iono-and osmoregulation, cellular metabolism and color by neurohormonal and classic hormonal systems. Aquatic and aerial respiration and how physical principles involved in gas exchange apply to various gas exchange structures e.g. body surface, gills, lungs and tracheal system. Structures and functions of circulatory system. Physiological role of water and solute regulation in terrestrial and aquatic animals. Structures and functions of specific excretory organs, e.g. coelomoducts, nephrons, Malpighian tubules, etc. Structures and functions of respiratory systems (lungs, gills, skin, tracheae, etc). Feeding mechanisms, cell secretion and movement (secretion and peristalsis by gut tube), cellular biochemistry (digestive enzymes and biochemistry of hydrolysis of various organic substrates) and nutrition (role of vitamins). Adaptations to low and high temperatures and altitude

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**MBL3731 RECOMBINANT DNA TECHNOLOGY**

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**Module title:** RECOMBINANT DNA TECHNOLOGY  
**Code:** MBL 3731  
**NQF level:** 7  
**Contact hours:** 4 L / week for 14 weeks + 3h P/week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%) Examination: **60%** (1 x 3h examination paper)

**Prerequisites:** **MBL3632** Introduction to Microbiology, **MBL3631** Cell Molecular Biology and Genetics

**Module description:** Recombinant DNA techniques were developed through discoveries in Molecular Biology. Although the experimental techniques used may vary, depending on the objectives of the investigation, a number of experimental protocols have been developed that could be considered to form the basic techniques in recombinant DNA technology. The students will critically assess and analyse the links between the research questions and the techniques to be used in order to develop the student's understanding of and appreciation for molecular biological processes. Students will have hands-on experience in laboratory sessions in both planning and executing experimental procedures. The principles and applications of the following techniques will be discussed: nucleic acid extraction, gel electrophoresis, restriction and other modifying enzymes, cloning vehicles and the cloning process, polymerase chain reaction, transformation, gene libraries, identifying recombinants, sequencing and characterizing genes.



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**MBL3712 BIOTECHNOLOGY**

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**Module title:** BIOTECHNOLOGY

**Code:** MBL 3712

**NQF level:** 7

**Contact hours:** 4 lecture periods / week for 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **40%** (minimum of 2 tests and 1 assignment)  
Examination **60%** (1 x 3 hour examination paper)

**Prerequisites:** **MBL3631** Cell Molecular Biology and Genetics, **MBL3731** Recombinant DNA Technology ,  
Biochemistry I **CHB3611**

**Module description:** This course is aimed at giving students a sound basic knowledge and skills in biotechnology related topics: Introduction to biotechnology: Definitions, scope of biotechnology, principles and techniques in genetics, biochemistry and microbiology, issues around GMOs. Genomics: Definitions, concepts of gene expression and analysis, techniques-genomic libraries and analysis, southern blots, applications. Proteomics: definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. Transcriptomics: definitions, concepts of gene regulation in prokaryotes and eukaryotes and analysis, Techniques- cDNA libraries and analysis, Northern blots, applications. Metabolomics: definitions, concepts of metabolism and analysis, primary and secondary metabolites, Techniques-metabolic pathways and analysis, site-directed mutagenesis, applications. Introduction to Bioinformatics: definitions, principles of bioinformatics, Techniques-databases and database searches, software usage, applications.

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**MBL3732 GENETICS**

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**Module title:** GENETICS

**Code:** MBL 3732

**NQF level:** 7

**Contact hours:** 4 lecture periods / week for 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **40%** (minimum of 2 tests and 2 Assignments)  
Examination **60%** (1 x 3 hour examination paper)

**Prerequisites:** Cell Molecular Biology and Genetics **MBL3631**, Introduction to Microbiology **MBL3632**

**Module description:** Chromosomes and gene maps: genetic recombination, linkage mapping, chromosome structure and number, construction of genetic linkage maps in humans, determining gene sequence during mapping, locating genes along a chromosome, identification of genes for disease. Evolutionary genetics: Causes and consequences of genetic variation at molecular level, detection of variation in proteins and DNA, gene families, genome evolution, comparison of prokaryotic and eukaryotic genomes, genetic organization of viruses. Genetic code, structure of DNA, DNA Organization in chromosomes, gene expression, Genome size and complexity, genome analysis, genetic mapping and analysis in bacteria, repetitive DNA, Extranuclear inheritance. The behaviour of chromosomes in dividing cells will be examined. Organisation of eukaryotic and prokaryotic genomes. Population Genetics : Darwin's Revolution, Variation and its Modulation, Selection Theory, Random Events and Polymorphism. Quantitative Genetics : Basic Statistical Norms, Genotypes and Phenotypic Distribution, Quantification of Heritability, Counting Locating Genes and Analysis of Variance. Advanced Transmission Genetics : Mapping Functions, Tetrad Analysis, Mitotic Segregation and Recombination and Mapping Human Chromosomes. Gene Mutations : Somatic versus Germinal Mutations, Types of Mutations, Mutation Induction and Detection and Mutation Breeding.

## FOURTH YEAR MODULES

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### EBL3800 FIELD ECOLOGY II

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|---------------------------|--|
| <b>Module title:</b>      | <b>FIELD ECOLOGY II</b>  |
| <b>Code:</b>              | <b>EBL3800</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 weeks field trip (2 weeks in each semester – up to 1 week for each module)   |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment: <b>100%</b> (field report)  |
| <b>Co-requisites:</b>     | <b>EBL3811</b> Environmental Management and <b>EBL3851</b> Biogeography (both 1st semester), <b>EBL3852</b> Behavioural Ecology and <b>EBL3832</b> Management of Natural Resources (both 2nd semester) |

**Module description:** Students must carry out compulsory field courses for the modules **EBL3811** Environmental Management and **EBL3851** Biogeography (both 1st semester), **EBL3852** Behavioural Ecology and **EBL3832** Management of Natural Resources (both 2nd semester). The field courses will be conducted in various localities, either jointly or separately and tasks may vary from year to year depending on the issues at hand. Any student who does not take part in the field course will NOT be allowed to sit the examinations of the respective modules.

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### BLG3810 RESEARCH PROJECT

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| <b>Module title:</b>      | <b>RESEARCH PROJECT</b>   |
| <b>Code:</b>              | <b>BLG3810</b>  |
| <b>NQF level:</b>         | 8   |
| <b>Contact hours:</b>     | Research project for one year   |
| <b>Credits:</b>           | 32  |
| <b>Module assessment:</b> | Continuous assessment: <b>100%</b> (Oral presentation of research proposal (10%); written research proposal (20%), oral presentation of results (20%), written research report (50%)) |
| <b>Prerequisites:</b>     | <b>BLG3702</b> Research Methodology, <b>STS3621</b> Statistics for Life Sciences I, <b>STS3622</b> Statistics for Life Sciences II  |

**Module description:** This module is designed to develop the research skills of students through the completion of a research project on an approved topic in the context of the major. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion.

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### EBL3811 ENVIRONMENTAL MANAGEMENT

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|---------------------------|---|
| <b>Module title:</b>      | <b>ENVIRONMENTAL MANAGEMENT</b>   |
| <b>Code:</b>              | <b>EBL3811</b>  |
| <b>NQF level:</b>         | 8   |
| <b>Contact hours:</b>     | 4 lecture periods per week, 3 hour practical per week for 14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous Assessment <b>40%</b> : Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination <b>60%</b> : 1x 3 hours theory paper |
| <b>Pre-requisites:</b>    | <b>EBL3731</b> Population Ecology, and <b>EBL3712</b> Ecosystem Ecology, and <b>EBL3732</b> Conservation Biology and Biodiversity                                       |

**Module description:** This course is multidisciplinary and aims to provide students with in-depth understanding of environmental management and its application. It addresses biophysical, social and economic issues affecting natural resources such as water, soil, air, plant and animal communities and their use through agriculture, forestry, fisheries, human settlement and industry. Any student who does not take part in the field course in **EBL3800** Field Ecology II will NOT be allowed to sit the examination. The concept of sustainable development and management of natural resources. Principles of environmental management, Human dimension in resource and environmental management, International Environmental conventions and treaties, Environmental legislation and policies in environmental protection with special reference to Namibia. Environmental Management Systems (EMS); ISO 14000 series of standards, Integrated Environmental Management Systems (IMS); Principles of IMS, proactive planning, informed decision making, open participatory approach, accountability for decisions and information on which they are based. Environmental impact assessment (EIA): history and evolution of EIA, the overall EIA process. Social Impact assessment; Law, policy and institutional arrangements for EIA systems, Public involvement, screening, scoping, assessment of impacts, mitigation and impact management, Reporting, Review, decision-making, monitoring and implementation. Environmental Management Plans. Project management, Environmental Audits, Environmental Cost Benefit Analysis, Clean technologies: current and best practices in methodologies of clean technology in waste minimization, prevention of pollution, cleaner production, cleaner processing. Problems associated with generation of waste and pollution. Management of solid and hazardous waste; current issues in environmental management.

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**EBL3831 BIOSYSTEMATICS**

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|---------------------------|---|
| <b>Module title:</b>      | <b>BIOSYSTEMATICS</b>   |
| <b>Code:</b>              | <b>EBL3831</b>  |
| <b>NQF Level:</b>         | 8   |
| <b>Contact hours:</b>     | 4 lecture periods per week, 3 hour practical per week for 14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> : Practicals 35% (5 or more assessed practicals), Theory 50% (2 tests, 1 assignment), Specimen Collecting project (15%). Examination <b>60%</b> : (1 x 3 hours theory paper) |
| <b>Pre-requisites:</b>    | <b>EBL3632</b> Ecological Field Techniques, and <b>BLG3612</b> Plant Form & Function, and <b>BLG3611</b> Animal Form & Function   |

**Module description:** This module is designed to thoroughly prepare candidates for biodiversity assessments and curation of natural history collections. The module emphasizes the collection, identification, curation (physical and taxonomic) and general management of natural history collections – thus endowing candidates with the necessary knowledge and skills to meet the above objective. Definitions, scope and importance of biosystematics; History and Development of biosystematics; Sources of taxonomic information; Types, use and construction of taxonomic keys; Evolution, variation and biosystematics; Principles of taxonomy; Principles of biological nomenclature, including provisions of Codes of Botanical and Zoological Nomenclature; Classification systems (The process of classification, Phenetic classification, Phylogenetic classification, Cladistics and the use of molecular techniques in phylogenetic analyses); Natural history collections (Collection and preservation of specimens, Herbarium collections and their management, Museum collections and their management, The value of Natural History Collections); Current issues in biosystematics; Biosystematics Collecting Project (Students will be required to carry out a compulsory mini-project on the collection and preservation of selected plant and animal specimens. These specimens will be accessioned as the UNAM Natural History Museum and UNAM Herbarium).

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**EBL3851 BIOGEOGRAPHY**

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|---------------------------|--|
| <b>Module title:</b>      | <b>BIOGEOGRAPHY</b>  |
| <b>Code:</b>              | <b>EBL3851</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods per week, 3 hour practical per week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous Assessment <b>40%</b> : Practicals 50% (at least 5 assessed practicals), Theory 50% (1 assignment, 2 tests) Examination <b>60%</b> : (1x3 hours theory paper) |
| <b>Pre-requisites:</b>    | <b>EBL3631</b> Introduction to Ecology and <b>EBL3712</b> Ecosystem Ecology  |

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

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**EBL3802 DISTURBANCE AND RESTORATION ECOLOGY**

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| <b>Module title:</b>      | <b>DISTURBANCE AND RESTORATION ECOLOGY</b>   |
| <b>Code:</b>              | <b>EBL3802</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lecture periods per week, 3 hour practical per week for 7 weeks  |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> : Practicals 50% (at least 3 assessed practicals), Theory 50% (1 test, 1 assignment) Examination <b>60%</b> : (1 x 2 hour theory paper) |

**Pre-requisites:** **EBL3712** Ecosystem Ecology and **EBL3732** Conservation Biology and Biodiversity

**Module description:** The world today is grappling with problems of degradation of habitats due to various factors. Such factors are usually referred to as 'disturbance factors' since they make these habitats less suitable for the original species to occupy. Such habitats have to be restored, somewhat, in order to conserve biological diversity. This module is designed to equip students with the knowledge about various disturbance factors and their impacts on the quality of habitats. The module also presents various approaches of restoring degraded/disturbed landscapes.

Disturbance ecology: Introduction (definitions, importance of disturbance, natural and anthropogenic disturbance, short-term and long-term aspects of disturbance, temporal and spatial aspects, reversible and non-reversible disturbance, disturbance regimes); resilience and stability in the face of disturbance; susceptibility to disturbance; types of disturbances and their impacts on ecosystem structure, function and productivity (include case examples to demonstrate impacts of fire, pollution, deforestation, unsustainable land management practices, over-exploitation, climate change, volcanoes, alien species, etc on the provision of goods and services by various ecosystems); interactive/synergistic impacts of disturbance factors; responses to disturbance from the organism level upwards the hierarchy, disturbance and biodiversity (include the intermediate disturbance hypothesis); modeling as a tool in disturbance ecology.

Restoration Ecology: Introduction (definitions, the need and importance of restoration); indicators of ecosystem degradation; principles of ecological restoration; planning for ecological restoration (various ecosystems); ecological restoration in practice (include case examples on various ecosystems); natural restoration; involvement of local communities in restoration work (case examples); Bio-monitoring and evaluation of the restoration process; challenges and opportunities for improving degraded landscapes.

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**EBL3832 MANAGEMENT OF NATURAL RESOURCES**

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| <b>Module title:</b>      | <b>MANAGEMENT OF NATURAL RESOURCES</b>   |
| <b>Code:</b>              | <b>EBL3832</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods per week, 3 hour practical per week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> : Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination <b>60%</b> : (1 x 3 hrs theory paper) |
| <b>Pre-requisites:</b>    | <b>EBL3731</b> Population Ecology, and <b>EBL3712</b> Ecosystem Ecology, and <b>EBL3732</b> Conservation Biology and Biodiversity  |

**Module description:** This module prepares students to be able to get employment in sectors dealing with natural resources management such as Forestry, Fisheries and National Parks. It is designed to give good grounding in natural resources management on which candidates can build. It is expected that candidates will quickly adapt to the work environment after doing this course, once employed. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Definitions: management, sustainable management, natural resources; Objectives of natural resources management; classification of natural resources and how the classes may be linked (stock, flow, renewable, non-renewable, perpetual, exhaustible, non-exhaustible); measures of stock resource availability (resource base, proven reserves, conditional, reserves, hypothetical resources, speculative resources, ultimately recoverable resources); measures of flow resource availability (maximum resource potential, sustainable capacity, absorptive capacity, carrying capacity); indigenous traditional/technical knowledge (ITK) systems in natural resource management; Community based natural resource management (CBNRM) practices in southern Africa; Adaptive management of natural resources; Communities and protected areas (conflicts in natural resource use including human-wildlife conflict, biosphere reserve concept); Management of fisheries resources (commercial fisheries (include yield models), seaweeds, fisheries regulations, causes and consequences of coastal pollution); Wildlife/Game management (management of game for tourism and harvest, manipulation of animal numbers, concept of maximum sustained yield, CITES and international trade (selected case species); management of forest resources (include non-timber forest products); natural resource accounting and economic valuation (cost-benefit analysis, multi-objective cost-benefit analysis, identifying cost-benefit flows – problems of selection bias, calculating material costs and benefits, placing money values on non-market goods); current issues in natural resources management.

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**EBL3812 BEHAVIOURAL ECOLOGY**

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| <b>Module title:</b>      | <b>BEHAVIOURAL ECOLOGY</b>   |
| <b>Code:</b>              | <b>EBL3812</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods per week, 3 hour practical per week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous Assessment <b>40%</b> : Theory 50% (at least 5 assessed practicals), Theory 50% (2 tests)<br>Examination <b>60%</b> : (1x 3 hours theory paper) |

**Pre-requisites** **EBL3731** Population Ecology

**Module description:** This module will introduce students to the role of behavior in understanding ecology of organisms. Special emphasis will be given to the genetic basis of behavior, how behavior evolved (phylogeny) as well as how it develops in organisms (ontogeny). These will provide a foundation to understand learned and innate behavior and how behavioral ecology is instrumental in applied ecology disciplines such as conservation biology. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination.

Introduction: definition of behavior, nervous system and behavior, simple (reflexes) and complex behavior. Development (Ontogeny) of behaviour: nature and nurture, instinct and learning in their biological setting, maturation-development involving growth, hormones and early development, play, imprinting and early experience. Evolution (Phylogeny) of behaviour: natural selection and behaviour, genetic basis of behaviour, the adaptiveness of behaviour, ritualisation. Diversity of behaviour: Innate behaviour, innate releasing mechanisms, fixed action patterns. Learned behaviour: habituation, conditioned reflex Type 1, trial & error learning, latent learning, insight learning. Communication: definition, evolution and use of signals in communication, information content of signals e.g. honey bees, manipulation in communication, cost, honesty/deceit & handicaps. Sex and sexual selection, advantages of sex (why two sexes), selection on males and females, Mate choice (male/female competition and female/male choice), Intra- and inter-sexual selection, sperm competition and mate guarding. Feeding and anti-predator behaviour: Feeding behaviour, diversity of prey capture techniques (prey detection and capture), optimal foraging behaviour, costs & benefits, optimality models, constraints in foraging efficiency; Anti-predator behaviour: detection of predators, chemical defenses, warning colouration, mimicry, alarm signals, improved vigilance, selfish herd effect. Dilution effect; Social organisation; group living (advantages), types of mating systems (e.g. polyandry, polygyny, monogamy, lek), social dominance, cooperation, aggression, altruism, parental care, territoriality, primate social organisation, insect social organisation.

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**MBL3811 IMMUNOLOGY**

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| <b>Module title:</b>      | <b>IMMUNOLOGY</b>  |
| <b>Code:</b>              | <b>MBL3811</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods per week and 3 hour practical per week for 14 weeks  |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> (minimum of 2 tests and 1 assignment) Examination <b>60%</b> (3 hour examination paper) |

**Prerequisites:** **MBL 3711** Microbiology

**Module description:** 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-Histocompatibility Complex and complement pathways. Different types of immunity such as cellular mediated immunity, humoral immunity and autoimmunity will also be addressed in the course. Various human diseases caused by viruses, bacteria and parasites such as HIV/AIDS, tuberculosis and malaria will then be discussed in order to give an applied perspective of immunology. Related aspects like vaccination and drug efficacy will also be covered as complementary components of the course. Contemporary issues pertaining to immunology such as gene therapy, and stem cell research will also be looked at. The practical content will include preparation of serum from whole blood, doing the Enzyme Linked Immuno-Sorbent Assays (ELISA), doing agglutination tests, antibody conjugation assays and inoculation of laboratory animals and monitoring antibody titre.

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**MBL 3831 APPLIED MOLECULAR BIOLOGY**

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| <b>Module title:</b>      | <b>APPLIED MOLECULAR BIOLOGY</b>   |
| <b>Code:</b>              | <b>MBL 3831</b>  |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks and one three hour practical session   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> : Theory (not less than 2 tests and 2 assignments) 40%, Practicals (not less than 10 marked assignments) 50% Examination: <b>60%</b> (1 x 3 hour examination paper) |

**Prerequisites:** **MBL 3731** Recombinant DNA Technology

**Module description:** This course will deal with new and exciting concepts and applications of molecular biology. This module aims to develop a better understanding of the many molecular methodologies that are utilized in current research. Topics such as FISH, GISH techniques, Advanced PCR techniques, Site-directed mutagenesis and analysis, Recombinant protein expression, Foot print technologies, Techniques for measuring transcript levels, RNA subtraction techniques, Reporter gene technologies, How to study protein-protein interactions - yeast 2-hybrid and immuno-precipitation technologies, Gene fusions, epitope- and fluorescent-tagging of proteins, How transgenic organisms are made, Examples of generating transgenic plants and animals and Biosafety aspects will be covered. This will be provided via consideration of DNA, RNA and proteins separately. A detailed account will be provided of how they are made and of the available methods for studying and manipulating them. Methodologies for the creation of transgenic organisms will also be provided and biosafety. Student will also gain hands on experience of some of the basic skills in molecular biology. This course will have laboratory sessions and the lectures will be given in a highly interactive manner.

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**MIC3811 MYCOLOGY**

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| <b>Module title:</b>      | <b>MYCOLOGY</b>  |
| <b>Code:</b>              | <b>MIC3811</b>   |
| <b>Course Equivalent:</b> | none   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks and one three hour practical session per week per semester   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment: <b>40%</b> Theory (not less than 2 tests and 2 assignments) 40%, Practicals(not less than 10 marked assignments) 50% Examination: <b>60%</b> (1 x 3 hour examination paper) |
| <b>Prerequisites:</b>     | <b>MBL3711:</b> Microbiology   |

**Module description:** This course will deal with concepts and applications of mycology. Topics will include Morphology, genetics, classification, ecology, and economic importance of Imperfect Fungi, Oomycetes, and Zygomycetes. Emphasis in the laboratory is on isolation, culture, and laboratory techniques. A survey of those fungi classified as Ascomycetes (such as yeasts, morels, powdery mildews and as Basidiomycetes (such as rusts, smuts, boletes, mushrooms, polypores). Emphasis 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.

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**MIC3802 PARASITOLOGY**

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| <b>Module title:</b>      | <b>PARASITOLOGY</b>   |
| <b>Code:</b>              | <b>MIC3802</b>  |
| <b>NQF level:</b>         | 8   |
| <b>Contact hours:</b>     | 2 lecture periods and 1 practical period per week for 14 weeks                    |
| <b>Credits:</b>           | 8   |
| <b>Module assessment:</b> | Continuous Assessment <b>40%</b> (2 tests). Examination <b>60%</b> (2 hour paper) |
| <b>Prerequisites:</b>     | Microbiology ( <b>MBL3711</b> ) (Pre), Immunology <b>MBL3811</b> (Co)             |

**Module description:** Emphasis will be put on major parasitic groups that include parasitic protozoa, monogeneans, digeneans, cestodes, nematodes, acanthocephalans, and parasitic arthropods. Parasites will be studied based on life cycles, host specificity, parasite biochemistry, molecular parasitology and parasites behavior. There will be a substantial basic introduction to endoparasites, ectoparasites, obligate parasites, facultative parasites as well as host-parasite interaction aspects such as symbiosis, commensalisms and mutualism. Medical Parasitology focusing on parasites that infect man and causing diseases like malaria, trypanosomiasis, leishmaniasis, schistosomiasis and etc will constitute an important component of the course. The course will also address Veterinary Parasitology to discuss those parasites that are causing economic losses in agriculture and aquaculture or which infect companion animal. The practical content will include: identification and isolation of intestinal parasites using Glucose Flotation Method/Sedimentation. Method and the microscopic preparation and examination of blood parasites.

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**MIC3822 MEDICAL MICROBIOLOGY**

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| <b>Module title:</b>      | <b>MEDICAL MICROBIOLOGY</b>  |
| <b>Code:</b>              | <b>MIC 3822</b>  |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week for 14 weeks and one 2-hour practical session per week per semester.   |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment ( <b>40%</b> ): Theory (not less than 2 tests and 2 assignments, 50%, Practicals (not less than 10 marked assignments) 50% Examination ( <b>60%</b> ): One 3-hour examination paper. |
| <b>Prerequisites:</b>     | Introduction to Microbiology ( <b>MBL3632</b> ) and Microbiology ( <b>MBL3711</b> )  |

**Module description:** This is an applied course equivalent to Clinical Microbiology or Diagnostic Microbiology. It will start with a discussion of the purpose and philosophy of medical microbiology, laboratory safety, laboratory organization, quality control and assessment, sterilization and disinfection, managing a clinical laboratory, handling clinical specimens. The course will then look at normal microbial flora versus pathogens, morphology and taxonomy, optical methods for laboratory diagnosis of infectious disease, cultivation and isolation of viable pathogens, conventional and rapid microbiological methods for identification of pathogens. Non-traditional methods for identification and detection of pathogens or their products (particle agglutination, ELISA, fluorogenic substrates, genetic probes, blotting techniques, PCR), diagnostic immunological principles and methods, antibiotics, antiviral strategies, methods for testing antimicrobial effectiveness, principles of automated methods of diagnosis, biochemical tests, histology, and histochemistry. Specific examples will be drawn from microorganisms encountered in the blood, cerebrospinal fluid, respiratory tract, gastrointestinal tract, urinary tract, wounds, abscesses, skin, soft tissue lesions, bones, head and neck, genital and sexually transmitted pathogens. Methods for identification of aetiological agents of infectious diseases will be based on selected examples such as parvo- and adenoviruses, herpes, and poxviruses, hepatitis viruses, picornaviruses, reo- and rotaviruses, arthropod- and rodent-borne viruses, orthomyxoviruses, paramyxoviruses and rubella, coronaviruses, rabies, prion diseases, lentiviruses and HIV, tumour viruses, bacilli, clostridium, anaerobes, corynebacterium, Listeria, actinomycetes, Streptococcus, Enterococci, Staphylococcus, Vibrio, Campylobacter, Helicobacter, Haemophilus, Brucella, Bordetella, Yersinia, Francisella, Pasteurella, Pseudomonas, Chlamydia, Neisseria, fungi, protozoa, and helminthes.

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**MIC3812 ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY**

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**Module title:** ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY  
**Code:** MIC 3812  
**NQF level:** 8  
**Contact hours:** 4 lecture periods / week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment **40%** (minimum of 2 tests and 2 assignments)  
Examination **60%** (1 x 2 hour examination paper)  
**Prerequisites:** Microbiology **MBL 3711**, Genetics **MBL 3732**,  
**Co-requisites:** Recombinant DNA Technology **MBL 3731**, **CHB3612** Biochemistry II

**Module description:** Industrial fermentation: Bioprocess development- isolation and screening of target organisms, strain selection, strain improvement, master culture preservation, media design, scale-up, fermentation vessels, oxygen transfer rate, bioprocess control, downstream processing. Batch culture, fed-batch culture, continuous culture, Crabtree effect, Pasteur effect. Production of antibiotics (eg. Penicillin), vaccines (eg. hepatitis B vaccine), beer, aminoacids (eg. Lysine, glutamate), organic acids (eg. Citric acid) and vitamins (eg. ascorbic acid), algal cultures. Design, operation and monitoring of a facility for manufacture of sterile products. Bioconversions, biodegradation, bioleaching. Factors that may influence sterility in manufacturing. Environmental microbiology: The role of microorganisms in the Environment. Terrestrial Environment: soils. Soil microorganism associations with plants. Marine Environment and Freshwater Environment including lakes and rivers. Sewage treatment: Conventional sewage and wastewater treatment , anaerobic digesters, constructed wetlands, septic tanks. Analysis of water purity. Indicator organisms, biocontrol, Baculovirus as a control agent, biomining, bioremediation, biostimulation, bioaugmentation.

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**MIC 3832 VIROLOGY**

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**Module title:** VIROLOGY  
**Code:** MIC3832  
**NQF level:** 8  
**Contact hours:** 4 lecture periods / week for 14 weeks and one three hour practical session per week per semester  
**Credits:** 16  
**Module assessment:** Continuous assessment **40%**: Theory (not less than 2 tests and 2 assignments) 40%, Practicals (not less than 10 marked assignments) 50%  
Examination: **60%** (1 x 3 hour examination paper)  
**Prerequisites:** **MBL3711** Microbiology

**Module description:** This course will deal with exciting concepts of virology and is intended to provide students with the latest information in virological methods and provide advanced knowledge.. Topics will include an introduction to viruses, their nature and structure. Nomenclature, classification and diversity of viruses. Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, assembly, maturation and release. Replicative strategies employed by plant and animal DNA and RNA viruses. Identification of virus prototypes associated with different RNA and DNA virus replication CHEms. Bacterial, plant and animal virus genetics. Host-virus interactions with emphasis on phenomena occurring at the molecular level and on the regulated control of gene expression in virus-infected cells. Viral pathogenesis and treatment using examples of common and emerging animal and plant viruses. Throughout the virology course, attempts are made at emphasizing those infectious diseases that are of great actual or potential importance to humans.

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**MOL3811 BIOINFORMATICS****4L + 1PS / week**

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**Module title:** BIOINFORMATICS  
**Code:** MOL3811  
**NQF level:** 8  
**Contact hours:** 4 L / week for 14 weeks + 3h P/week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%)  
Examination: **60%** (1 x 3h examination paper)  
**Prerequisites:** Cell Molecular Biology and Genetics **MBL3631**, Genetics **MBL3732**,  
**Co-requisite** Applied Molecular Biology **MBL3831**

**Module description:** The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and interactive course in which students will acquire knowledge on information networks, the world wide web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed. The information retrieval and analysis tools such as sequence similarity and alignment will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. The module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences The course will consist of lectures, student presentations and assignments.

| <b>MOL3812 APPLIED GENETICS</b> |  | <b>4L + 1PS / week</b> |
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| <b>Module title:</b>            | <b>APPLIED GENETICS</b>  |                        |
| <b>Code:</b>                    | <b>MBL3812</b>   |                        |
| <b>Course Equivalent:</b>       | none   |                        |
| <b>NQF level:</b>               | 8  |                        |
| <b>Contact hours:</b>           | 4 lecture periods/week for 14 weeks and one three hour practical session per week per semester   |                        |
| <b>Credits:</b>                 | 16   |                        |
| <b>Module assessment:</b>       | Continuous assessment <b>40%</b> : Theory (not less than 2 tests and 2 assignments) 40%<br>Practicals (not less than 10 marked assignments) 50%  |                        |
| <b>Examination:</b>             | <b>60%</b> (1 x 3 hour examination paper)  |                        |
| <b>Prerequisites:</b>           | <b>MBL3732</b> Genetics  |                        |
| <b>Module description:</b>      | This is a senior undergraduate course designed to allow students to conceptualise the applications of genetics in dealing with day to day situations in agriculture, medicine and the environment. This course will deal with exciting concepts in genetics. Topics will include plant breeding, animal breeding, medical genetics and the genetics of industrial fungi. These are usually taught separately, but they are all linked by strong central concepts regarding the generation, control, fate and use of genetic variation at the levels of genes, chromosomes, genomes and populations. Systematically, the course will cover: Aims of Applied Genetics, The Inheritance and Analysis of Qualitative and Quantitative Characters. Regression, Transgression, Environmental Effects and Heritability, Correlations between Characters, Genotype, Phenotype and Breeding Values. Applied aspects of Population Genetics: Allele Frequencies, Genetic Equilibria, Population Mixing, Genetic Drift and Gene Flow. Types and uses of Selection. Departures from Random Mating. Mutation and its uses. Recombination and mapping. Breeding methods and examples. Applied aspects of human and medical genetics. Genetic Engineering in Plants, Animals and Micro-Organisms, and Human Gene Therapy. Genetic Variation in Wild and Agricultural Populations, Genetics of Conservation. Genetic methods of insect Pest Control. Reproductive Physiology in Plants, Animals and Humans, Crossing Methods. Applied fungal genetics. The economics of Agricultural Products and Breeding programmes. |                        |

| <b>MOL3852 ANIMAL GROWTH AND DEVELOPMENT</b> |  | <b>4L + 1PS / week</b> |
|--|--|------------------------|
| <b>Module title:</b>                         | <b>ANIMAL GROWTH AND DEVELOPMENT</b>   |                        |
| <b>Code:</b>                                 | <b>MOL3852</b>   |                        |
| <b>Course equivalent:</b>                    | Animal Growth and Development (MBL3432)  |                        |
| <b>NQF level:</b>                            | 8  |                        |
| <b>Contact hours:</b>                        | 4 lecture periods / week for 14 weeks  |                        |
| <b>Credits:</b>                              | 16   |                        |
| <b>Module assessment:</b>                    | Continuous assessment <b>40%</b> (minimum of 2 tests and 2 Assignments)<br>Examination <b>60%</b> (1 x 2 hour examination paper)   |                        |
| <b>Prerequisites:</b>                        | Animal Form and Function <b>BLG3611</b> , Genetics <b>MBL 3732</b>   |                        |
| <b>Module description:</b>                   | This course will cover animal growth, including the genetic control of cell growth, differentiation and morphogenesis, development of the gametes, fertilization, all stages of pre-embryonic and post-embryonic development such as cleavage, blastulation, gastrulation and organogenesis. The two developmental paths followed by animals namely regulative development and mosaic development will be discussed. Evolutionary Development. Aging: Telomere-deletion hypothesis, wear-and-tear hypothesis, Gene-clock hypothesis, accumulated mutation hypothesis and effects of various physiological and Environmental factors affecting these processes. Cancer: cell-cycle regulation and genetics of cancer, causes and development of cancer. Stem cells: embryonic stem cells, somatic stem cells, therapeutic stem cell cloning etc. Animal tissue culture and Cloning: tissue culture techniques, tissue culture media, cloning. |                        |

| <b>MOL3832 PLANT GROWTH AND DEVELOPMENT</b> |  | <b>4L + 1PS / week</b> |
|---|--|------------------------|
| <b>Module title:</b>                        | <b>PLANT GROWTH AND DEVELOPMENT</b>  |                        |
| <b>Code:</b>                                | <b>MOL3832</b>   |                        |
| <b>NQF level:</b>                           | 8  |                        |
| <b>Contact hours:</b>                       | 4 L/week for 14 weeks + 3h P/week for 14 weeks   |                        |
| <b>Credits:</b>                             | 16   |                        |
| <b>Module assessment:</b>                   | Continuous assessment <b>40%</b> : (at least 2 tests and at least 8 practical marks) Examination <b>60%</b> : (1 x 3h paper)   |                        |
| <b>Prerequisites:</b>                       | <b>CHM3511</b> (Chemistry 1A) OR <b>CHM3512</b> (Chemistry 1B) or <b>CHM3532</b> Chemistry for Life Sciences   |                        |
| <b>Module description:</b>                  | This module is designed to provide students with an understanding and appreciation of the complex processes of plant growth and development from a molecular perspective. The module will examine the characteristics of plant growth, with emphasis on the meristematic nature of this growth. The process of growth will be discussed from a physical perspective taking into account Heyn's concept of cell wall extensibility and the role of pH and expansins. A number of developmental control mechanisms will be considered with emphasis on the interdependency between genetic, hormonal and environmental mechanisms, as well as signal perception and transduction by second messengers. The role of the six classes of plant hormones in the regulation of cell division, cell enlargement, cell differentiation with emphasis on tissue cultures, will be discussed. The control of processes such as seed development, shoot & root development, senescence and abscission, as well as flower and fruit development will be investigated, mainly from results obtained with mutagenic studies. The module will further examine the structure, characteristics and functions of plant photoreceptors with emphasis on photocontrol of seed germination, the processes of etiolation & de-etiolation, canopy shading and photoreceptor signal transduction. Plant movements such as nyctinasty, thigmonasty, phototropism and gravitropism will be discussed in detail. The concept of photoperiodism and the role of biological clocks will be investigated taking into account the ecological aspects of photoperiodism, response types, perception of the photoperiodic signal, transduction of the floral stimulus, rhythmic responses, Zeitgebers, and time measurement in photoperiodism. The module will conclude with an investigation of flowering by considering aspects such as floral induction and floral development. |                        |



## **SERVICE MODULES FOR EDUCATION STUDENTS ONLY**

**Module Title:** CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS

**Module equivalent:** New module

**Code:** MBE 3771

**NQF level:** 7

**Contact hours:** 4 lecture periods / week for 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **40%** (minimum of 2 tests and 2 Assignments) Examination **60%** (1 x 3hour examination paper)

**Prerequisites:** **BLG3612** Plant Form and Function, **BLG3611** Animal Form and Function, **MBL3652** Human Biology

**Module description:** This is a broad based course that will start with an introduction to the chemical basis of cellular processes, an overview of mitosis and meiosis, Mendelian & non-Mendelian Genetics: monohybrid crosses, dihybrid cross, test crosses, chromosomal theory of inheritance, sex determination & sex-linked genes, basic genetic linkage and chromosome mapping, and the genetic code; structure and function of eukaryotic chromosomes and mutations as the basis for genetic variations and their effects and natural selection. Macromolecules : proteins, carbohydrates fatty acids and nucleic acids and their roles in cellular organization; the structure of DNA and genome sizes and complexity; DNA replication; Eukaryotic transcription and RNA processing. The module will include principles of microbiology, importance of microorganisms, microbial cell structure, physiological diversity of microorganisms, prokaryotic diversity, microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and bacterial taxis, staining techniques, microbial nutrition and metabolism, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, Identification of bacteria; Microbial genetics and genetic engineering: conjugation, transformation and transduction; Mutations, causes and uses of mutations; DNA Isolation; molecular cloning, genetic recombination, detection of variation in proteins and DNA. Genetically Modified Organisms: examples, risks and benefits.

**Module Title:** ENVIRONMENTAL BIOLOGY FOR EDUCATORS

**Module equivalent:** New Module

**Module Code:** EBE 3772

**NQF Level:** 7

**Credits:** 16

**Module Assessment:** CA **40%** Exam **60%** - 1 x 3 hour paper

**Prerequisite:** **BLG3611** Animal Form and Function, **BLG 3612** Plant Form and Function

**Module description:** This module is designed to equip students with the necessary understanding of various topics in environmental studies. The main focus of this module is to enhance understanding of relationships of organisms with one another and with their environment including the human dimension. The following will be covered in this module: Ecology and environment: definitions. Basic components of ecological systems, essential processes of ecological systems: photosynthesis and decomposition. Primary and secondary production, energy flow and flux of matter and trophic structures, food chains and food webs, trophic levels and ecological pyramids, Food chains and poisons in the environment. Biogeochemical cycles (water-, carbon- nitrogen and phosphorous -cycles) and human influence cycles. Climate change: definition, causes, mitigation and adaptations. Climate change conventions and protocols. Namibia and climate change. Biomes: definition, classification and characteristics of biomes of the world and biomes of Namibia. Population Ecology: characteristics of populations- birth, death, immigration, emigration, size, age structure, and sex ratios. Population density, dispersion, mortality, natality and survivorship, population growth, parasitism (classes and characteristics of parasites, hosts as habitats, parasite population dynamics, evolutionary aspects of parasitism, social parasitism), Population regulation (mechanisms of population regulation, intra-specific competition, dispersal, social interactions). Arid environments: causes, classification and characteristics of arid ecosystems, surface and ground water, floods, Humidity, temperature, wind and wind erosion, soils, dust & dust storms, adaptations of organisms to arid environments. Desertification: definitions, causes of desertification (proximate or immediate and ultimate or underlying causes), manifestations of desertification, action to combat desertification. Deforestation: causes (proximate or immediate and ultimate or underlying causes) and effects of deforestation, deforestation in Namibia and possible solutions to deforestation. Conservation ecology: definitions, global patterns, distribution and measurement of biodiversity with special emphasis on Namibian. Conservation and sustainable exploitation of natural resources. Threats to biological diversity (including habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease). Human influences on ecosystems; damage to the environment, urbanization. Aquatic Ecology: the physical properties of water, stream ecology, lake ecology, physical and chemical properties of oceans, food chains and webs in the marine environment, estuarine ecology.

## E. DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

### E.1. DEPARTMENTAL REGULATIONS

Students who want to register for Chemistry and Biochemistry must have at least a "C" symbol in Physical Science at NSSC-O level (IGCSE level).

All practical sessions are compulsory. At least **80%** of practical attendance is required to qualify for the final examination. Tutorial sessions are compulsory in the modules where they are offered.

To qualify for the second opportunity examination, you need a final mark of between **45-49%**, a subminimum of **40%** for the exam mark as well as a **50%** in either your exam or CA mark.

#### E.1.1. B.Sc. (HONOURS) CHEMISTRY MAJORS AND MINORS, CURRICULUM AND PREREQUISITES

##### QUALIFICATION: B. Sc. (Honours) Chemistry Major and Physics Minor (11BCHP)

Students opting for a major in **Chemistry** (with minor in Physics) must take all of the following modules:

##### Year 1

| Semester              | Module Name                                   | Codes   | Pre- Requisites            |
|-----------------------|---|---------|----------------------------|
| 1                     | Chemistry 1A                                  | CHM3511 | Faculty Entry Requirements |
| 1                     | Analytic Geometry, Complex Numbers & Matrices | MAT3531 | Faculty Entry Requirements |
| 1                     | Basic Mathematics                             | MAT3511 | Faculty Entry Requirements |
| 1                     | English Communication and Study Skills        | LCE3519 | Faculty Entry Requirements |
| <b>Physics Minor:</b> |   |         |                            |
| 1                     | Physics for Physical Sciences I               | PHY3511 | Faculty Entry Requirements |

| Semester              | Module Name                      | Codes   | Pre- Requisites            |
|-----------------------|----------------------------------|---------|----------------------------|
| 2                     | Chemistry 1B                     | CHM3512 | Faculty Entry Requirements |
| 2                     | Precalculus                      | MAT3512 | Faculty Entry Requirements |
| 2                     | English for Academic Purposes    | LEA3519 | Faculty Entry Requirements |
| 2                     | Contemporary Social Issues       | CSI3529 | Faculty Entry Requirements |
| 2                     | Computer Literacy                | CLC3509 | Faculty Entry Requirements |
| <b>Physics Minor:</b> |                                  |         |                            |
| 2                     | Physics for Physical Sciences II | PHY3512 | Faculty Entry Requirements |

##### Year 2

| Semester              | Module Name           | Codes   | Pre- Requisites                       |
|-----------------------|-----------------------|---------|---------------------------------------|
| 1                     | Inorganic Chemistry I | CHM3611 | CHM3511 & CHM3512                     |
| 1                     | Physical Chemistry I  | CHM3631 | CHM3511 & CHM3512, & MAT3511, MAT3512 |
| 1                     | Calculus I            | MAT3611 | MAT3512 + 1 Full Mathematics Module   |
| <b>Physics Minor:</b> |                       |         |                                       |
| 1                     | Classical Mechanics   | PHY3611 | PHY3511, MAT3511, MAT3512             |
| 1                     | Waves and Optics      | PHY3631 | PHY3511, PHY3512                      |

| Semester              | Module Name                | Codes   | Pre- Requisites                     |
|-----------------------|----------------------------|---------|-------------------------------------|
| 2                     | Analytical Chemistry I     | CHM3602 | CHM3511 & CHM3512                   |
| 2                     | Organic Chemistry I        | CHM3612 | CHM3511 & CHM3512                   |
| 2                     | Introduction to Statistics | STS3522 | Faculty Entry Requirements          |
| 2                     | Calculus II                | MAT3612 | MAT3512 + 1 Full Mathematics Module |
| 2                     | Elementary Linear Algebra  | MAT3652 | MAT3511                             |
| <b>Physics Minor:</b> |                            |         |                                     |
| 2                     | Modern Physics I           | PHY3602 | PHY3511, PHY3512, MAT3511, MAT3512  |

##### Year 3

| Semester | Module Name                | Codes   | Pre- Requisites                         |
|----------|----------------------------|---------|---|
| 1        | Industrial Chemistry I     | CHM3761 | CHM3611, CHM3612                        |
| 1        | Inorganic Chemistry II     | CHM3701 | CHM3611, MAT3512                        |
| 1        | Analytical Chemistry II    | CHM3721 | CHM3602                                 |
| 1        | Organic Chemistry II       | CHM3711 | CHM3612                                 |
| 1        | Numerical Methods          | MAT3621 | Any 2 full 1st Year Mathematics Modules |
| 1        | Programming Fundamentals I | CMP3511 |   |

| <b>Physics Minor:</b> |                                 |         |                  |
|-----------------------|---------------------------------|---------|------------------|
| 1                     | Thermodynamics & Kinetic Theory | PHY3701 | PHY3611, MAT3612 |
| 1                     | Computational Physics with C++  | PHY3721 | None             |

| Semester              | Module Name                     | Codes   | Pre- Requisites                         |
|-----------------------|---------------------------------|---------|---|
| 2                     | Instrumental Analysis I         | CHM3702 | CHM3602, CHM3612                        |
| 2                     | Physical Chemistry II           | CHM3712 | CHM3631, MAT3611, MAT3612               |
| 2                     | Ordinary Differential Equations | MAT3642 | Any 2 full 1st Year Mathematics Modules |
| 2                     | Research Methodology            | CHM3722 | All second year chemistry modules       |
| <b>Physics Minor:</b> |                                 |         |   |
| 2                     | Modern Physics II               | PHY3732 | PHY3602                                 |

#### Year 4

| Semester                          | Module Name                  | Codes   | Pre- Requisites                  |
|-----------------------------------|------------------------------|---------|----------------------------------|
| 1                                 | Instrumental Analysis II     | CHM3801 | CHM3702, CHM3711                 |
| 1                                 | Organic Chemistry III        | CHM3811 | CHM3711                          |
| 1                                 | Physical Chemistry III       | CHM3831 | CHM3631, MAT3612                 |
| 1                                 | Research Projects            | CHM3810 | All third year chemistry modules |
| 1                                 | Physical Inorganic Chemistry | CHM3841 | CHM3701                          |
| <b>Physics Minor: No offering</b> |                              |         |                                  |

| Semester                          | Module Name                  | Codes   | Pre- Requisites                  |
|-----------------------------------|------------------------------|---------|----------------------------------|
| 2                                 | Inorganic Chemistry III      | CHM3802 | CHM3701                          |
| 2                                 | Industrial Chemistry II      | CHM3812 | CHM3712, CHM3761                 |
| 2                                 | Molecular Spectroscopy       | CHM3832 | CHM3631, MAT3612                 |
| 2                                 | Advanced Topics in Chemistry | CHM3842 | All third year chemistry modules |
| 2                                 | Research Projects            | CHM3810 | All third year chemistry modules |
| <b>Physics Minor: No offering</b> |                              |         |                                  |

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

Students opting for a major in **Chemistry** (with minor in Biology) must take all of the following modules:

**Year 1**

| Semester             | Module Name                            | Codes   | Pre- Requisites            |
|----------------------|--|---------|----------------------------|
| 1                    | Chemistry 1A                           | CHM3511 | Faculty Entry Requirements |
| 1                    | Physics for Physical Sciences I        | PHY3511 | Faculty Entry Requirements |
| 1                    | Basic Mathematics                      | MAT3511 | Faculty Entry Requirements |
| 1                    | English Communication and Study Skills | LCE3519 | Faculty Entry Requirements |
| <b>Biology Minor</b> |  |         |                            |
| 1                    | Introduction to Biology                | BLG3511 | NSSC Biology C             |

| Semester             | Module Name                   | Codes   | Pre- Requisites            |
|----------------------|-------------------------------|---------|----------------------------|
| 2                    | Chemistry 1B                  | CHM3512 | Faculty Entry Requirements |
| 2                    | Precalculus                   | MAT3512 | Faculty Entry Requirements |
| 2                    | Computer Literacy             | CLC3509 | Faculty Entry Requirements |
| 2                    | Contemporary Social Issues    | CSI3529 | Faculty Entry Requirements |
| 2                    | English for Academic Purposes | LEA3519 | Faculty Entry Requirements |
| <b>Biology Minor</b> |                               |         |                            |
| 2                    | Diversity of Life             | BLG3512 | NSSC Biology C             |

**Year 2**

| Semester             | Module Name                       | Codes   | Pre- Requisites                       |
|----------------------|-----------------------------------|---------|---------------------------------------|
| 1                    | Inorganic Chemistry I             | CHM3611 | CHM3511 & CHM3512                     |
| 1                    | Physical Chemistry I              | CHM3631 | CHM3511 & CHM3512, & MAT3511, MAT3512 |
| 1                    | Calculus I                        | MAT3611 | MAT3512 + 1 Full Mathematics Module   |
| 1                    | Biochemistry I                    | CHB3611 | CHM3511 & CHM3512 & BLG3511           |
| <b>Biology Minor</b> |                                   |         |                                       |
| 1                    | Cell Molecular Biology & Genetics | MBL3631 | BLG3511, BLG3512                      |

| Semester             | Module Name                  | Codes   | Pre- Requisites                     |
|----------------------|------------------------------|---------|-------------------------------------|
| 2                    | Analytical Chemistry I       | CHM3602 | CHM3511 & CHM3512                   |
| 2                    | Organic Chemistry I          | CHM3612 | CHM3511 & CHM3512                   |
| 2                    | Calculus II                  | MAT3612 | MAT3512 + 1 Full Mathematics Module |
| 2                    | Biochemistry II              | CHB3612 | CHM3511 & CHM3512 & BLG3511         |
| 2                    | Introduction to Statistics   | STS3522 | Faculty Entry Requirements          |
| <b>Biology Minor</b> |                              |         |                                     |
| 2                    | Introduction to Microbiology | MBL3632 | BLG3511, BLG3512                    |

**Year 3**

| Semester             | Module Name                | Codes   | Pre- Requisites  |
|----------------------|----------------------------|---------|------------------|
| 1                    | Industrial Chemistry I     | CHM3761 | CHM3611, CHM3612 |
| 1                    | Inorganic Chemistry II     | CHM3701 | CHM3611, MAT3512 |
| 1                    | Analytical Chemistry II    | CHM3721 | CHM3602          |
| 1                    | Organic Chemistry II       | CHM3711 | CHM3612          |
| 1                    | Biochemistry III           | CHB3701 | CHB3612, MBL3631 |
| <b>Biology Minor</b> |                            |         |                  |
| 1                    | Microbiology               | MBL3711 | MBL3632          |
| 1                    | Recombinant DNA Technology | MBL3731 | MBL3631, MBL3632 |

| Semester                          | Module Name             | Codes   | Pre- Requisites                   |
|-----------------------------------|-------------------------|---------|-----------------------------------|
| 2                                 | Instrumental Analysis I | CHM3702 | CHM3602, CHM3612                  |
| 2                                 | Physical Chemistry II   | CHM3712 | CHM3631, MAT3611, MAT3612         |
| 2                                 | Biochemistry IV         | CHB3712 | CHB3612, MBL3631                  |
| 2                                 | Research Methodology    | CHM3722 | All second year chemistry modules |
| <b>Biology Minor: No offering</b> |                         |         |                                   |

#### Year 4

| Semester                          | Module Name                  | Codes   | Pre- Requisites                  |
|-----------------------------------|------------------------------|---------|----------------------------------|
| 1                                 | Instrumental Analysis II     | CHM3801 | CHM3702, CHM3711                 |
| 1                                 | Organic Chemistry III        | CHM3811 | CHM3711                          |
| 1                                 | Physical Chemistry III       | CHM3831 | CHM3631, MAT3612                 |
| 1                                 | Natural Product Chemistry I  | CHB3821 | CHM3711                          |
| 1                                 | Research Projects            | CHM3810 | All third year chemistry modules |
| 1                                 | Physical Inorganic Chemistry | CHM3841 | CHM3701                          |
| <b>Biology Minor: No offering</b> |                              |         |                                  |

| Semester                          | Module Name                  | Codes   | Pre- Requisites        |
|-----------------------------------|------------------------------|---------|------------------------|
| 2                                 | Inorganic Chemistry III      | CHM3802 | CHM3701                |
| 2                                 | Industrial Chemistry II      | CHM3812 | CHM3712, CHM3761       |
| 2                                 | Natural Product Chemistry II | CHB3822 | CHM3711                |
| 2                                 | Advanced Topics in Chemistry | CHM3842 | All third year modules |
| 2                                 | Research Projects            | CHM3810 | All third year modules |
| <b>Biology Minor: No offering</b> |                              |         |                        |

#### QUALIFICATION: B. Sc (Honours) 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   | Pre- Requisites            |
|-----------------------|--|---------|----------------------------|
| 1                     | Chemistry 1A                                   | CHM3511 | Faculty Entry Requirements |
| 1                     | Physics for Physical Sciences I                | PHY3511 | Faculty Entry Requirements |
| 1                     | Basic Mathematics                              | MAT3511 | Faculty Entry Requirements |
| 1                     | Analytic Geometry, Complex Numbers & Matrices  | MAT3531 | Faculty Entry Requirements |
| 1                     | English Communication and Study Skills         | LCE3519 | Faculty Entry Requirements |
| <b>Geology Minor:</b> |  |         |                            |
| 1                     | Intro. to Physical Geology & Surface Processes | GLY3521 | Faculty Entry Requirements |

| Semester              | Module Name                   | Codes   | Pre- Requisites            |
|-----------------------|-------------------------------|---------|----------------------------|
| 2                     | Chemistry 1B                  | CHM3512 | Faculty Entry Requirements |
| 2                     | Precalculus                   | MAT3512 | Faculty Entry Requirements |
| 2                     | Contemporary Social Issues    | CSI3529 | Faculty Entry Requirements |
| 2                     | Computer Literacy             | CLC3509 | Faculty Entry Requirements |
| 2                     | English for Academic Purposes | LEA3519 | Faculty Entry Requirements |
| <b>Geology Minor:</b> |                               |         |                            |
| 2                     | Intro. To Earth Systems       | GLY3502 | Faculty Entry Requirements |

#### Year 2

| Semester              | Module Name               | Codes   | Pre- Requisites                       |
|-----------------------|---------------------------|---------|---------------------------------------|
| 1                     | Inorganic Chemistry I     | CHM3611 | CHM3511 & CHM3512                     |
| 1                     | Physical Chemistry I      | CHM3631 | CHM3511 & CHM3512, & MAT3511, MAT3512 |
| 1                     | Calculus I                | MAT3611 | MAT3512 + 1 Full Mathematics Module   |
| <b>Geology Minor:</b> |                           |         |                                       |
| 1                     | Earth Resources           | GLY3641 | GLY3521                               |
| 1                     | Introduction to Hydrology | GLY3621 | MAT3512 & GLY3521                     |

| Semester              | Module Name                           | Codes   | Pre- Requisites                     |
|-----------------------|---------------------------------------|---------|-------------------------------------|
| 2                     | Analytical Chemistry I                | CHM3602 | CHM3511 & CHM3512                   |
| 2                     | Organic Chemistry I                   | CHM3612 | CHM3511 & CHM3512                   |
| 2                     | Physics for Physical Sciences II      | PHY3512 | Faculty Entry Requirements          |
| 2                     | Calculus II                           | MAT3612 | MAT3512 + 1 Full Mathematics Module |
| 2                     | Introduction to Statistics            | STS3522 | Faculty Entry Requirements          |
| <b>Geology Minor:</b> |                                       |         |                                     |
| 2                     | Introduction to Geochemistry          | GLY3642 | GLY3521 & MAT3512 & CHM3512         |
| 2                     | Crystallography and Mineral Chemistry | GLY3632 | MAT3512 & CHM3512                   |

### Year 3

| Semester              | Module Name                 | Codes   | Pre- Requisites   |
|-----------------------|-----------------------------|---------|---|
| 1                     | Industrial Chemistry I      | CHM3761 | CHM3611, CHM3612  |
| 1                     | Inorganic Chemistry II      | CHM3701 | CHM3611, MAT3512  |
| 1                     | Analytical Chemistry II     | CHM3721 | CHM3602   |
| 1                     | Organic Chemistry II        | CHM3711 | CHM3612   |
| <b>Geology Minor:</b> |                             |         |   |
| 1                     | Coal, Petroleum & Gas       | GLY3701 | GLY3521; <del>GLY3600 (co-requisite)</del>                |
| 1                     | Regional Geology of Namibia | GLY3761 | GLY3521; <del>GLY3600 (co-requisite (co-requisite))</del> |
| 1                     | Mineralogy                  | GLY3711 | GLY3632 & <del>GLY3632; GLY3600 (co-requisite)</del>      |
| 1                     | Field Geology I             | GLY3600 | <del>GLY3521</del> None                                   |

| Semester              | Module Name                              | Codes   | Pre- Requisites                                      |
|-----------------------|--|---------|--|
| 2                     | Instrumental Analysis I                  | CHM3702 | CHM3602, CHM3612                                     |
| 2                     | Physical Chemistry II                    | CHM3712 | CHM3631, MAT3611, MAT3612                            |
| 2                     | Research Methodology                     | CHM3722 | All second year chemistry modules                    |
| <b>Geology Minor:</b> |  |         |  |
| 2                     | Exploration Geochemistry & Geostatistics | GLY3782 | GLY3642; GLY3600 (co-requisite)                      |
| 2                     | Hydrogeology I                           | GLY3702 | GLY3621 & <del>GLY3642; GLY3600 (co-requisite)</del> |
| 2                     | Field Geology I                          | GLY3600 | <del>GLY3521</del> None                              |

### Year 4

| Semester                          | Module Name                  | Codes   | Pre- Requisites                  |
|-----------------------------------|------------------------------|---------|----------------------------------|
| 1                                 | Instrumental Analysis II     | CHM3801 | CHM3702, CHM3711                 |
| 1                                 | Organic Chemistry III        | CHM3811 | CHM3711                          |
| 1                                 | Physical Chemistry III       | CHM3831 | CHM3631, MAT3612                 |
| 1                                 | Physical Inorganic Chemistry | CHM3841 | CHM3701                          |
| 1                                 | Research Projects            | CHM3810 | All third year chemistry modules |
| <b>Geology Minor: No offering</b> |                              |         |                                  |

| Semester                          | Module Name                  | Codes   | Pre- Requisites                  |
|-----------------------------------|------------------------------|---------|----------------------------------|
| 2                                 | Inorganic Chemistry III      | CHM3802 | CHM3701                          |
| 2                                 | Industrial Chemistry II      | CHM3812 | CHM3712, CHM3761                 |
| 2                                 | Molecular Spectroscopy       | CHM3832 | CHM3631, MAT3612                 |
| 2                                 | Advanced Topics in Chemistry | CHM3842 | All third year chemistry modules |
| 2                                 | Research Projects            | CHM3810 | All third year chemistry modules |
| <b>Geology Minor: No offering</b> |                              |         |                                  |

### QUALIFICATION: B. Sc. (Honours) 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   | Pre- Requisites            |
|-----------------------|--|---------|----------------------------|
| 1                     | Chemistry 1A                           | CHM3511 | Faculty Entry Requirements |
| 1                     | Physics for Life Sciences I            | PHY3501 | Faculty Entry Requirements |
| 1                     | Basic Mathematics                      | MAT3511 | Faculty Entry Requirements |
| 1                     | English Communication and Study Skills | LCE3519 | Faculty Entry Requirements |
| 1                     | Computer Literacy                      | CLC3509 | Faculty Entry Requirements |
| <b>Biology Minor:</b> |  |         |                            |
| 1                     | Introduction to Biology                | BLG3511 | NSSC Biology C             |

| Semester              | Module Name                   | Codes   | Pre- Requisites            |
|-----------------------|-------------------------------|---------|----------------------------|
| 2                     | Chemistry 1B                  | CHM3512 | Faculty Entry Requirements |
| 2                     | Precalculus                   | MAT3512 | Faculty Entry Requirements |
| 2                     | Introduction to Statistics    | STS3522 | Faculty Entry Requirements |
| 2                     | Contemporary Social Issues    | CSI3529 | Faculty Entry Requirements |
| 2                     | English for Academic Purposes | LEA3519 | Faculty Entry Requirements |
| <b>Biology Minor:</b> |                               |         |                            |
| 2                     | Diversity of Life             | BLG3512 | NSSC Biology C             |

## Year 2

| Semester              | Module Name                       | Codes   | Pre- Requisites                       |
|-----------------------|-----------------------------------|---------|---------------------------------------|
| 1                     | Inorganic Chemistry I             | CHM3611 | CHM3511 & CHM3512                     |
| 1                     | Physical Chemistry I              | CHM3631 | CHM3511 & CHM3512, & MAT3511, MAT3512 |
| 1                     | Calculus I                        | MAT3611 | MAT3512 + 1 Full Mathematics Module   |
| 1                     | Biochemistry I                    | CHB3611 | CHM3511 & CHM3512 & BLG3511           |
| 1                     | Statistics for Life Sciences I    | STS3621 | STS3522                               |
| <b>Biology Minor:</b> |                                   |         |                                       |
| 1                     | Cell Molecular Biology & Genetics | MBL3631 | BLG3511, BLG3512                      |

| Semester              | Module Name                     | Codes   | Pre- Requisites             |
|-----------------------|---------------------------------|---------|-----------------------------|
| 2                     | Analytical Chemistry I          | CHM3602 | CHM3511 & CHM3512           |
| 2                     | Organic Chemistry I             | CHM3612 | CHM3511 & CHM3512           |
| 2                     | Statistics for Life Sciences II | STS3622 | STS3522                     |
| 2                     | Biochemistry II                 | CHB3612 | CHM3511 & CHM3512 & BLG3511 |
| <b>Biology Minor:</b> |                                 |         |                             |
| 2                     | Introduction to Microbiology    | MBL3632 | BLG3511, BLG3512            |

## Year 3

| Semester              | Module Name                | Codes   | Pre- Requisites  |
|-----------------------|----------------------------|---------|------------------|
| 1                     | Inorganic Chemistry II     | CHM3701 | CHM3611, MAT3512 |
| 1                     | Analytical Chemistry II    | CHM3721 | CHM3602          |
| 1                     | Organic Chemistry II       | CHM3711 | CHM3612          |
| 1                     | Biochemistry III           | CHB3701 | CHB3612, MBL3631 |
| <b>Biology Minor:</b> |                            |         |                  |
| 1                     | Microbiology               | MBL3711 | MBL3632          |
| 1                     | Recombinant DNA Technology | MBL3731 | MBL3631, MBL3632 |

| Semester              | Module Name             | Codes   | Pre- Requisites                   |
|-----------------------|-------------------------|---------|-----------------------------------|
| 2                     | Instrumental Analysis I | CHM3702 | CHM3602, CHM3612                  |
| 2                     | Research Methodology    | CHM3722 | All second year chemistry modules |
| 2                     | Biochemistry IV         | CHB3712 | CHB3612, MBL3631                  |
| 2                     | Medical Biochemistry    | CHB3732 | CHB3612                           |
| <b>Biology Minor:</b> |                         |         |                                   |
| 2                     | Genetics                | MBL3732 | MBL3632, MBL3631                  |

## Year 4

| Semester                          | Module Name                     | Codes   | Pre- Requisites                  |
|-----------------------------------|---------------------------------|---------|----------------------------------|
| 1                                 | Nutritional Biochemistry        | CHB3801 | CHB3612, CHM3702                 |
| 1                                 | Natural Product Chemistry I     | CHB3821 | CHM3711                          |
| 1                                 | Bioinformatics for Biochemistry | CHB3831 | CHB3612, MBL3631                 |
| 1                                 | Physical Inorganic Chemistry    | CHM3841 | CHM3701                          |
| 1                                 | Research Projects               | CHB3810 | All third year chemistry modules |
| <b>Biology Minor: No offering</b> |                                 |         |                                  |

| Semester                          | Module Name                           | Codes   | Pre- Requisites                  |
|-----------------------------------|---------------------------------------|---------|----------------------------------|
| 2                                 | Professional Training in Biochemistry | CHB3832 | CHB3712, MBL3632                 |
| 2                                 | Environmental Biochemistry            | CHB3812 | CHB3702                          |
| 2                                 | Natural Product Chemistry II          | CHB3822 | CHM3711                          |
| 2                                 | Advanced Topics in Biochemistry       | CHB3852 | All third year chemistry modules |
| 2                                 | Research Projects                     | CHB3810 | All third year chemistry modules |
| <b>Biology Minor: No offering</b> |                                       |         |                                  |

**QUALIFICATION: B. Sc. (Honours) 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   | Pre- Requisites            |
|----------|--|---------|----------------------------|
| 1        | Chemistry 1A                           | CHM3511 | Faculty Entry Requirements |
| 1        | Physics for Life Sciences I            | PHY3501 | Faculty Entry Requirements |
| 1        | Introduction to Biology                | BLG3511 | NSSC Biology C             |
| 1        | Basic Mathematics                      | MAT3511 | Faculty Entry Requirements |
| 1        | English Communication and Study Skills | LCE3519 | Faculty Entry Requirements |
| 1        | Computer Literacy                      | CLC3509 | Faculty Entry Requirements |

| Semester | Module Name                   | Codes   | Pre- Requisites            |
|----------|-------------------------------|---------|----------------------------|
| 2        | Precalculus                   | MAT3512 | Faculty Entry Requirements |
| 2        | Diversity of Life             | BLG3512 | NSSC Biology C             |
| 2        | Chemistry 1B                  | CHM3512 | Faculty Entry Requirements |
| 2        | Introduction to Statistics    | STS3522 | Faculty Entry Requirements |
| 2        | Contemporary Social Issues    | CSI3529 | Faculty Entry Requirements |
| 2        | English for Academic Purposes | LEA3519 | Faculty Entry Requirements |

**Year 2**

| Semester                | Module Name                       | Codes   | Pre- Requisites                       |
|-------------------------|-----------------------------------|---------|---------------------------------------|
| 1                       | Calculus I                        | MAT3611 | MAT3512 + 1 Full Mathematics Module   |
| 1                       | Biochemistry I                    | CHB3611 | CHM3511 & CHM3512 & BLG3511           |
| 1                       | Cell Molecular Biology & Genetics | MBL3631 | BLG3511, BLG3512                      |
| 1                       | Statistics for Life Sciences I    | STS3621 | STS3522                               |
| <b>Chemistry Minor:</b> |                                   |         |                                       |
| 1                       | Inorganic Chemistry I             | CHM3611 | CHM3511 & CHM3512                     |
| 1                       | Physical Chemistry I              | CHM3631 | CHM3511 & CHM3512, & MAT3511, MAT3512 |

| Semester                | Module Name                  | Codes   | Pre- Requisites                     |
|-------------------------|------------------------------|---------|-------------------------------------|
| 2                       | Biochemistry II              | CHB3612 | CHM3511 & CHM3512 & BLG3511         |
| 2                       | Introduction to Microbiology | MBL3632 | BLG3511, BLG3512                    |
| 2                       | Calculus II                  | MAT3612 | MAT3512 + 1 Full Mathematics Module |
| <b>Chemistry Minor:</b> |                              |         |                                     |
| 2                       | Analytical Chemistry I       | CHM3602 | CHM3511 & CHM3512                   |
| 2                       | Organic Chemistry I          | CHM3612 | CHM3511 & CHM3512                   |

**Year 3**

| Semester                | Module Name                | Codes   | Pre- Requisites  |
|-------------------------|----------------------------|---------|------------------|
| 1                       | Biochemistry III           | CHB3701 | CHB3612, MBL3631 |
| 1                       | Recombinant DNA Technology | MBL3731 | MBL3631, MBL3632 |
| <b>Chemistry Minor:</b> |                            |         |                  |
| 1                       | Industrial Chemistry I     | CHM3761 | CHM3611, CHM3612 |
| 1                       | Inorganic Chemistry II     | CHM3701 | CHM3611, MAT3512 |
| 1                       | Analytical Chemistry II    | CHM3721 | CHM3602          |
| 1                       | Organic Chemistry II       | CHM3711 | CHM3612          |

| Semester                | Module Name             | Codes   | Pre- Requisites                   |
|-------------------------|-------------------------|---------|-----------------------------------|
| 2                       | Biochemistry IV         | CHB3712 | CHB3612, MBL3631                  |
| 2                       | Research Methodology    | CHM3722 | All second year chemistry modules |
| 2                       | Medical Biochemistry    | CHB3732 | CHB3612                           |
| <b>Chemistry Minor:</b> |                         |         |                                   |
| 2                       | Instrumental Analysis I | CHM3702 | CHM3602, CHM3612                  |
| 2                       | Physical Chemistry II   | CHM3712 | CHM3631, MAT3611, MAT3612         |

**Year 4**

| Semester                            | Module Name                     | Codes   | Pre- Requisites                  |
|-------------------------------------|---------------------------------|---------|----------------------------------|
| 1                                   | Nutritional Biochemistry        | CHB3801 | CHB3612, CHM3702                 |
| 1                                   | Natural Product Chemistry I     | CHB3821 | CHM3711                          |
| 1                                   | Bioinformatics for Biochemistry | CHB3831 | CHB3612, MBL3631                 |
| 1                                   | Physical Inorganic Chemistry    | CHM3841 | CHM3701                          |
| 1                                   | Research Projects               | CHB3810 | All third year chemistry modules |
| <b>Chemistry Minor: No offering</b> |                                 |         |                                  |



| Semester                            | Module Name                           | Codes   | Pre- Requisites                  |
|-------------------------------------|---------------------------------------|---------|----------------------------------|
| 2                                   | Professional Training in Biochemistry | CHB3832 | CHB3712, MBL3632                 |
| 2                                   | Environmental Biochemistry            | CHB3812 | CHB3702                          |
| 2                                   | Natural Product Chemistry II          | CHB3822 | CHM3711                          |
| 2                                   | Advanced Topics in Biochemistry       | CHB3852 | All third year chemistry modules |
| 2                                   | Research Projects                     | CHB3810 | All third year chemistry modules |
| <b>Chemistry Minor: No offering</b> |                                       |         |                                  |

## E.1.2. B.S.C. (HONOURS) CHEMISTRY AND BIOCHEMISTRY CURRICULUM MODULE DESCRIPTIONS

### FIRST YEAR MODULES

#### CHM3511 CHEMISTRY 1A

|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | Chemistry 1A  |
| <b>Code:</b>               | CHM3511   |
| <b>NQF Level:</b>          | 5   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 75 %, laboratory component 15 %, tutorial assignments 10%). Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)  |
| <b>Prerequisites:</b>      | Faculty Entry Requirements  |
| <b>Module Description:</b> | This module is a brief introduction to general chemistry and it lays the foundation of basic facts necessary for further studies in chemistry. The following topics are covered:  |
| <b>Content:</b>            | An Introduction To Chemistry: Classification of Matter; The Three States of Matter; Physical and Chemical Properties of Matter; Measurement; Handling Numbers (scientific notation, significant figures); Factor-Label Method in Solving Problems. Atoms, Molecules and Ions: The Structure of the Atom; Atomic Number, Mass Number, and Isotopes; Molecules and Ions; Chemical Formulas (molecular and empirical); Naming Compounds. Mass Relationships in Chemical Reactions: Atomic Mass; Avogadro's Number and Molar mass; Molecular Mass; Percent Composition of Compounds; Experimental Determination of Empirical Formulas; Chemical Reactions and Chemical Equations; Stoichiometry (amounts of reactants and products); Limiting & Excess Reagents; Reaction Yield; Concentration of Solutions. Reactions in Aqueous Solutions: General Properties of Aqueous Solutions; Precipitation Reactions; Acid-Base Reactions; Oxidation and Reduction Reactions (assigning oxidation states, writing redox equations, balancing redox reactions). Quantum Theory and the Electronic Structure of Atoms: The Photoelectric Effect; Bohr's Theory of the Hydrogen Atom; Quantum Numbers; Atomic Orbitals; Electron Configuration; The Building-up Principle. Periodic Relationships Among Elements: Periodic Classification of the Elements; Periodic Variation in Physical Properties (effective nuclear charge, atomic radius, ionic radius); Ionization Energy; Electron Affinity; Variation in Chemical Properties of the Representative Elements (main group elements). Chemical Bonding: Lewis Dot Symbols; Ionic Bonding; Covalent Bonding; Metallic Bonding; Electronegativity; Writing Lewis Structures; Formal Charge; Concept of Resonance; Bond Enthalpy. Basic Molecular Geometry and Hybridization of Atomic Orbitals: Molecular Geometry; Dipole Moments; Valence Bond Theory; Hybridization of Atomic Orbitals; Molecular Orbital Theory; Molecular Orbital Configurations. |

#### CHM3512 CHEMISTRY 1B

|                            |  |
|----------------------------|--|
| <b>Module Title:</b>       | <b>CHEMISTRY 1B</b>  |
| <b>Code:</b>               | <b>CHM3512</b>   |
| <b>NQF Level:</b>          | 5  |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 75%, laboratory component 15%, tutorial assignments 10%)<br>Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)   |
| <b>Prerequisites:</b>      | Faculty Entry Requirements   |
| <b>Module Description:</b> | This module is a continuation of Chemistry 1A and it introduces the students to properties of gases, thermochemistry, chemical kinetics, chemical equilibrium, Introduction to laws of thermodynamics, electrochemistry and organic chemistry. The following topics are covered:   |
| <b>Content:</b>            | Gases: Pressure of a Gas; The Gas Laws; The Ideal Gas Equation; Gas Stoichiometry; The Kinetic-Molecular Theory of Gases; Deviation from Ideal Behaviour. Basic Thermochemistry: The Nature of Energy and Types of Energy; Energy Changes in Chemical Reactions; Introduction to Thermodynamics; Enthalpy of Chemical Reactions; Calorimetry; Standard Enthalpy of Formation and Reaction; Heat of Solution and Dilution. Introductory Chemical Kinetics: Rate of Reaction; Rate Law; Relation between Reactant Concentration and Time; Activation Energy and Temperature Dependence of Rate Constants; Reaction Mechanisms; Catalysis. Introduction to Chemical Equilibrium: The Equilibrium Constant; Writing Equilibrium Constant Expressions; Relationship between Chemical Kinetics and Chemical Equilibrium; What Does the Equilibrium Constant tell Us? Factors that Affect Chemical Equilibrium. Acid-Base Equilibria & Solubility Equilibria: The Common Ion Effect; Buffer Solution; Acid – Base Titrations; Acid-Base Indicators; Solubility Equilibria; Separation of Ions by Fractional Precipitation; The Common Effect and Solubility; pH and Solubility; Complex Ion Equilibria and Solubility. Entropy, Free Energy and Equilibrium: The Three Laws of Thermodynamics; Spontaneous Processes; Entropy; The Second Law of Thermodynamics; Gibbs Free Energy; Free Energy and Chemical Equilibrium; Thermodynamics in Living Systems. Introduction to Electrochemistry: Galvanic Cells; Standard Reduction Potentials; Spontaneity of Redox Reactions; Effect of Concentration of Cell EMF; Electrolysis. Introduction to Organic Chemistry: Classes of Organic Compounds; Structure and Nomenclature Main Functional Groups (alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids, esters, amines, amides). Introduction to carbohydrates, lipids and porphyrins. |

THE FOLLOWING SERVICE MODULE IS OFFERED FOR AGRICULTURE AND ENVIRONMENTAL BIOLOGY STUDENTS ONLY.

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### CHM3532 CHEMISTRY FOR LIFE SCIENCES

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>CHEMISTRY FOR LIFE SCIENCES</b>  |
| <b>Code:</b>               | <b>CHM3532</b>  |
| <b>NQF Level:</b>          | 5   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks.   |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 75%, laboratory component 15%, tutorial assignments 10%)<br>Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)  |
| <b>Pre-requisites:</b>     | Faculty Entry Requirements  |
| <b>Module Description:</b> | This module is designed for students that have insufficient background in chemistry and for non-chemistry majors. It is an introduction to topics in general and organic chemistry, and biochemistry. The following will be covered:<br><b>Content:</b> Classification of Matter: Mixtures and Pure substances; Physical States of Matter; Physical and Chemical Properties. Extensive and Intensive properties. Measurements: Units, Significant figures; Precision and Accuracy, Factor Label Method. Atomic structure and the Periodic table; Electron configuration; Physical and Chemical properties as predicted from groups. Ionic compounds and Molecular compounds: Writing chemical formulae and naming of ionic and molecular compounds. Average Atomic Mass. The Mole Concept; Percent Composition, Empirical formula and Molecular formula. Stoichiometry: limiting reagent, percent yield. Solutions: electrolytes and non-electrolytes, aqueous solutions, ionic equations; concentrations: percent concentration; molarity, molality; dilution of solutions; structure and solubility. Types of bonds; Lewis structures; Resonance structures; Molecular geometry: the VSEPR model, Polarity of molecules. Acid-base equilibrium: properties of acids and bases; relations of acids and bases, self ionisation of water; strengths of acids and bases; the pH scale; hydrolysis of salts; buffers; acid-base titration. Introduction to organic chemistry: organic compounds; structural formulae and conformations; functional groups; Classes of hydrocarbons: alkanes, cycloalkanes: alkanes; alkenes and alkynes; oxidation and reduction; addition reactions; stereo-isomerism. Alcohols, phenols, thiols, ethers: organic compounds of oxygen; common alcohols and phenols. Carboxylic acids and esters, amines and amides: Introduction to carbohydrates, lipids and porphyrins. |

### SECOND YEAR MODULES

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### CHM3611 INORGANIC CHEMISTRY I

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|                            |  |
|----------------------------|--|
| <b>Module Title:</b>       | <b>INORGANIC CHEMISTRY I</b>   |
| <b>Code:</b>               | <b>CHM3611</b>   |
| <b>NQF level:</b>          | 6  |
| <b>Contact hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests and assignments 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> (1 x 3 hour exam paper)   |
| <b>Prerequisite:</b>       | <b>CHM3511</b> (Chemistry 1A), <b>CHM3512</b> (Chemistry 1B)   |
| <b>Module Description:</b> | 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.<br><b>Content:</b> Atomic parameters:- radii, ionization energy, electronegativity, and electron affinity; In-depth studies of chemical bonding; (valence bond theory (VBT), shapes of molecules and hybridization; molecular orbital theory (MOT) in diatomic and polyatomic molecules); Delocalized multiple bonding. S-block elements: The chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides; Brief introduction to the organometallic chemistry of s-block elements with emphasis on organometallic chemistry of lithium and magnesium; Brief introduction to d-block chemistry: Occurrence, recovery and common oxidation states and compounds. |

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**CHM3631 PHYSICAL CHEMISTRY I**

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|                            |  |
|----------------------------|--|
| <b>Module title:</b>       | <b>PHYSICAL CHEMISTRY I</b>  |
| <b>Code:</b>               | <b>CHM3631</b>   |
| <b>NQF Level:</b>          | 6  |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks.  |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)   |
| <b>Pre-requisites:</b>     | <b>CHM3511</b> (Chemistry 1A), <b>CHM3512</b> (Chemistry 1B), <b>MAT3511</b> (Basic Mathematics), <b>MAT3512</b> (Precalculus)   |
| <b>Module Description:</b> | The course deals with equilibrium thermodynamics for chemistry majors and minors. Laws of thermodynamics are treated in a more rigorous way and applied to chemical problems. The following topics are covered:<br><b>Content:</b> Empirical gas laws. The perfect gas. The Kinetic model of gases. Real Gases: Molecular interaction, The van der Waals equation. The principle of corresponding states. The First Law of Thermodynamics. Work, heat, and energy, The internal energy, Expansion Work, Heat transactions, Enthalpy, Adiabatic Changes. Thermochemistry. Standard enthalpy changes, Standard enthalpies of formation, The temperature-dependence of reaction enthalpies. State functions and exact differentials, Exact and inexact differentials, Changes in internal energy, The Joule-Thompson effect. The Second Law of Thermodynamics. The direction of spontaneous change and The dispersal of energy, Entropy, Canot Cycle, Entropy changes accompanying specific processes, The Third Law of thermodynamics, The Helmholtz and Gibbs energies, Standard reaction Gibbs energies. Combining the First and Second Laws of Thermodynamics, The properties of internal energy, The properties of Gibbs energy. Physical Transformations of Pure Substances. Phase diagrams, The stabilities of phases, Phase boundaries, The thermodynamics criterion of equilibrium, The location of phase boundaries, Ehrenfest classification of phase transitions. Simple Mixtures. The thermodynamic description of mixtures, Partial molar quantities, The thermodynamics of mixing, The chemical potentials of liquids. The properties of solutions, Liquid mixtures, Colligative Properties. Two-component systems: Vapour pressure diagrams, Temperature-composition diagrams, Liquid-liquid phase diagrams, Liquid-solid phase diagrams. Chemical equilibrium. The Gibbs energy minimum. The description of equilibrium, The response of equilibria to pressure and temperature. |

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**CHB3611 BIOCHEMISTRY I**

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>BIOCHEMISTRY I</b>   |
| <b>Code:</b>               | <b>CHB3611</b>  |
| <b>NQF Level:</b>          | 6   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests and assignments 80%, laboratory component 20%,)<br>Final Exam: <b>50%</b> (1 x 3 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHM3511</b> (Chemistry 1A, and <b>CHM3512</b> (Chemistry 1B) and <b>BLG3511</b> (Introduction to Biology)  |
| <b>Module Description:</b> | This module forms the basis for further studies in biochemistry. The following topics are covered:<br><b>Content:</b> Chemical bonds in Biochemistry; Composition and structure of biochemicals; Biochemical reactions in aqueous solutions; Energy and biochemical reactions; Application of stereoisomers and chirality in biochemical systems; In-depth studies of Carbohydrates: classification and configurations; glycosides; and reactions; Lipids: classification; terpenes and steroids; fatty acids; triacylglycerols; glycerophospholipids and glycosphingolipids; Active and passive transport of ions; Biominerallization; metabolism and activation; occurrence and function of essential elements; Proteins: structure of amino acids, structure of proteins; physical and chemical properties; ionisation; folding and conformation; Introduction to Enzymes: nomenclature; proteins as catalysts; kinetics measurements; factors influencing enzyme-catalysed reactions. |

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**CHM3602 ANALYTICAL CHEMISTRY I**

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>ANALYTICAL CHEMISTRY I</b>   |
| <b>Code:</b>               | <b>CHM3602</b>  |
| <b>NQF Level:</b>          | 6   |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks   |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 2 hour exam paper)  |
| <b>Prerequisites:</b>      | <b>CHM3511</b> (Chemistry 1A), <b>CHM3512</b> (Chemistry 1B)  |
| <b>Module Description:</b> | This module provides general introduction to sampling and evaluation of analytical data. It deals in depth with analytical tools like titrimetric analysis, gravimetric analysis and it gives basic information about spectroscopic methods of analysis.<br><b>Content:</b> Review of some fundamental concepts; sampling and sample preparation; expressions of concentration and content; evaluation of analytical data; measures of accuracy and precision; random and systematic errors; aqueous equilibria; mass and charge balance equations and their use in solving multiple ion and complex ion equilibria; principles of titrimetry; acid-base titrations; titration curves and indicators; polyprotic acid-base equilibria, applications of acid-base titrations; gravimetric methods of analysis; solubility and solubility product; common ion and diverse ion effects; precipitation titrations; indicators used in precipitation titrations. |

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**CHM3612 ORGANIC CHEMISTRY I**

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**Module Title:** ORGANIC CHEMISTRY I  
**Code:** CHM3612  
**NQF Level:** 6  
**Contact Hours:** 4 lecture periods per week and 1 practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** CA: **50%** (minimum 3 tests 80%, laboratory component 20%)  
Final Exam: **50%**; (1 x 3 hour exam paper)

**Prerequisites:** CHM3511 (Chemistry IA), CHM3512 (Chemistry IB)

**Module Description:** This module is a survey of the chemistry of carbon compounds, their nomenclature, physical properties, structure and reactions with an introduction to reaction mechanisms and stereochemistry. The following topics will be covered.

**Content:** Alkanes and cycloalkanes: nomenclature, physical properties, bond rotation, conformations, ring strain, bicyclic and polycyclic alkanes, reactions and synthesis of alkanes. Alkenes and alkynes: Properties and synthesis, hydrogenation, index of hydrogen deficiency, preparation, addition reactions, Markovnikov's rule, hydroboration, Radical reactions: free radicals, halogenation of alkanes, chain reactions. Alcohols and ethers: synthesis, reactions, mesylates and tosylates, epoxides, crown ethers, phase transfer catalysis. Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, racemates, meso compounds, optical activity, resolution. Nucleophilic substitution and elimination: nucleophiles and electrophiles, SN2 and SN1 reactions; carbocations and carbanions, E1 and E2 reactions.

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**CHB3612 BIOCHEMISTRY II**

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**Module Title:** BIOCHEMISTRY II  
**Code:** CHM3612  
**NQF Level:** 6  
**Contact Hours:** 4 lecture periods per week and 1 practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** CA: **50%** (minimum 3 tests 80%, laboratory component 20%,  
Final Exam: **50%** (1 x 3 hour exam paper)

**Prerequisites:** CHM3511 (Chemistry 1A, and CHM3512 (Chemistry 1B) and BLG3511 (Introduction to Biology)

**Module Description:** This module introduces the students to glycogen and amino acids metabolism, fat catabolism, synthesis of lipids, citric acid cycle. The following topics are covered:

**Content:** Metabolism: catabolism and anabolism pathways; glycolysis; gluconeogenesis; glyoxylate cycle, regulation of central metabolism. Glycogen metabolism: (structure and function, synthesis and degradation, and storage). Lipid synthesis and transport: fatty acids and triglycerol; biosynthesis; bile acids; complex lipids; prostaglandins and related compounds; phospholipids and glycolipids. Citric acid cycle: stoichiometry and regulation; hexose monophosphate pathways. Fat catabolism: digestion and absorption. Amino Acids metabolism: digestion of dietary proteins; transport of amino acids into cells; removal of nitrogen from amino acids; urea cycle; metabolism of ammonia; catabolism of the carbon skeletons of amino acids; role of folic acid in amino acid metabolism, biosynthesis of non essential amino acids.

**THE FOLLOWING SERVICE MODULE IS OFFERED FOR EDUCATION STUDENTS ONLY.**

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**CHE3622 ORGANIC CHEMISTRY FOR EDUCATORS (FOR EDUCATION STUDENTS ONLY!)**

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**Module Title:** ORGANIC CHEMISTRY FOR EDUCATORS  
**Code:** CHE3622  
**NQF Level:** 6  
**Contact Hours:** 28 hours lectures, 21 hours of practical sessions  
**Credits:** 8  
**Module Assessment:** CA:**50%** (minimum 2 tests 80%, laboratory component 20%) Final Exam:**50%**; (1 x 2 hour exam paper)

**Prerequisites:** CHM3511 (Chemistry IA), CHM3512 (Chemistry IB)

**Module Description:** This module is a survey of the chemistry of carbon compounds, their nomenclature, physical properties, structure and reactions with an introduction to reaction mechanisms and stereochemistry. The following topics will be covered.

**Content:** Alkanes and cycloalkanes: nomenclature, physical properties, bond rotation, conformations, ring strain, bicyclic and polycyclic alkanes, synthesis and reactions of alkanes; Alkenes and alkynes: physical properties and synthesis (Zaytev's Rule), addition reactions (hydrogenations, halogenations, hydrations), Markovnikov's Rule, index of hydrogen deficiency; Ionic reactions: nucleophilic substitutions, elimination reactions; Radical reactions: free radicals, halogenation of alkanes, chain reactions; Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, meso compounds, optical activity. Alkyl halides: physical properties, synthesis, reactions; Alcohols and ethers: physical properties, synthesis, reactions.

### THIRD YEAR MODULES

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#### CHM3701 INORGANIC CHEMISTRY II

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>INORGANIC CHEMISTRY II</b>   |
| <b>Code:</b>               | <b>CHM3701</b>  |
| <b>NQF Level:</b>          | 7   |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks   |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%) Final Exam: <b>50%</b> (1 x 2 hour exam paper)   |
| <b>Prerequisite:</b>       | <b>CHM3611</b> (Inorganic Chemistry I), <b>MAT3512</b> (Precalculus)  |
| <b>Module Description:</b> | This course covers the chemistry of transition metals. This means the student would have been equipped with adequate background from the chemistry of main group elements. With such a background the student will be in a position to follow the chemistry of transition metals.   |
| <b>Content:</b>            | Transition metal chemistry: transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Bonding-Application of Valence Bond Theory (VBT); Crystal Field Theory (CFT); Ligand Field Theory (LFT). Molecular Orbital Theory (MOT); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes; Molecular symmetry: symmetry elements; plane of symmetry; proper and improper axes; principal axis; point of inversion ; classification of molecules into point groups. |

THE FOLLOWING SERVICE MODULE IS OFFERED FOR EDUCATION STUDENTS ONLY.

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#### CHE3732 INORGANIC CHEMISTRY FOR EDUCATORS (FOR EDUCATION STUDENTS ONLY)

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>INORGANIC CHEMISTRY FOR EDUCATORS</b>  |
| <b>Code:</b>               | <b>CHE3732</b>  |
| <b>NQF Level:</b>          | 7   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%) Final Exam: 50% (1 x 3 hour exam paper)  |
| <b>Prerequisite:</b>       | <b>CHM3511</b> (Chemistry IA), <b>CHM3512</b> (Chemistry IB)  |
| <b>Module Description:</b> | This course covers the chemistry of transition metals. This means the student would have been equipped with adequate background from the chemistry of main group elements. With such a background the student will be in a position to follow the chemistry of transition metals.   |
| <b>Content:</b>            | The brief introduction to the chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides. Delocalized multiple bonding. S-block elements. In-depth studies of chemical bonding (valence bond theory (VBT), shapes of molecules and hybridization, molecular orbital theory (MOT) in diatomic and polyatomic molecules) and Bonding-Application of VBT; CFT; LFT, MOT; Introduction to transition metal chemistry (d-block elements): transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes; Molecular symmetry: symmetry elements; plane of symmetry; proper and improper axes; principal axis; point of inversion ; classification of molecules into point groups. Introduction to the organometallic chemistry of s-block elements (magnesium and lithium). |

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#### CHM3711 ORGANIC CHEMISTRY II

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| <b>Module Title:</b>       | <b>ORGANIC CHEMISTRY II</b>   |
| <b>Code:</b>               | <b>CHM3711</b>  |
| <b>NQF Level:</b>          | 7   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%) Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHM3612</b> (Organic Chemistry I)  |
| <b>Module Description:</b> | This module is a continuation of Organic Chemistry I. Units covered include an in-depth study of the following topics show below.   |
| <b>Content:</b>            | Conjugated systems: allyl radical and allyl cation, alkenes and polyunsaturated hydrocarbons, 1, 2- and 1,4-addition, Diels-Alder reaction. Aromatic compounds: Hückel's rule, aromatic-, antiaromatic-, nonaromatic-classification; annulenes, fullerenes, nanotubes. Heterocyclic compounds. Electrophilic aromatic substitution: halogenation of benzene, nitration, sulfonation, Friedel-Crafts-alkylations and acylations. Aldehydes and ketones: synthesis; addition to carbon-oxygen double bond, hydride, hydrogen cyanide, alcohols, derivatives of ammonia; Wittig reaction. Tautomers, enolates, aldol reactions, aldol condensation. Protecting and blocking groups. Retrosynthetic analysis. |

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**CHM3721 ANALYTICAL CHEMISTRY II**

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| <b>Module Title:</b>       | <b>ANALYTICAL CHEMISTRY II</b>  |
| <b>Code:</b>               | <b>CHM3721</b>  |
| <b>NQF Level:</b>          | 7   |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks.  |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80 %, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHM3602</b> (Analytical Chemistry I)   |
| <b>Module Description:</b> | This module introduces the students to EDTA titrations and provides detain information about voltaic cells, redox titrations and potentiometric methods of analysis.  |
| <b>Content:</b>            | Complexometric and EDTA titrations; oxidation reduction, oxidation states and balancing redox equations, the half cell concept; voltaic cells and the Nernst equation; redox titrations and redox titration curves; applications of redox titrimetry. Potentiometric methods; Coulometry and electrogravimetry. |

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**CHB3701 BIOCHEMISTRY III**

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| <b>Module Title:</b>       | <b>BIOCHEMISTRY III</b>   |
| <b>Code:</b>               | <b>CHB3701</b>  |
| <b>NQF Level:</b>          | 7   |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks   |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%),<br>Final Exam: <b>50%</b> (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHB3612</b> (Biochemistry II), <b>MBL3631</b> (Cell Molecular Biology & Genetics)  |
| <b>Module Description:</b> | This module is designed to teach the students the biochemistry of Nucleic acids. The following topics are covered:  |
| <b>Content:</b>            | Expression and transmission of genetic information: Nucleic acids structure and functions; chemical modification of nucleotides and nucleic acids; Primary, secondary and tertiary of DNA and RNA (different types and its synthesis control of transcription, processing) and sequence induced conformation types, gene expression and protein synthesis. Sequence based analysis and functional regions and genome analysis; Fidelity of DNA replication; Translation: Genetic code; transfer RNA and its aminoacylation; Protein degradation. Exploring genes, manipulating the genes of Eukaryotes; Hybridization of nucleic acid strands, process of thermodynamics and kinetics, nucleic acids binding proteins, enzymology of gene manipulation. |

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**CHM3761 INDUSTRIAL CHEMISTRY I**

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| <b>Module Title:</b>       | <b>INDUSTRIAL CHEMISTRY I</b>  |
| <b>Code:</b>               | <b>CHM3761</b>   |
| <b>NQF Level:</b>          | 7  |
| <b>Contact hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks  |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%);<br>Final Exam <b>50%</b> (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | Inorganic Chemistry I ( <b>CHM3611</b> ), Organic Chemistry I ( <b>CHM3612</b> )   |
| <b>Module Description:</b> | This module introduces the processes and technologies in industrial chemistry, the techniques of treatment and control of pollution, and technological economics in chemical industry. The following topics are covered  |
| <b>Content:</b>            | Sources of chemical industry: inorganic chemicals, organic chemicals from biomass, coke, natural gas, crude oil. The world's major chemical industries: introduce the major companies and products. Environmental pollution control: the techniques of pollution control including physic, chemical and biological methods. Material and energy balance: equations of balances. Technological economics: cost and profit of producing processes, effects of scale and flow rate of operation. Oil and fat industry: structure, isolation, additives, applications. Coatings industry: composition, pigments, binders, solvents. Soap and domestic industry: soap, surfactant, detergent. Leather industry: softening, evaluating effects of fat in leather. Flavor industry: vehicles, fixatives, synthetics used in perfume and flavors; perfume formation. Pharmaceutical industry: type of drugs, antibacterial agents, steroids, analgesics, antihistamines. Meat industry, fish industry; dairy industry: prepared and preserved products. Biotechnology industry: beer, cheese. Sulfuric acid and fertilizer industry: manufacture of sulfuric acid and fertilizer. Salt industry: manufacture of caustic. Uranium industry: extraction, concentration and purification of uranium. Cement industry: the compositions and manufacture of cement, processes in the solidification cement. |

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**CHM3702 INSTRUMENTAL ANALYSIS I**

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| <b>Module Title:</b>       | <b>INSTRUMENTAL ANALYSIS I</b>  |
| <b>Code:</b>               | <b>CHM3702</b>  |
| <b>NQF Level:</b>          | 7   |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks   |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 2 hour exam paper)  |
| <b>Prerequisites:</b>      | <b>CHM3602</b> (Analytical Chemistry I), <b>CHM3612</b> (Organic Chemistry I)   |
| <b>Module Description:</b> | This module provides general introduction to flame emission and atomic absorption spectrometry. It provides the students with the necessary information to analyze NMR, mass spectrometry and infrared data.  |
| <b>Content:</b>            | Instrumental methods of analysis; Flame emission and atomic absorption spectrometry; ICP; X-ray methods; Molecular fluorescence and phosphorescence; NMR spectroscopy; theory and experimental methods of NMR spectroscopy; applications of proton and C-13 NMR spectroscopy. Mass spectrometry; ultraviolet; Infrared absorption spectroscopy; Theory and applications of IR and Raman spectroscopy. |

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**CHM3712 PHYSICAL CHEMISTRY II**

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| <b>Module title:</b>       | <b>PHYSICAL CHEMISTRY II</b>  |
| <b>Code:</b>               | <b>CHM3712</b>  |
| <b>NQF level:</b>          | 7   |
| <b>Contact hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> (1 x 3 hour exam paper)  |
| <b>Pre-requisites:</b>     | <b>CHM3631</b> (Physical Chemistry I), <b>MAT3611</b> (Calculus I), <b>MAT3612</b> (Calculus II)  |
| <b>Module Description:</b> | The course is for chemistry major students. It deals with chemical kinetics, chemical dynamics, equilibrium electrochemistry, dynamic electrochemistry, molecular interactions and processes at the solid surfaces. The following topics are covered:   |
| <b>Content:</b>            | Chemical kinetics: Rate and rate law. Order and molecularity. Integrated rate equations and half-life expressions for 0, 1, 2, 3 and nth order reactions. Pseudo-order reactions. Kinetics of radioactive decay and carbon dating. Methods of determining order and rate coefficient. Temperature dependence of rate coefficients (Arrhenius equation). Complex reactions – parallel, opposing, consecutive and chain reactions. Mechanisms. Theories of reaction rates – unimolecular and bimolecular reactions. Activated complex. Effect of catalyst. Experimental methods for studying slow and fast reactions. Electrochemistry: Definitions and units relating to electricity. Ohm's law. Faraday's laws of electrolysis. Definition and measurement of conductivity and molar conductivity. Strong/weak electrolytes. Arrhenius theory. van't Hoff measurements. Ostwald dilution law. Kohlrausch's law of independent migration. Ionic mobilities and transport numbers. Applications of conductivity measurements – dissociation constant, solubilities and solubility products of sparingly soluble salts, conductometric titrations. Thermodynamics of electrolyte solutions. Electrochemical cells and electrode processes. Fuel cells. Photovoltaics (as renewable energy technology). Overpotential. Corrosion. Thermodynamics of electrochemical cells, Surface chemistry and colloids: Chemical, biological and medicinal applications of colloids. Surface tension and interfacial tension, Spreading of one liquid on another. Insoluble monolayer films and their application in water evaporation control. Detergency. Formation and stability of emulsions, Adsorption and absorption isotherms, Langmuir, Freundlich, BET and Tempkin adsorption equations, Chermisorption and heterogeneous catalysis–Langmuir-Hinshelwood and Eley-Rideal mechanisms. |

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**CHM3722 RESEARCH METHODOLOGY**

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| <b>Module Title:</b>       | <b>RESEARCH METHODOLOGY</b>  |
| <b>Code:</b>               | <b>CHM3722</b>   |
| <b>NQF Level:</b>          | 8  |
| <b>Contact Hours:</b>      | 2 lecture periods per week   |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests and assignments) Final Exam <b>50%</b> . (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | Pass in all second year chemistry modules  |
| <b>Module description:</b> | This module is designed to provide students with knowledge of theoretical aspects of scientific principles that are followed in order to conduct research, analyze and interpret data, and communicate scientific results properly.  |
| <b>Content:</b>            | Ethics of Research; The scientific method: Logic and scientific, natural observations, asking questions and formulation of hypotheses, Predictions, Types of hypotheses (null, alternative, research); Chemostatics Topics: Handling experimental data; Processing and reporting; Significant tests; Analysis of variants (ANOVA); Regression analysis; Validation of experimental data (quality control); Experimental design; Optimization of parameters; Use of existing literature; Using the internet and the university library; Report Writing; Oral presentation using state-of-the-art equipment; Ethical considerations in research; Plagiarism; Finding and using literature references; Citation of references; Writing a literature review; Presenting results as posters |

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**CHB3732 MEDICAL BIOCHEMISTRY**

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| <b>Module Title:</b>       | <b>MEDICAL BIOCHEMISTRY</b>  |
| <b>Code:</b>               | <b>CHB3732</b>   |
| <b>NQF Level:</b>          | 7  |
| <b>Contact hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%) Final Exam: <b>50%</b> (1 x 3 hour exam paper)  |
| <b>Prerequisites:</b>      | <b>CHB3612</b> (Biochemistry II)   |
| <b>Module Description:</b> | This module is designed for students that are considering a career in research into the biochemical basis of disease and therapeutic medicine. It discusses some of the current developments in the area of medical biochemistry. The following topics are covered:  |
| <b>Content:</b>            | 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. |

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**CHB3712 BIOCHEMISTRY IV**

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| <b>Module Title:</b>       | <b>BIOCHEMISTRY IV</b>   |
| <b>Code:</b>               | <b>CHB3712</b>   |
| <b>NQF Level:</b>          | 7  |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80 %, laboratory component 20 %)<br>Final Exam: <b>50%</b> (1 x 3 hour exam paper)           |
| <b>Prerequisites:</b>      | <b>CHB3612</b> (Biochemistry II), <b>MBL3631</b> (Cell Molecular Biology & Genetics)   |
| <b>Module Description:</b> | This module is designed to deepen the knowledge of inheritance and, biochemical evolution. The following topics are covered: |

**Content:** In depth discussion of inheritance in eukaryotes; Biochemistry and the Genomic Revolution: Studying the relationship between form and function through DNA. Biochemical unity as a basis for biological diversity; Biochemical Evolution: How organic molecules are utilized by living systems; Energy transformations necessary for sustaining living systems; Cells and their response to changes in the environment; Novel Proteins which can be engineered by site specific mutagenesis; Immunobiochemistry: Synthesis of plasma membrane; secretory pathways and lysosomal proteins; interaction between antigens and antibodies; control of the immune response. Protein separation and analytical techniques (chromatography, electrophoresis, protein and enzyme activity determination).

**FOURTH YEAR MODULES**

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**CHM3811 ORGANIC CHEMISTRY III**

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| <b>Module Title:</b>       | <b>ORGANIC CHEMISTRY III</b>   |
| <b>Code:</b>               | <b>CHM3811</b>   |
| <b>NQF Level:</b>          | 8  |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, 20% laboratory component)<br>Final Exam: <b>50%</b> ; (1 x 3 hour exam paper) |
| <b>Prerequisites:</b>      | <b>CHM3711</b> (Organic Chemistry II)  |
| <b>Module Description:</b> | This module is a description of Carboxylic acids and their derivatives and various rearrangement reactions.        |

**Content:** Carboxylic acids and their derivatives: acids, acyl chlorides, acid anhydrides, esters, lactones, amides and imides, lactams. Amines: preparations, reactions, Hofmann and Cope elimination reactions. Phenols. Organo-sulfur compounds. Rearrangement reactions: Baeyer-Villiger, Beckmann, pinacol-pinacolone. Pericyclic reactions: electrocyclic and cycloaddition reactions; sigmatropic rearrangements. Chemistry of carbohydrates. Selected examples of multistep synthesis of organic compounds.

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**CHM3831 PHYSICAL CHEMISTRY III**

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| <b>Module title:</b>       | <b>PHYSICAL CHEMISTRY III</b>   |
| <b>Code:</b>               | <b>CHM3831</b>  |
| <b>NQF Level:</b>          | 8   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests, tutorial tests and assignments 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)                                      |
| <b>Pre-requisites:</b>     | <b>CHM3631</b> (Physical Chemistry I), <b>MAT3612</b> (Calculus II)   |
| <b>Module Description:</b> | It introduces topics in quantum mechanics with applications to chemical systems. The second part of the course deals with statistical thermodynamics. The following topics are covered: |

**Content:** Quantum Chemistry: Classical mechanics and failure; Quantization of energy; Wave and particle nature of light and electrons; Experimental evidence of diffraction of the light and electrons and photoelectric effect; de Broglie relationship; Electromagnetic radiation and the electromagnetic spectrum; Spectrum of the hydrogen atom; Operators; Schrödinger wave equation and its solution; Interpretation of the wave function; Wave functions for (1) particle-in-a-box: application to conjugated systems and (2) simple harmonic oscillator as model of vibrating molecule; Postulates of quantum mechanics; Operators; Eigenvalues; Zero point energy; Vibrational - Infrared and Raman spectroscopy; Electronic spectroscopy of atoms and molecules; Electron spin resonance spectroscopy; Nuclear magnetic resonance; Photoelectron spectroscopy. Statistical Thermodynamics: The distribution of molecular states, configuration and weights, the Boltzmann distribution; the molecular partition function; the internal energy and entropy, the canonical partition function; the thermodynamic function and the molecular partition function; using statistical thermodynamics (mean energies, heat capacities, equations of state, residual entropies and equilibrium constants). Translational, rotational, vibrational and electronic partition functions.



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**CHM3841 PHYSICAL INORGANIC CHEMISTRY**

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|----------------------------|---|
| <b>Module Title:</b>       | <b>PHYSICAL INORGANIC CHEMISTRY</b>   |
| <b>Code:</b>               | <b>CHM 3841</b>   |
| <b>NQF Level:</b>          | 8   |
| <b>Contact hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks   |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%),<br>Final Exam: <b>50%</b> (1 x 2 hour exam paper)   |
| <b>Prerequisite:</b>       | <b>CHM3701</b> (Inorganic Chemistry II)   |
| <b>Module Description:</b> | This course applies simple concepts of group theory to molecular geometry. Certain aspects of vibrational and electronic properties of molecules can be deduced from the molecular geometry using simple group theory concepts. |

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

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**CHM3801 INSTRUMENTAL ANALYSIS II**

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| <b>Module Title:</b>       | <b>INSTRUMENTAL ANALYSIS II</b>  |
| <b>Code:</b>               | <b>CHM3801</b>   |
| <b>NQF Level:</b>          | 8  |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks  |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHM3702</b> (Instrumental Analysis I)   |
| <b>Module Description:</b> | This module is designed to teach the students about different methods of separation, provide enough information about different types of chromatography with emphasis on high performance liquid chromatography (HPLC). The module also provides information about advanced NMR and 2-dimensional NMR. |

**Content:** Separation methods; fractional processes; solvent extraction; introduction to chromatographic methods of separation; general description of chromatography. GC, GLC, LC, TLC, HPLC; supercritical fluid chromatography; important relationships from chromatography; qualitative and quantitative analysis by chromatography; gas chromatography; principles of gas-liquid chromatography; high performance liquid chromatography, column efficiency and chromatographic mobile phases; partition chromatography; adsorption chromatography ion-exchange chromatography; size exclusion chromatography; planar chromatography; different types of detectors used in chromatographic separations; solid phase extraction (SPE) method; Advanced NMR: Fourier Transformation in NMR, 1-dimensional NMR, DEPT, NOE, 2 dimensional NMR, theory, experimental methods and interpretation of spectra, 1H-1H COSY, HETCOR, NOESY.

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**CHB3801 NUTRITIONAL BIOCHEMISTRY**

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|----------------------------|---|
| <b>Module Title:</b>       | <b>NUTRITIONAL BIOCHEMISTRY</b>   |
| <b>Code:</b>               | <b>CHB3801</b>  |
| <b>NQF Level:</b>          | 8   |
| <b>Contact hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks   |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> (1 x 2 hour exam paper)          |
| <b>Prerequisites:</b>      | <b>CHB3612</b> (Biochemistry II), <b>MBL3632</b> (Introduction to Microbiology)   |
| <b>Module Description:</b> | This module is designed to enhance the students' knowledge of nutrition and metabolism. The following topics are covered: |

**Content:** Biochemistry and Nutrition (proximate of nutrients, function of water, vitamins and minerals); Food groups and how these are linked to Digestion and Absorption; Nutrition and Metabolism; Link between food and health (A case study in connectivity among metabolic pathways, nutrition, regulation and immune system); Concept of energy, specific dynamic action, basal metabolism, measurement of food stuff, caloric value of protein.

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**CHB3821 NATURAL PRODUCT CHEMISTRY I**

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| <b>Module Title:</b>       | <b>NATURAL PRODUCT CHEMISTRY I</b>   |
| <b>Code:</b>               | <b>CHB3821</b>   |
| <b>NQF Level:</b>          | 8  |
| <b>Contact Hours:</b>      | 2 lecture periods per week and 1 practical session per week for 7 weeks.   |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHM3711</b> (Organic Chemistry II)  |
| <b>Module Description:</b> | This module explores the basic biosynthesis pathway of secondary metabolites. We will learn how natural products are normally classified according to their biosynthetic origins and chemical properties. A special emphasis will be placed on how chemical structure affects the physiological function of various natural products. The following will be covered. |

**Content:** Distinguishing primary and secondary metabolites; NMR techniques in biosynthesis studies (<sup>13</sup>C NMR, Isotopic incorporation). Polyketide pathway: Fatty acids, cyclization of polyketides to aromatics, skeletal types of polyketides. The shikimic acid pathway: biosynthesis of shikimic acid and aromatic amino acids, phenylpropanoid metabolism, other metabolites from shikimate pathway. Isoprenoids: biosynthesis of mevalonic acids, monoterpenes, sesquiterpenes, diterpenes, sesterterpenes, triterpenes, tetraterpenes and steroids.

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**CHB3831 BIOINFORMATICS FOR BIOCHEMISTRY**

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**Module Title:** BIOINFORMATICS FOR BIOCHEMISTRY  
**Code:** CHB3831  
**NQF Level:** 8  
**Contact hours:** 4 lecture periods per week and 1 practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** CA: **50%** (minimum 3 tests 80%, laboratory component 20%)  
Final Exam: **50%** (1 x 3 hour exam paper)

**Prerequisites:** **CHB3612** (Biochemistry II), **MBL3631** (Cell Molecular Biology and Genetics),

**Module Description:** The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and interactive course in which students will acquire knowledge on information networks, the world wide web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed. The information retrieval and analysis tools such as sequence similarity and alignment will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. The module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences. The course will consist of lectures, student presentations and assignments.

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**CHM3810 RESEARCH PROJECTS (FOR CHEMISTRY MAJORS ONLY)**

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**Module Title:** RESEARCH PROJECT  
**Code:** CHM3810  
**NQF Level:** 8  
**Contact Hours:** Research project for one year.  
**Credits:** 32  
**Module Assessment:** CA: **100%** (Oral presentation of results – 30%, Consultation and efforts shown during the year- 20 %; written research report - 50%)

**Prerequisites:** Pass in all third year chemistry modules and at least one statistics module

**Module description:** This module is designed to provide students with knowledge of theoretical aspects of scientific principles that are followed in order to conduct research, analyze and interpret data, and communicate scientific results properly.

**Content:** An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The 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 oral examination.

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**CHB3810 RESEARCH PROJECTS (FOR BIOCHEMISTRY MAJORS ONLY)**

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**Module Title:** RESEARCH PROJECT  
**Code:** CHB3810  
**NQF Level:** 8  
**Contact Hours:** Research project for one year.  
**Credits:** 32  
**Module Assessment:** CA: **100%** (Oral presentation of results – 30%, Consultation and efforts shown during the year- 20 %; written research report - 50%)

**Prerequisites:** Pass in all third year chemistry modules and at least one statistics module

**Module description:** This module is designed to provide students with knowledge of theoretical aspects of scientific principles that are followed in order to conduct research, analyze and interpret data, and communicate scientific results properly.

**Content:** An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The 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 oral examination.

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**CHM3802 INORGANIC CHEMISTRY III**

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**Module Title:** INORGANIC CHEMISTRY III  
**Code:** CHM3802  
**NQF level:** 8  
**Contact hours:** 2 lecture periods per week and 1 practical session per week for 7 weeks.  
**Credits:** 8  
**Module Assessment:** CA: **50%** (minimum 2 tests 80%, laboratory component 20%,  
Final Exam: **50%** (1 x 2 hour exam paper)

**Prerequisite:** **CHM3701** (Inorganic chemistry II), **CHM3711** (Organic chemistry II)

**Module Description:** This course deals with the organometallic chemistry which is a hybrid discipline comprising the knowledge of inorganic and organic chemistry.

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

THE FOLLOWING SERVICE MODULE IS OFFERED FOR EDUCATION STUDENTS ONLY.

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**CHE3862 INORGANIC CHEMISTRY III (FOR EDUCATION STUDENTS ONLY)**

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| <b>Module Title:</b>       | <b>INORGANIC CHEMISTRY III (FOR EDUCATION STUDENTS ONLY)</b>   |
| <b>Code:</b>               | <b>CHE3862</b>   |
| <b>NQF level:</b>          | 8  |
| <b>Contact hours:</b>      | 28 hours lectures, 21 hours practical sessions.  |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 2 tests 80%, laboratory component 20%, Final Exam: <b>50%</b> (1 x 2 hour exam paper))   |
| <b>Prerequisite:</b>       | <b>CHE3732</b> (Inorganic Chemistry for Educators)   |
| <b>Module Description:</b> | This course deals with the organometallic chemistry which is a hybrid discipline comprising the knowledge of inorganic and organic chemistry.  |
| <b>Content:</b>            | Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds. Chemistry of f-block elements; Nuclear Chemistry. |

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**CHM3812 INDUSTRIAL CHEMISTRY II**

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| <b>Module Title:</b>       | <b>INDUSTRIAL CHEMISTRY II</b>   |
| <b>CODE:</b>               | <b>CHM3812</b>   |
| <b>NQF Level:</b>          | 8  |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%); Final exam <b>50%</b> (1 x 3 hours exam paper)   |
| <b>Prerequisites:</b>      | Physical Chemistry II ( <b>CHM3712</b> ); Industrial Chemistry I ( <b>CHM3761</b> )  |
| <b>Module Description:</b> | This module introduces the principles of fluid flow, heat exchange, distillation and their applications. The students will be able to calculate and analyse the equipments in chemical industry.   |
| <b>Content:</b>            | 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. |

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**CHB3812 ENVIRONMENTAL BIOCHEMISTRY**

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|----------------------------|---|
| <b>Module Title:</b>       | <b>ENVIRONMENTAL BIOCHEMISTRY</b>   |
| <b>Code:</b>               | <b>CHB3812</b>  |
| <b>NQF Level:</b>          | 8   |
| <b>Contact hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests 80%, laboratory component 20%),<br>Final Exam: <b>50%</b> (1 x 2 hour exam paper)   |
| <b>Prerequisites:</b>      | <b>CHB3712</b> (Biochemistry IV)  |
| <b>Module Description:</b> | This module is designed to study the interactions between environmental contaminants and living organisms. It looks at the behaviour of xenobiotics into living organisms particularly the biotransformation reactions and reactive species formation and it also looks at the effects that chemical xenobiotics can cause on biological processes.   |
| <b>Content:</b>            | Chemical Xenobiotics: classification and behaviours. Bioaccumulation and biomagnification of xenobiotics. Behaviour of xenobiotics into living organisms: absorption, distribution, biotransformation, toxic effects and elimination. The fate and impact of synthetic and natural molecules in the environment. Important pollutants will be used as case studies to illustrate the principles. Principles of toxicology; chemical and biochemical mechanism; pesticide toxicity. Analysis of specific health and environmental impact of hazardous waste. |

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**CHM3832 MOLECULAR SPECTROSCOPY**

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|----------------------------|---|
| <b>Module title:</b>       | <b>MOLECULAR SPECTROSCOPY</b>   |
| <b>Code:</b>               | <b>CHM3832</b>  |
| <b>NQF Level:</b>          | 8   |
| <b>Contact Hours:</b>      | 4 lecture periods per week and 1 practical session per week for 14 weeks  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | CA: <b>50%</b> (minimum 3 tests, tutorial tests and assignments 80%, laboratory component 20%)<br>Final Exam: <b>50%</b> ; (1 x 3 hour exam paper)  |
| <b>Pre-requisites:</b>     | <b>CHM3631</b> (Physical Chemistry I), <b>MAT3612</b> (Calculus II)   |
| <b>Module Description:</b> | This course is designed for chemistry majors who preferably have taken Physical Chemistry III (CHM 3831). The course is a theoretical approach to molecular spectroscopy using quantum mechanics:   |
| <b>Content:</b>            | Brief review of matrix algebra, group theory and quantum chemistry. Polarization and the Clausius_Mosotti relation: induced polarization (nonpolar molecules), orientation polarization (polar molecules), distortion polarization in an alternating field. The Time-Dependent Schroedinger Equation. The Einstein Absorption and Emission Coefficients. Magnetic dipole and electric quadrupole transitions. Spectral line widths. Theoretical treatment of microwave spectroscopy and molecular rotation: applications to diatomic and polyatomic molecules. Theoretical treatment of infrared and Raman spectroscopy and molecular vibration: applications to diatomic and polyatomic molecules. Theoretical treatment of UV-visible spectroscopy and molecular electronic energy levels: applications to diatomic and polyatomic molecules. Nonlinear |

optics. Production of excited states. Radiation processes: fluorescence, phosphorescence, kinetics, quantum yields and lifetimes. Radiationless processes: the statistical limit, the resonance limit and the intermediate case.

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### CHB3822 NATURAL PRODUCT CHEMISTRY II

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**Module Title:** NATURAL PRODUCT CHEMISTRY II  
**Code:** CHB3822  
**NQF Level:** 8  
**Contact Hours:** 2 lecture periods per week and 1 practical session per week for 7 weeks  
**Credits:** 8  
**Module Assessment:** CA: **50%** (minimum 2 tests 80%, laboratory component 20%)  
Final Exam: **50%**; (1 x 2 hour exam paper)

**Prerequisites:** CHM3711 (Organic Chemistry II)

**Module Description:** This is the continuation of natural products chemistry I. In this module, the student will be provided with sound knowledge on principles and techniques involved in the extraction and isolation of chemical constituents from natural sources and how to determine their structures

**Content:** Alkaloids; alkaloids derived from ornithine and lysine, alkaloids derived from tyrosine, alkaloids derived from tryptophan. Metabolites of mixed biosynthetic origin: metabolites derived from acetate and mevalonate; metabolites derived from shikimate and mevalonate; metabolites derived from acetate and shikimate; and metabolites derived from tryptophan and mevalonate. Isolation of natural products: Chemical screening of different classes/groups of natural products; Bioassay-directed isolation of natural products; (use of different bioassay and chromatographic techniques). Determining the chemical structure of isolated compounds: Techniques; IR, UV, NMR and mass spectroscopy (very brief theoretical treatment, but detailed application of these techniques in structure determination).

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### CHB3832 PROFESSIONAL TRAINING IN BIOCHEMISTRY

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**Module Title:** Professional Training in Biochemistry  
**Code:** CHB3832  
**NQF Level:** 8  
**Contact hours:** 4 lecture periods per week and 2 weeks full-time practical in-service training in industry during recess period if possible or one practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** CA: **50%** (minimum 3 tests 80%, laboratory component 20%, assignments 10 %) Final Exam: **50%** (1 x 3 hour exam paper)

**Prerequisites:** CHB3712 (Biochemistry IV), MBL3632 (Introduction to Microbiology)

**Module Description:** This module is designed to expose the students to the application of biochemistry in the industries. The course will be jointly delivered by academics and professionals in the selected fields. Method of delivery will include seminars, workshops and job attachments. Following topics under each profession will be covered. However, delivery of some topics will depend on the availability of expertise in a specific field. It covers the following topics:

**Pharmacology:** Careers in Pharmacology, the kinetics of drug-receptor interaction, drug metabolism, pharmacokinetics and molecular pharmacology. **Forensic science:** Careers in forensic science, History and Nature of Forensic Science, Crime Scene Investigation, Biological Evidence, Forensic DNA Analysis, Illicit Drugs; Forensic Toxicology. **Oncology:** Careers in oncology, biochemical and molecular basis of cancer, multistage nature of cancer, including the roles of the environment and somatic mutation, Explore the known genetic mechanisms leading to cancer, Discuss approaches to targeted therapies for different cancers. **Toxicology:** Careers in toxicology, Methods in isolating, identifying and quantifying toxic substances or radiation; assessing toxicity and creating safety profiles, Safe handling of toxic substances and radiation, risk assessments on potential new drugs. **Pathology:** Careers in pathology, scientific investigation of the biology of human disease, 'Genes and the cell in health and disease' and 'Infection, Inflammation and immunity, Histochemistry, Immunocytochemistry. **Brewing science:** Brewing technologies, Quality control and management. **Veterinary Science:** Animal diseases, Food hygiene, Best practices in veterinary science.

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### CHM3842 ADVANCED TOPICS IN CHEMISTRY

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**Module Title:** ADVANCED TOPICS IN CHEMISTRY  
**Code:** CHM3842  
**NQF Level:** 8  
**Contact Hours:** 2 lecture periods per week for 14 weeks  
**Credits:** 8  
**Module Assessment:** CA: **50%** ; Final Exam **50%**.

**Prerequisites:** Pass in all third year chemistry modules

**Module Description:** The course reviews aspects of advanced developments in the field of Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Biotechnology and Biochemistry, which relate to the interests of the students. Only two topics are covered every year. Topics to be covered include:

**Content:** Waste Water Treatment: Water quality parameters; Drinking water processing; Primary chemical processes involved in water treatment for example, Chlorination and Ozonation; Biological wastewater treatment; Chemical wastewater treatment. Electronic Structure Calculations: Z-matrix for simple molecules; Spin multiplicities for any system; basis sets with regards to electronic structure calculations; The number of functions and primitives employed for a given molecule in electronic structure. Natural Product Chemistry: Introduction & History of Natural Product Research; Discovery and development of drugs from natural resources. Chemical characterization of pharmacologically active compounds from plants. Agricultural Biotechnology and Nanotechnology: The science behind biotechnology: Scope; Principles and techniques of agricultural biotechnology (genetic engineering). Technology Studies: Risk assessment; Pesticide producing crops; Herbicide-tolerant transgenic crops; Insect-resistance transgenic crops. Environmental and food safety of transgenic crops; Ethical and cultural issues in biotechnology; cloning and tissue engineering; Patenting Life; Surveying of Methods and Uses of Animal Biotechnology. Considerations regarding animal biotechnology; human safety; animal welfare; and sociological effects. Scope, principles and techniques of nanotechnology; preparation of nano particles and their properties, application of nanotechnology in biotechnology. Principles of bioethics and biolaw: ethics; philosophy; law

issues in relation to biosciences; Regulation of human tissue and stem cells; International environmental law; Intellectual property law and the biosciences.

Sustainable Renewable Energy: Desirable characteristics of energy sources; Current and potential energy sources. Solar energy: How solar energy can be converted to other forms of energy; Principles of using solar energy for space heating; Discuss the methods for converting solar energy into electricity; Converting solar energy into electricity Inorganic Chemistry: Explain the basic features of electronic spectra of transition metal complexes. Industrial Chemistry: Petroleum refinement: petroleum separation and cracking.

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### CHB3852 ADVANCED TOPICS IN BIOCHEMISTRY

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**Module Title:** ADVANCED TOPICS IN BIOCHEMISTRY

**Code:** CHB3852

**NQF Level:** 8

**Contact Hours:** 4 lecture periods per week and 1 practical session per week for 14 weeks

**Credits:** 16

**Module Assessment:** CA: **50 %** (minimum 3 tests 80%, 42 hours practical sessions 20%)

Final Exam: **50 %** (1 x 3 hour exam paper)

**Prerequisites:** All third year biochemistry modules

**Module Description:** The course reviews aspects of advanced developments in the field of Biotechnology and Biochemistry, which relate to the interests of the students. Topics to be covered include:

**Content:** Criminology, Crime Detection and Investigation, Enforcement, Substantive Criminal Aspects, Human Behaviour, Criminal and Delinquent Behaviour, Introduction to Research Methods in Criminology, Environmental Chemistry, Introduction to Archaeology and Anthropological fieldwork, Textiles Evaluation, Crime Scene Investigation, Crime Scene Analysis using modern techniques, DNA Fingerprints, Shoe and lip prints, Forensic DNA profiling, Chromatography techniques, ELISA techniques, Sequencing, Molecular markers, Micro-arrays, Method validations.

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### E.1.3 DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY: MODULES EQUIVALENCES

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| Old Curriculum Module Failed (up to 2007) | Equivalent Module To Be Taken (from 2008)                        |
|---|--|
| CHM3101 Chemistry IA                      | CHM3511 & CHM3511 Chemistry IA                                   |
| CHM3112 Chemistry IB                      | CHM3512 Chemistry IB   |
| CHM3192 Chemistry For Life Sciences       | CHM3532 Chemistry For Life Sciences                              |
| CHM3211 Inorganic Chemistry I             | CHM3611 Inorganic Chemistry I                                    |
| CHM3261 Physical Chemistry I              | CHM3631 Physical Chemistry I                                     |
| CHM3361 Biochemistry I                    | CHB3611 Biochemistry I   |
| CHM3242 Analytical Chemistry I            | CHM3602 Analytical Chemistry I                                   |
| CHM3232 Organic Chemistry I               | CHM3612 Organic Chemistry I                                      |
| CHM3362 Biochemistry II                   | CHB3612 Biochemistry II  |
| CHM3381 Inorganic Chemistry II            | CHM3701 Inorganic Chemistry II                                   |
| CHM3321 Organic Chemistry II              | CHM3711 Organic Chemistry II                                     |
| CHM3341 Analytical Chemistry II           | CHM3721 Analytical Chemistry II                                  |
| CHM3472 Industrial Chemistry I            | CHM3761 Industrial Chemistry I                                   |
| CHM3342 Instrumental Analysis I           | CHM3702 Instrumental Analysis I                                  |
| CHM3332 Physical Chemistry II             | CHM3712 Physical Chemistry II                                    |
| CHM3421 Organic Chemistry III             | CHM3811 Organic Chemistry III                                    |
| CHM3461 Physical Chemistry III            | CHM3831 Physical Chemistry III                                   |
| CHM3441 Instrumental Analysis II          | CHM3801 Instrumental Analysis II                                 |
| CHM3480 Research Projects                 | CHM3810 or CHB3810(for Biochemistry majors)<br>Research Projects |
| CHM3422 Inorganic Chemistry III           | CHM3802 Inorganic Chemistry III                                  |
| CHM3442 Advanced Topics                   | CHM3842 Advanced Topics in Chemistry                             |

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## **F. DEPARTMENT OF COMPUTER SCIENCE**

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### **F.1. DEPARTMENTAL REGULATIONS**

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#### **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 Information Technology (IT) Programme (11MSci) is based on a pool of taught courses and the completion of a dissertation.

#### **COMPILATION OF THE CA MARK**

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

#### **WEIGHTING OF CA AND EXAM MARKS**

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

## F.2. COMPUTER SCIENCE MAJOR

### F.2.1. BACHELOR OF SCIENCE (HONOURS) MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

#### QUALIFICATION: B.Sc. (Honours) Computer Science Major and Information Technology Minor (11BCMI)

Students opting for a major in **Computer Science** (with minor in Information Technology) must take all of the following modules:

#### YEAR 1

| SEMESTER                             | MODULE NAME                            | CODE     | PRE-/COREQUISITES             |
|--------------------------------------|--|----------|-------------------------------|
| 1                                    | English Communication & Study Skills   | LCE3519  | University entry requirements |
| 1                                    | Basic Mathematics                      | MAT3511  | Faculty entry requirements    |
| 1                                    | Computer Literacy                      | CLC3509  | University entry requirements |
| 1                                    | Programming Fundamentals I             | CMP 3511 | Departmental Entry Test       |
| 1                                    | Fundamentals of Digital Electronics    | CMP 3521 | Departmental Entry Test       |
| <b>Information Technology Minor:</b> |  |          |                               |
| 1                                    | Introduction to Information Technology | CME3511  | Departmental Entry Test       |

| SEMESTER                             | MODULE NAME                   | CODE    | PRE-/COREQUISITES                  |
|--------------------------------------|-------------------------------|---------|------------------------------------|
| 2                                    | English for Academic Purposes | LEA3519 | Co-requisite: LCE3519              |
| 2                                    | Contemporary Social Issues    | CSI3529 | University Entry Requirements      |
| 2                                    | Programming Fundamentals II   | CMP3512 | CMP3511 Programming Fundamentals I |
| 2                                    | Computer Organization         | CMP3532 | Departmental Entry Test            |
| 2                                    | Introduction to Statistics    | STS3522 | Faculty entry requirements         |
| <b>Information Technology Minor:</b> |                               |         |                                    |
| 2                                    | Introduction to Web Design    | CME3512 | Departmental Entry Test            |

#### YEAR 2

| SEMESTER                             | MODULE NAME                        | CODE    | PRE-/COREQUISITES                           |
|--------------------------------------|------------------------------------|---------|---|
| 1                                    | Introduction to Database Systems   | CMP3611 | CMP3511 Programming Fundamentals I          |
| 1                                    | Object Oriented Programming        | CMP3631 | CMP3511 Programming Fundamentals I          |
| 1                                    | Software Engineering I             | CMP3641 | CMP3511 Programming Fundamentals I          |
| 1                                    | Mathematics for Computer Science I | CMP3671 | MAT3511 Basic Mathematics                   |
| <b>Information Technology Minor:</b> |                                    |         |   |
| 1                                    | Telecommunications                 | CME3611 | CMP3521 Fundamentals of Digital Electronics |

| SEMESTER                             | MODULE NAME                          | CODE    | PRE-/COREQUISITES  |
|--------------------------------------|--------------------------------------|---------|--|
| 2                                    | Advanced Databases                   | CMP3622 | Co-Requisite: CMP3611 Introduction to Database Systems                                     |
| 2                                    | Data Structures and Algorithms       | CMP3612 | Co-Requisite: CMP3631 Object Oriented Programming  |
| 2                                    | Foundations of Data Communications   | CMP3632 | CMP 3532 Computer Organization   |
| 2                                    | Software Engineering II              | CMP3652 | Co-Requisite: CMP3641 Software Engineering I   |
| 2                                    | Mathematics for Computer Science II  | CMP3672 | Co-Requisite: CMP3671 Mathematics for Computer Science I                                   |
| <b>Information Technology Minor:</b> |                                      |         |  |
| 2                                    | Networking and Emerging Technologies | CME3612 | CME3511 Introduction to Information Technology<br>Co-Requisite: CME3611 Telecommunications |

#### YEAR 3

| SEMESTER                             | MODULE NAME                      | CODE    | PRE-/COREQUISITES  |
|--------------------------------------|----------------------------------|---------|--|
| 1                                    | Computer Networks                | CMP3721 | CMP3632 Foundations of Data Communications                                     |
| 1                                    | Computer Theory                  | CMP3741 | CMP3672 Mathematics for Computer Science II                                    |
| 1                                    | Computer Architecture            | CMP3761 | CMP3532 Computer Organization<br>CMP3521 Fundamentals of Digital Electronics   |
| 1                                    | Artificial Intelligence          | CMP3771 | CMP3511 Programming Fundamentals I   |
|                                      | Research Methodology I           | CMP3701 | STS3522 Introduction to Statistics <b>OR</b><br>STS3531 Descriptive Statistics |
| <b>Information Technology Minor:</b> |                                  |         |  |
| 1                                    | Introduction to Network Security | CME3731 | CME3612 Networking and Emerging Technologies                                   |

| SEMESTER                             | MODULE NAME                                    | CODE    | PRE-/COREQUISITES   |
|--------------------------------------|--|---------|---|
| 2                                    | Operating Systems                              | CMP3722 | CMP 3532 Computer Organization<br><b>OR</b> CMP 3612 Data Structures and Algorithms |
| 2                                    | Human Computer Interaction and Computer Ethics | CMP3742 | CMP 3652 Software Engineering II  |
| 2                                    | Computer Graphics                              | CMP3762 | CMP 3612 Data Structures and Algorithms   |
| 2                                    | Internet Technologies and Applications         | CMP3712 | Co-Requisite: CMP 3721 Computer Networks  |
| 2                                    | Research Methodology II                        | CMP3702 | Co-Requisite: CMP 3701 Research Methodology I                                       |
| <b>Information Technology Minor:</b> |  |         |   |
| 2                                    | Advanced Web Programming                       | CME3732 | CME 3512 Introduction to Web Design<br>CMP 3512 Programming Fundamentals II         |

#### YEAR 4

| SEMESTER  | MODULE NAME                     | CODE    | PRE-/COREQUISITES  |
|---|---------------------------------|---------|--|
| 1   | Research Project                | CMP3810 | Pass all Third Year Modules  |
| 1   | Network Systems Security        | CMP3821 | CMP 3721 Computer Networks   |
| 1   | Wireless and Mobile Computing   | CMP3841 | CMP 3721 Computer Networks   |
| <b>Choose Any Two Full Modules (Subject to Dept Approval)</b> |                                 |         |  |
| 1   | Software Project Management     | CMP3819 | CMP 3742 Human computer Interaction and Computer Ethics  |
| 1   | Numerical Methods               | CMP3811 | CMP 3672 Mathematics for Computer Science II<br><b>OR</b> CEEM3672 Intermediate Mathematical Economics |
| 1   | Operations Research             | CMP3831 | CMP3672 Mathematics for Computer Science II<br><b>OR</b> EEM3672 Intermediate Mathematical Economics   |
| 1   | Distributed Systems             | CMP3851 | CMP3721 Computer Networks<br>CMP3612 Data Structures and Algorithms                                    |
| 1   | Advanced Computer System Design | CMP3871 | CMP3532 Computer Organization<br>CMP3761 Computer Architecture   |

| SEMESTER  | MODULE NAME                                   | CODE    | PRE-/COREQUISITES   |
|---|---|---------|---|
| 2   | Research Project                              | CMP3810 | Pass all Third Year Modules                                       |
| 2   | Field Attachment                              | CMP3802 | Pass all Third Year Modules                                       |
| 2   | Data Warehousing and Data Mining              | CMP3822 | CMP3622 Advanced Databases  |
| <b>Choose Any Two Full Modules (Subject to Dept Approval)</b> |   |         |   |
| 2   | Digital Libraries                             | CMP3839 | CMP3622 Advanced Databases  |
| 2   | Network Administration                        | CMP3882 | CMP3721 Computer Networks<br>CMP3722 Operating Systems            |
| 2   | Real Time Multimedia                          | CMP3812 | CMP3742 Human computer Interaction and Computer Ethics            |
| 2   | Entrepreneurship and Management of IT Systems | CMP3832 | CMP3742 Human computer Interaction and Computer Ethics            |
| 2   | Database Programming                          | CMP3872 | CMP3512 Programming Fundamentals II<br>CMP3622 Advanced Databases |
| 2   | Expert Systems                                | CMP3852 | CMP3771 Artificial Intelligence                                   |



**F.2.2. B.SC. (HONOURS) COMPUTER SCIENCE MAJOR AND AND MATHEMATICS MINOR (11BCMM)**

Students opting for a major in **Computer Science** (with minor in Mathematics) must take all of the following modules:

**YEAR 1**

| SEMESTER | MODULE NAME                                       | CODE    | PRE-/COREQUISITES             |
|----------|---|---------|-------------------------------|
| 1        | English Communication & Study Skills              | LCE3519 | University entry requirements |
| 1        | Basic Mathematics                                 | MAT3511 | Faculty entry requirements    |
| 1        | Computer Literacy                                 | CLC3509 | University entry requirements |
| 1        | Programming Fundamentals I                        | CMP3511 | Departmental Entry Test       |
| 1        | Fundamentals of Digital Electronics               | CMP3521 | Departmental Entry Test       |
| 1        | Analytical Geometry, Complex Numbers and Matrices | MAT3531 | Faculty entry requirements    |

| SEMESTER | MODULE NAME                   | CODE    | PRE-/COREQUISITES                  |
|----------|-------------------------------|---------|------------------------------------|
| 2        | English for Academic Purposes | LEA3519 | Co-requisite: LCE3519              |
| 2        | Contemporary Social Issues    | CSI3529 | University Entry Requirements      |
| 2        | Programming Fundamentals II   | CMP3512 | CMP3511 Programming Fundamentals I |
| 2        | Computer Organization         | CMP3532 | Departmental Entry Test            |
| 2        | Introduction to Statistics    | STS3522 | Faculty entry requirements         |
| 2        | Pre-calculus                  | MAT3512 | Faculty entry requirements         |

**YEAR 2**

| SEMESTER | MODULE NAME                         | CODE    | PRE-/COREQUISITES  |
|----------|-------------------------------------|---------|--|
| 1        | Introduction to Database Systems    | CMP3611 | CMP3511 Programming Fundamentals I                       |
| 1        | Object Oriented Programming         | CMP3631 | CMP3511 Programming Fundamentals I                       |
| 1        | Software Engineering I              | CMP3641 | CMP3511 Programming Fundamentals I                       |
| 1        | Mathematics for Computer Science I  | CMP3671 | MAT3511 Basic Mathematics                                |
| 1        | Sets and Numbers                    | MAT3601 | Any two full modules of first year mathematics           |
| 1        | Numerical Methods                   | MAT3621 | Any two full modules of first year mathematics           |
| SEMESTER | MODULE NAME                         | CODE    | PRE-/COREQUISITES  |
| 2        | Advanced Databases                  | CMP3622 | Co-Requisite: CMP3611 Introduction to Database Systems   |
| 2        | Data Structures and Algorithms      | CMP3612 | Co-Requisite: CMP3631 Object Oriented Programming        |
| 2        | Foundations of Data Communications  | CMP3632 | CMP3532 Computer Organization                            |
| 2        | Software Engineering II             | CMP3652 | Co-Requisite: CMP3641 Software Engineering I             |
| 2        | Mathematics for Computer Science II | CMP3672 | Co-Requisite: CMP3671 Mathematics for Computer Science I |
| 2        | Elementary Linear Algebra           | MAT3652 | Any two full modules of first year Mathematics           |

**YEAR 3**

| SEMESTER | MODULE NAME             | CODE    | PRE-/COREQUISITES  |
|----------|-------------------------|---------|--|
| 1        | Computer Networks       | CMP3721 | CMP3632 Foundations of Data Communications                                     |
| 1        | Computer Theory         | CMP3741 | CMP3672 Mathematics for Computer Science II                                    |
| 1        | Computer Architecture   | CMP3761 | CMP3532 Computer Organization<br>CMP3521 Fundamentals of Digital Electronics   |
| 1        | Artificial Intelligence | CMP3771 | CMP3511 Programming Fundamentals I   |
| 1        | Research Methodology I  | CMP3701 | STS3522 Introduction to Statistics <b>OR</b><br>STS3531 Descriptive Statistics |
| 1        | Linear Algebra I        | MAT3711 | MAT3601 Sets and Numbers<br>MAT3652 Elementary Linear Algebra                  |

| SEMESTER | MODULE NAME                                    | CODE    | PRE-/COREQUISITES  |
|----------|--|---------|--|
| 2        | Operating Systems                              | CMP3722 | CMP3532 Computer Organization<br>OR CMP3612 Data Structures and Algorithms |
| 2        | Human Computer Interaction and Computer Ethics | CMP3742 | CMP3652 Software Engineering II  |
| 2        | Computer Graphics                              | CMP3762 | CMP3612 Data Structures and Algorithms                                     |
| 2        | Internet Technologies and Applications         | CMP3712 | Co-Requisite: CMP3721 Computer Networks                                    |
| 2        | Research Methodology II                        | CMP3702 | Co-Requisite: CMP3701 Research Methodology I                               |
| 2        | Linear Algebra II                              | MAT3712 | MAT3601 Sets and Numbers<br>MAT3652 Elementary Linear Algebra              |

#### YEAR 4

| SEMESTER  | MODULE NAME                     | CODE    | PRE-/COREQUISITES  |
|---|---------------------------------|---------|--|
| 1   | Research Project                | CMP3810 | Pass all Third Year Modules  |
| 1   | Network Systems Security        | CMP3821 | CMP 3721 Computer Networks   |
| 1   | Wireless and Mobile Computing   | CMP3841 | CMP 3721 Computer Networks   |
| <b>Choose Any Two Full Modules (Subject to Dept Approval)</b> |                                 |         |  |
| 1   | Software Project Management     | CMP3819 | CMP 3742 Human computer Interaction and Computer Ethics  |
| 1   | Numerical Methods               | CMP3811 | CMP 3672 Mathematics for Computer Science II<br>OR CEEM 3672 Intermediate Mathematical Economics |
| 1   | Operations Research             | CMP3831 | CMP 3672 Mathematics for Computer Science II<br>OR CEEM 3672 Intermediate Mathematical Economics |
| 1   | Distributed Systems             | CMP3851 | CMP 3721 Computer Networks<br>CMP 3612 Data Structures and Algorithms                            |
| 1   | Advanced Computer System Design | CMP3871 | CMP 3532 Computer Organization<br>CMP 3761 Computer Architecture                                 |

| SEMESTER   | MODULE NAME                                   | CODE    | PRE-/COREQUISITES   |
|--|---|---------|---|
| 2  | Research Project                              | CMP3810 | Pass all Third Year Modules   |
| 2  | Field Attachment                              | CMP3802 | Pass all Third Year Modules   |
| 2  | Data Warehousing and Data Mining              | CMP3822 | CMP 3622 Advanced Databases   |
| <b>Choose Any Two Modules (Subject to Dept Approval)</b> |   |         |   |
| 2  | Digital Libraries                             | CMP3839 | CMP 3622 Advanced Databases   |
| 2  | Network Administration                        | CMP3882 | CMP 3721 Computer Networks<br>CMP 3722 Operating Systems            |
| 2  | Real Time Multimedia                          | CMP3812 | CMP 3742 Human computer Interaction and Computer Ethics             |
| 2  | Entrepreneurship and Management of IT Systems | CMP3832 | CMP 3742 Human computer Interaction and Computer Ethics             |
| 2  | Database Programming                          | CMP3872 | CMP 3512 Programming Fundamentals II<br>CMP 3622 Advanced Databases |
| 2  | Expert Systems                                | CMP3852 | CMP 3771 Artificial Intelligence                                    |

### F.2.3. B.SC. (HONOURS)COMPUTER SCIENCE MAJOR AND AND STATISTICS MINOR (11BCMS)

Students opting for a major in **Computer Science** (with minor in Statistics) must take all of the following modules:

#### YEAR 1

| SEMESTER | MODULE NAME                          | CODE    | PRE-/COREQUISITES             |
|----------|--------------------------------------|---------|-------------------------------|
| 1        | English Communication & Study Skills | LCE3519 | University entry requirements |
| 1        | Basic Mathematics                    | MAT3511 | Faculty entry requirements    |
| 1        | Computer Literacy                    | CLC3509 | University entry requirements |
| 1        | Programming Fundamentals I           | CMP3511 | Departmental Entry Test       |
| 1        | Fundamentals of Digital Electronics  | CMP3521 | Departmental Entry Test       |
| 1        | Descriptive Statistics               | STS3531 | Faculty entry requirements    |

| SEMESTER | MODULE NAME                   | CODE    | PRE-/COREQUISITES                  |
|----------|-------------------------------|---------|------------------------------------|
| 2        | English for Academic Purposes | LEA3519 | Co-requisite: LCE3519              |
| 2        | Contemporary Social Issues    | CSI3529 | University Entry Requirements      |
| 2        | Programming Fundamentals II   | CMP3512 | CMP3511 Programming Fundamentals I |
| 2        | Computer Organization         | CMP3532 | Departmental Entry Test            |
| 2        | Pre-calculus                  | MAT3512 | Faculty entry requirements         |
| 2        | Introduction to Probability   | STS3532 | Faculty entry requirements         |

#### YEAR 2

| SEMESTER | MODULE NAME                        | CODE    | PRE-/COREQUISITES   |
|----------|------------------------------------|---------|---|
| 1        | Introduction to Database Systems   | CMP3611 | CMP3511 Programming Fundamentals I                          |
| 1        | Object Oriented Programming        | CMP3631 | CMP3511 Programming Fundamentals I                          |
| 1        | Software Engineering I             | CMP3641 | CMP3511 Programming Fundamentals I                          |
| 1        | Mathematics for Computer Science I | CMP3671 | MAT3511 Basic Mathematics                                   |
| 1        | Probability Theory                 | STS3611 | STS3532 Introduction to Probability<br>MAT3512 Pre-calculus |

| SEMESTER | MODULE NAME                         | CODE    | PRE-/COREQUISITES  |
|----------|-------------------------------------|---------|--|
| 2        | Advanced Databases                  | CMP3622 | Co-Requisite: CMP3611 Introduction to Database Systems   |
| 2        | Data Structures and Algorithms      | CMP3612 | Co-Requisite: CMP3631 Object Oriented Programming        |
| 2        | Foundations of Data Communications  | CMP3632 | CMP 3532 Computer Organization                           |
| 2        | Software Engineering II             | CMP3652 | Co-Requisite: CMP3641 Software Engineering I             |
| 2        | Mathematics for Computer Science II | CMP3672 | Co-Requisite: CMP3671 Mathematics for Computer Science I |
| 2        | Statistical Inferences              | STS3632 | STS 3532 Introduction to Probability                     |

#### YEAR 3

| SEMESTER | MODULE NAME             | CODE    | PRE-/COREQUISITES  |
|----------|-------------------------|---------|--|
| 1        | Computer Networks       | CMP3721 | CMP 3632 Foundations of Data Communications                                    |
| 1        | Computer Theory         | CMP3741 | CMP3672 Mathematics for Computer Science II                                    |
| 1        | Computer Architecture   | CMP3761 | CMP3532 Computer Organization<br>CMP3521 Fundamentals of Digital Electronics   |
| 1        | Artificial Intelligence | CMP3771 | CMP3511 Programming Fundamentals I   |
| 1        | Research Methodology I  | CMP3701 | STS3522 Introduction to Statistics <b>OR</b><br>STS3531 Descriptive Statistics |
| 1        | Sampling Methods        | STS3731 | STS3531 Descriptive Statistics   |

| SEMESTER | MODULE NAME                                    | CODE    | PRE-/COREQUISITES   |
|----------|--|---------|---|
| 2        | Operating Systems                              | CMP3722 | CMP3532 Computer Organization<br><b>OR</b> CMP3612 Data Structures and Algorithms |
| 2        | Human Computer Interaction and Computer Ethics | CMP3742 | CMP3652 Software Engineering II   |
| 2        | Computer Graphics                              | CMP3762 | CMP3612 Data Structures and Algorithms  |
| 2        | Internet Technologies and Applications         | CMP3712 | Co-Requisite: CMP3721 Computer Networks   |
| 2        | Research Methodology II                        | CMP3702 | Co-Requisite: CMP3701 Research Methodology I                                      |
| 2        | Nonparametric and Categorical Data Analysis    | STS3712 | STS 3632 Statistical Inference  |

**YEAR 4**

| SEMESTER  | MODULE NAME                     | CODE    | PRE-/COREQUISITES  |
|---|---------------------------------|---------|--|
| 1   | Research Project                | CMP3810 | Pass all Third Year Modules  |
| 1   | Network Systems Security        | CMP3821 | CMP3721 Computer Networks  |
| 1   | Wireless and Mobile Computing   | CMP3841 | CMP3721 Computer Networks  |
| <b>Choose Any Two Full Modules (Subject to Dept Approval)</b> |                                 |         |  |
| 1   | Software Project Management     | CMP3819 | CMP3742 Human computer Interaction and Computer Ethics   |
| 1   | Numerical Methods               | CMP3811 | CMP3672 Mathematics for Computer Science II <b>OR</b> EEM 3672 Intermediate Mathematical Economics |
| 1   | Operations Research             | CMP3831 | CMP3672 Mathematics for Computer Science II <b>OR</b> EEM 3672 Intermediate Mathematical Economics |
| 1   | Distributed Systems             | CMP3851 | CMP3721 Computer Networks<br>CMP3612 Data Structures and Algorithms                                |
| 1   | Advanced Computer System Design | CMP3871 | CMP3532 Computer Organization<br>CMP 3761 Computer Architecture                                    |

| SEMESTER   | MODULE NAME                                   | CODE    | PRE-/COREQUISITES   |
|--|---|---------|---|
| 2  | Research Project                              | CMP3810 | Pass all Third Year Modules                                       |
| 2  | Field Attachment                              | CMP3802 | Pass all Third Year Modules                                       |
| 2  | Data Warehousing and Data Mining              | CMP3822 | CMP3622 Advanced Databases  |
| <b>Choose Any Two Modules (Subject to Dept Approval)</b> |   |         |   |
| 2  | Digital Libraries                             | CMP3839 | CMP3622 Advanced Databases  |
| 2  | Network Administration                        | CMP3882 | CMP3721 Computer Networks<br>CMP3722 Operating Systems            |
| 2  | Real Time Multimedia                          | CMP3812 | CMP3742 Human computer Interaction and Computer Ethics            |
| 2  | Entrepreneurship and Management of IT Systems | CMP3832 | CMP 3742 Human computer Interaction and Computer Ethics           |
| 2  | Database Programming                          | CMP3872 | CMP3512 Programming Fundamentals II<br>CMP3622 Advanced Databases |
| 2  | Expert Systems                                | CMP3852 | CMP3771 Artificial Intelligence                                   |

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## F.2.4. B.Sc.(HONOURS) COMPUTER SCIENCE CURRICULUM MODULE DESCRIPTIONS

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### FIRST YEAR MODULES

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#### CLC3509 COMPUTER LITERACY

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**Module title:** COMPUTER LITERACY

**Code:** CLC3509

**NQF level:** 5

**Contact hours:** 1 lecture theory and 1 lecture practical per week for 14 weeks

**Credits:** 8

**Module assessment:** Continuous Assessment **100%:** 2 Practical Tests 50% , 2 Theory Tests 50%

**Prerequisites:** University Entry

**Module description:** The aim of this module is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment.

**Content:** The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

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#### CMP3511 PROGRAMMING FUNDAMENTALS I

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**Module title:** PROGRAMMING FUNDAMENTALS I

**Code:** CMP3511

**NQF level:** 5

**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks

**Credits:** 16

**Module Assessment** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)

Final Examinations **50%**

**Prerequisites:** Departmental Entry Test

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

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#### CMP3521 FUNDAMENTALS OF DIGITAL ELECTRONICS

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**Module title :** FUNDAMENTALS OF DIGITAL ELECTRONICS

**Code:** CMP3521

**NQF level:** 5

**Contact hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks

**Credits:** 8

**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)

Final Examinations **50%**

**Prerequisites:** Departmental Entry Test

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

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**CMP3512 PROGRAMMING FUNDAMENTALS II**

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

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

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**CMP3532 COMPUTER ORGANIZATION**

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**Module title :** COMPUTER ORGANIZATION  
**Code:** CMP3532  
**NQF level:** 5  
**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%**  
**Prerequisites:** Departmental Entry Test

**Module Description :** This module gives a general introduction to digital computer systems. It introduces key terminologies and concepts that give a clear understanding of the computer as a digital computing machine including functional organization, memory categorization and addressing, units of memory measurement, input/output devices, serial and parallel communication. It also introduces the classical Von Neumann Architecture. The following topics will be covered in the module: -Introduction to Computers; Circuit Technology; Binary (Boolean) Algebra; Introduction to Memories; Memory and Registers Instructions; Memory organization; Arithmetic and Logic Instructions; Useful Circuits; Input and Output organization; Control Unit; Bus; Data Representation; a Simple Computer; Addressing Modes; Topics; High-Level Circuit Design; Hardware Elements; Examples of Coding; Exceptions; Subroutines and Macros.

**FIRST YEAR COMPUTER SCIENCE MINOR MODULES**

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**CME3511 INTRODUCTION TO INFORMATION TECHNOLOGY**

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**Module title:** INTRODUCTION TO INFORMATION TECHNOLOGY  
**Code:** CME3511  
**NQF level:** 5  
**Contact hours:** 4 lecture periods/week; 3 hour practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 3 hour examination)  
**Prerequisites:** Departmental entry test

**Module Description:** This module is intended to introduce students to the basic elements of IT. The following topics will be covered: Hardware and software; classification of computers; software applications; Unix operating system; other operating systems e.g. DOS, MAC, Windows, Linux; Introduction to programming – language levels, language samples; hardware fundamentals – CPU, Registers, memory; Spreadsheets; graphics; Databases – MS Access; Input/output devices; Report writing.

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**CME3512 INTRODUCTION TO WEB DESIGN**

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**Module title:** INTRODUCTION TO WEB DESIGN  
**Code:** CME3512  
**NQF level:** 5  
**Contact hours:** 4 lecture periods/week; 3 hour practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 3 hour examination)  
**Prerequisites:** Departmental entry Test

**Module Description:** This module is intended to teach fresh university students the principles behind web design and create a website. The following topical areas will be covered: Basic concepts of web site design using hypertext Mark up language (HTML); Creating Web pages using Ms FrontPage or Macromedia Dream weaver; Introduce Web servers e.g. IIS and Apache; Creating a database with Mysql or Ms-Access; Concepts of Web page/database connectivity using Active Server Pages (ASP) and or PHP; Web Publishing techniques.

## SECOND YEAR MODULES

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### CMP3611 INTRODUCTION TO DATABASE SYSTEMS

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>INTRODUCTION TO DATABASE SYSTEMS</b>  |
| <b>Code:</b>              | <b>CMP3611</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Prerequisites:** **CMP3511** – Programming Fundamentals I

**Module Description:** This module covers material necessary to provide the students with the required skills for working with a variety of database systems. The module will cover the following topics:- Types of databases; Evolution of Database technologies; Database technology versus conventional file-processing systems; The Systems Development Life Cycle (SDLC); The prototyping methodology ;The enterprise data model; Conceptual Data Modeling; Types of entities; ER diagrams; Business rules; Integrity Control Statements; Writing SQL statements; ER Diagram to relation transformation; Functional Dependencies; Normalization and Demoralization.

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### CMP3631 OBJECT ORIENTED PROGRAMMING

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|---------------------------|--|
| <b>Module title:</b>      | <b>OBJECT ORIENTED PROGRAMMING</b>   |
| <b>Code:</b>              | <b>CMP3631</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Prerequisites:** **CMP3511** – Programming Fundamentals I

**Module Description:** This module introduces a student to the Object Oriented paradigm that is widely adopted in modern software design and implementation. The student should demonstrate an in-depth understanding of Object-Oriented concepts and apply these concepts using a selected OOP language like Java or C++ to solve simple to medium sized programming tasks. The module will cover the following topics: - Introduction to OOP, and Java; Objects and classes, understanding class definitions; Object interaction; Grouping objects; More sophisticated behavior - libraries; Well-behaved objects - testing, maintaining, debugging; Designing classes; Well-behaved objects - testing, maintaining, debugging; Designing classes; Inheritance; Polymorphism; Threads; Further abstraction techniques: abstract classes and interfaces; Building Graphical User Interfaces; Handling errors; Designing applications; Networking and Case study.

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### CMP3641 SOFTWARE ENGINEERING I

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>SOFTWARE ENGINEERING I</b>  |
| <b>Code:</b>              | <b>CMP3641</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks                  |
| <b>Credits:</b>           | 8  |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Prerequisites:** **CMP3511** Programming Fundamentals I

**Module Description:** This module is intended to introduce the need, importance and concepts of software Engineering. The module shows how software systems undergo the processes of specification, development, management and evolution. The following topics will be covered:

Definition of Software Engineering; Ethical and professional issues related to Software Engineering; FAQ about Software Engineering; Software process and a software process models; Examples of software process models; Software requirements engineering; Software development; Software testing; Evolution; Software project management; Tasks of software project managers; Why project planning is essential; Graphical representations; Risk management; Fundamentals of software costing and pricing; Metrics for software productivity assessment; Estimating software costs and CHedule; Testing techniques; Testing of component interfaces; Component testing for object oriented systems; Integration testing for object oriented systems; CASE tools; Define Software reuse; Benefits of reusing software components; Problems of reuse; Types of reusable components; Design processes for reuse; Concept of real-time systems; Concurrent processes; Design process for real-time systems; Real-time executive; Monitoring and control systems; Data acquisition systems.

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**CMP3671 MATHEMATICS FOR COMPUTER SCIENCE I**

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|                           |  |
|---------------------------|--|
| <b>Module Title:</b>      | <b>MATHEMATICS FOR COMPUTER SCIENCE I</b>  |
| <b>Code:</b>              | <b>CMP3671</b>   |
| <b>NQF Level:</b>         | 6  |
| <b>Contact Hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Pre-Requisites:** **MAT3511** Basic Mathematics

**Module Description:** This module provides the students with the necessary skills that are essential for the mathematical analysis of problems with emphasis on representation of the mathematical formulation of the problems for solution with the application of the computer. The module provides the beginning student with an initial but practical orientation to mathematics for computing and its basic theorems with a view to applying them to the solution of real life problems. The module will cover the following topics:

Number Systems, Representation Of Numbers In The Computer, Computer Arithmetic, Errors, Computer Codes, Logical Statements And Truth Tables, Predicate Logic, Algorithms, Flowcharts, Pseudocode Programs. Set Theory, Relations, Functions or Mapping, Graphs, Algebraic Structures. Number Theory and Methods of Proof, Division Algorithm, The Fundamental Theorem of Arithmetic, Methods of Proof. Rectangular Coordinate System in the Plane, Coordinate Geometry of a Point in the Plane, Equation of a Line, The Straight Line, Second Order Lines, Polar Coordinates, Parametric Equations of Lines, Coordinates On the Computer Screen. Numerical and Algebraic Expressions, Monomials and Polynomials, Factoring Polynomials, Algebraic Fractions and Irrational Expressions, Equations and Inequalities. Elementary Linear Algebra, Matrices and Determinants of the Second and Third Order, Matrix Multiplication, Subscripted Variables, Matrix Representation of a System of Linear Equations, Systems of Linear Equations in Two and Three Unknowns, Gauss-Jordan Elimination Procedure. Fundamental Principles of Counting, Factorial Notation, Permutations and Combinations, Binomial Theorem, Tree Diagrams, Multinomial Theorem, Elements of Probability Theory.

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**CMP3622 ADVANCED DATABASES**

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>ADVANCED DATABASES</b>  |
| <b>Code:</b>              | <b>CMP3622</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks                  |
| <b>Credits:</b>           | 8  |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Co-requisites:** **CMP3611** Introduction to Database Systems

**Module Description:** This module is a follow up of Introduction to databases and is intended to consolidate the students design and use of databases and concentrates mainly on database Administration security and other advanced aspects in database systems. The following topics will be covered: Discretionary and mandatory Access Control; The role of the database administrator; Security in statistical databases and encryption; The concept of a transaction; Concurrent Execution of Transactions; Role of Lock-Based Concurrency control; Crash Recovery; Relational Query Optimization; System Catalog in DBMS; architectures of Parallel Databases; architectures of Distributed Databases; distributed query processing; distributed Concurrency Control; deadlock ; recovery; HTML; XML; XML DTDs; XML-QL; Indexing for Text Search; Multidimensional Data model and OLAP queries; Views ; Decision support systems; Spatial Data Management; recursive queries; warehousing ; data mining; mining for rules; Tree-structured rules; decision Trees ; Clustering.

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**CMP3612 DATA STRUCTURES AND ALGORITHMS**

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>DATA STRUCTURES AND ALGORITHMS</b>  |
| <b>Code:</b>              | <b>CMP3612</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Co-requisites:** **CMP3631** Object Oriented Programming

**Module Description:** The purpose of this module is to provide the students with solid foundations in the basic concepts of programming: data structures and algorithms. The main objective of the module is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter. This module is also about showing the correctness of algorithms and studying their computational complexities. This module offers the students a mixture of theoretical knowledge and practical experience. The study of data structures and algorithms is carried out within an object-oriented framework. When implementations are considered, the Java programming language is used. The module will cover the following topics: -Programming Strategies; Data Structures; Introduction; Programming Strategies Data Structures; Introduction; Programming Strategies; Data Structures; Analysis of algorithms; Hard or Intractable problems; Searching; Sequential Searches; Dynamic Algorithms; Dictionaries; Hash tables; Graphs; Complexity; Queues; Sorting; Searching Revisited; Eulerian or Hamiltonian Paths and Traveling Salesman's Problem.



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**CMP3652 SOFTWARE ENGINEERING II**

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|---------------------------|--|
| <b>Module title:</b>      | <b>SOFTWARE ENGINEERING II</b>   |
| <b>Code:</b>              | <b>CMP3652</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks                  |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Co-requisites:** **CMP3641** Software Engineering I

**Module Description:** This module is intended to teach students the in-depth of Software Engineering. It is an addition to the work covered in Software engineering I. The module will cover the following topics: Formal specifications techniques; Algebraic techniques of formal specification; Model-based formal techniques; Software design; Activities in general object-oriented design process; Models for documentation of an object oriented design; UML; UML diagrams; Comparison of CASE tools and UML; Definition of Cleanroom Philosophy; Effectiveness of cleanroom method; Legacy stems; Structure of legacy systems; Function-oriented design; Legacy system assessment; Definition of Encryption; Benefits of data encryption; Definition of PGP; How to use PGP; Human memory; Problem solving; Motivation ;Team dynamics; Selecting and Retaining staff; Software Development Legal issues.

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**CMP3672 MATHEMATICS FOR COMPUTER SCIENCE II**

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|                           |  |
|---------------------------|--|
| <b>Module Title:</b>      | <b>MATHEMATICS FOR COMPUTER SCIENCE II</b>   |
| <b>Code:</b>              | <b>CMP3672</b>   |
| <b>Contact Hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |

**Co-Requisites:** **CMP3671** Mathematics for Computer Science I

**Module Description:** This module provides the students with the necessary skills that are essential for the mathematical analysis of problems with emphasis on representation of the mathematical formulation of the problems for solution with the application of the computer. The module aims to provide the beginning student with an initial but practical orientation to mathematics for computing and its basic theorems with a view to applying them to the solution of real life problems. The module will cover the followings: -Variables and Functions, Review of Basic Elementary Functions, Empirical Functions, Interpolation of Functions, Limits and Continuity, The Derivative of a Function, Basic Derivative Theorems, Applications of the Derivative, Differentials, Indefinite Integral, The Definite Integral, Application of the Definite Integral. Complex Numbers, Complex Function of a Real Variable, The Concept of a Function of a Complex Variable, Series. The Concept of a Function of Several Variables, Continuity, Partial Derivatives of the First-Order, The Total Differential of a Function, Application of the Differential of a Function to Approximate Computations, Partial Derivatives of Higher Order, Test for the Total Differential, The Extremum of a Function of several Variables, Constructing Empirical Formulas by the Method of Least Squares. Differential Equations of the First-Order, First-Order Equations with Variables Separable, First-Order Homogeneous Differential Equations, First-Order Linear Differential Equations, Euler's Method, Differential Equations of the Second Order, Integrating a Differential Equation with the Aid of Power Series, Second-Order Linear Homogenous Differential Equations with Constant Coefficients, Partial Differential Equations, Linear Partial Differential Equations. Line Integrals of the First Kind, The Line Integral of the Second Kind, The Physical Meaning of the Line Integral of the Second Kind, Conditions under Which the Line Integral of the Second Kind is Independent Path, The Work Performed by a Potential Force, Double Integrals, Triple Integrals

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**CMP3632 FOUNDATIONS OF DATA COMMUNICATIONS**

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>FOUNDATION OF DATA COMMUNICATIONS</b>  |
| <b>Code:</b>              | <b>CMP3632</b>  |
| <b>NQF level:</b>         | 6   |
| <b>Contact hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks           |
| <b>Credits:</b>           | 16  |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations 50% |

**Co-requisites:** **CMP3532** Computer Organisation

**Module Description:** This module covers: data communication and open system standards; data transmission; data link controls; Network architectures, layered protocols, network service interface; local networks long-haul networks; internet protocols; link protocols; addressing; routing; flow control; higher level protocols.

## SECOND YEAR INFORMATION TECHNOLOGY MODULES

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### CME3611 TELECOMMUNICATIONS

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|---------------------------|--|
| <b>Module Title:</b>      | <b>TELECOMMUNICATIONS</b>  |
| <b>Code:</b>              | <b>CME3611</b>   |
| <b>NQF Level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lecture periods/week; 3 hour practical session per week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> (1x 3 hour examination) |
| <b>Pre-Requisites:</b>    | <b>CMP3521</b> Fundamentals of Digital Electronics   |

**Module Description:** This module covers the principles and practice of wireless communications. The module presents the concepts of frequency re-use and cellular structure and cover propagation effects, multipath fading, digital and analogue modulation, diversity and equalization, multiple access and wireless networks. The module also presents modern communication systems and standards. The module also introduces the use and application of fibre and satellite systems to telecommunication as well as packet switching, traffic and queuing theory. Application of electromagnetic wave propagation and communication theory to telecommunication networks. The focus of the module is to combine communication at a system level and is designed as a senior elective.

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### CME3612 NETWORKING AND EMERGING TECHNOLOGIES

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|---------------------------|--|
| <b>Module title:</b>      | <b>NETWORKING AND EMERGING TECHNOLOGIES</b>  |
| <b>Code:</b>              | <b>CME3612</b>   |
| <b>NQF Level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lecture periods/week; 3 hour practical session per week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> (1x 3 hour examination) |
| <b>Pre-requisites:</b>    | <b>CME3511</b> Introduction to Information technology  |
| <b>Co-Requisites:</b>     | <b>CME3611</b> Telecommunications  |

**Module description:** The Networking and Emerging Technologies Program provides instruction in various network designs, computer-related equipment, network management, systems and application software. In addition, the program will introduce the student to exciting emerging technologies; such as, network security, wireless networks, Voice Over IP, and remote network management. This program offers course work designed to train the network administrator in standard networking principles as well as new and emerging technologies.

## THIRD YEAR MODULES

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### CMP3721 COMPUTER NETWORKS

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|---------------------------|---|
| <b>Module title:</b>      | <b>COMPUTER NETWORKS</b>  |
| <b>Code:</b>              | <b>CMP3721</b>  |
| <b>NQF level:</b>         | 7   |
| <b>Contact hours:</b>     | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks               |
| <b>Credits:</b>           | 8   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments) Final Examinations <b>50%</b> |
| <b>Prerequisites:</b>     | <b>CMP3632</b> Foundation of Data Communications  |

**Module description:** This module introduces the problems, solutions, and limitations associated with interconnecting computers by communication networks (LAN or WAN). The seven layer ISO Open Systems Interconnection (OSI) reference model serves as a framework for the module with major emphasis on the physical layer standards, data link protocols, network and transportation layer protocols. Topics include: modems, baseband and broadband communications, HDLC, Ethernet and token ring LANs, cell and frame relay networks, bridges, routers, services of the upper layers (Session, Presentation, Application), and network security.

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### CMP3741 COMPUTER THEORY

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|---------------------------|---|
| <b>Module title:</b>      | <b>COMPUTER THEORY</b>  |
| <b>Code:</b>              | <b>CMP3741</b>  |
| <b>NQF level:</b>         | 7   |
| <b>Contact hours:</b>     | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks               |
| <b>Credits:</b>           | 8   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments) Final Examinations <b>50%</b> |
| <b>Prerequisites:</b>     | <b>CMP3672</b> Mathematics for Computer Science II  |

**Module description:** This module introduces the student working with mathematical proofs and the concepts, notations, and techniques of the theories of Automata, formal languages, and Turing machines; and to provide historical perspective on the creation of the computer with a profound understanding of some of its capabilities and limitations. This module is necessary in understanding of the modules on Computer design, Artificial Intelligence, the analysis of algorithms. The module also provides the basis for the development of the abilities to recognize and manipulate context-free grammars and to understand the power of the recursive interaction of parts of a procedure. The module will cover the following topics: - Functions, Relations, Sets, Propositional Logics: Logic, graphs, trees and algebraic structures, Tautologies, contradictions and contingencies., Logical equivalence and logical implication, Argument evaluation and rules of inference. Predicate logic, Combining quantifiers, Proving mathematical theorems. Proof by induction, Recursive definitions and recurrence relations, Recurrence relations (cont) and expert systems, Program correctness. Graph and Trees: : Graphs, , Simple graphs and connectedness, Paths in graphs, Hamilton paths and Euler paths, Hamilton circuit of least possible total weight, Matrix representations of graphs, isomorphisms and planarity, Isomorphisms and planarity, Isomorphisms and trees, Rooted and

binary trees, Huffman codes, Algebraic structures, Semigroups, Groups, Subgroups, Semigroups obtained from finite alphabets Error-detecting/correcting capabilities of codes, Generator matrices and codes, Characteristics of error detecting/correcting codes, Parity-check matrices, Syndromes, Syndromes, error correction and Hamming codes. Theory of Computation : Regular Languages, Finite Automata, equivalence, minimization, Myhill-Nerode Theorem, introduction to nondeterminism, Context free grammars, Pushdown automata, equivalence and applications. Turing machines, Recursive and Recursively enumerable sets, non-determinism, RAMs and equivalence, Universal Turing Machines, undecidability, Rice's theorems for RE sets, Post machines, Basics of Recursive function theory. Equivalence, Church's thesis, computational complexity, space and time complexity of Turing Machines, Relationships, Savage's theorem, Complexity classes, Complete problems, NP-completeness, Cook-Levin theorem. Automata theory: Deterministic finite Automata and Non-deterministic finite automata. Equivalence of DFAs and NFAs, Regular expressions, the pumping lemma for Regular expressions, Push-down Automata (PDAs), relations of PDAs and context-free grammars and its properties, Turning machines, sets and languages, Chomsky hierarchy, the church turning thesis, decidability, tracability

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### CMP3761 COMPUTER ARCHITECTURE

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|---------------------------|--|
| <b>Module title:</b>      | <b>COMPUTER ARCHITECTURE</b>   |
| <b>Code:</b>              | <b>CMP3761</b>   |
| <b>NQF level:</b>         | 7  |
| <b>Contact hours:</b>     | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks                  |
| <b>Credits:</b>           | 8  |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |
| <b>Prerequisites</b>      | <b>CMP3532</b> Computer Organization<br><b>CMP3521</b> Fundamentals of Digital Electronics               |

**Module description:** This module refers to those attributes of a system visible to a programmer or those attributes that have a direct impact on the logical execution of a program. It introduces how a Microprocessor inside a computer can perform many different activities or tasks have been performed by the same machine controlling extra pieces of hardware attached to it (what goes on inside a computer). The module will cover the following topics: -CPU design, memory systems, bus structure, processing exceptions, language features that influence architecture, memory management, Microprogramming, Microprocessors, bit slice architecture, multiprocessor architectures, shared memory, associative processors, interconnection networks, pipelined architectures, tagged architecture, data flow architecture, special purpose architecture, performance evaluation, RAID architectures, cache memories, language for parallel/distributed computation, case studies, graphics systems, computer peripherals. It deals with Processor data path design, Input/Output organization, interrupts and DMA. Design and modelling of disks, disk caches, Redundant Arrays of Inexpensive Disks (RAID) devices, parallel I/O subsystems, parallel file systems, and Flash memory.

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### CMP3771 ARTIFICIAL INTELLIGENCE

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|---------------------------|--|
| <b>Module Title:</b>      | <b>ARTIFICIAL INTELLIGENCE</b>   |
| <b>Code:</b>              | <b>CMP3771</b>   |
| <b>NQF Level:</b>         | 7  |
| <b>Contact Hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> |
| <b>Pre-Requisites:</b>    | <b>CMP3511</b> Programming Fundamentals I  |

**Module Description:** This module provides the framework for the development of the necessary skills that are essential for the application of Artificial Intelligence to real-life problem situations. The emphasis is on developing the necessary theory and programming skills required in building and deploying Artificial Intelligence systems. The module provides practical projects that constitute the best way of learning and developing skills in Artificial Intelligence through the use of industry strong Artificial Intelligence programming language. By integrating theory and practice, the module provides the concepts, skills, tools, and techniques required for the development of appropriate skills in Artificial Intelligence. The module will cover the following topics: -Artificial Intelligence Problems and the Underlying Assumptions; Problems, Problem Spaces, and Search; Heuristic Search Techniques; Knowledge Representation and Issues; Using Predicate Logic; Representing Knowledge Using Rules; Statistical Reasoning; Slot-and-Filter Structures; Game Playing; and Planning. Introduction to PROLOG, The PROLOG Language, PROLOG in AI, More PROLOG in AI, Expert Systems, Perception and Action. Natural Language Processing, Understanding, Parallel and Distributed Artificial Intelligence, Learning, Connectionist Models, and Common Sense.

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**CMP3701 RESEARCH METHODOLOGY I**

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**Module Title:** RESEARCH METHODOLOGY I  
**Code:** CMP3701  
**NQF Level:** 7  
**Contact Hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
1½-hour tutorial /week for 14 weeks

**Credits:** 8  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 2 hour exam)

**Pre-Requisites:** **STS3522:** Introduction to Statistics or STS3531 Descriptive Statistics

**Module Description:** This module provides the framework for the development of the necessary skills that are essential for conducting and reporting the results of a research. The emphasis is on the development of methods for doing research both for scientific contribution in the field of computer science and in the development of computing and information related projects. The module will cover the following topics: - Research Methodology, Quantitative and Qualitative Research Cycles, The Research Topic, Statement of the Research Problem, Research Design, Research Hypotheses, The Cyclic Progress of the Scientific Expansion of Knowledge. Literature Review, Literature Searches, Compiling a Literature Review, The Reference System, Reference in the Text, Language Reference. Research Design: Population and Types of Samples, The Sampling Frame, Random Sampling, Other Types of Probability Sampling, Non-probability Sampling, Sample Size ( $n$ ). The Research Proposal, Requirements of a Research Topic, Designing a Research Project, Sections of a Research Proposal, Evaluation Criteria for a Research Proposal, the Student-Study Supervisor Role.

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**CMP3722 OPERATING SYSTEMS**

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**Module title:** OPERATING SYSTEMS  
**Code:** CMP3722  
**NQF level:** 7  
**Contact hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
**Credits:** 8

**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 2 hour exam)

**Prerequisites:** **CMP3532** Computer Organisation or **CMP3612** Data Structures and Algorithms

**Module description:** This module introduces the student to the concepts that underlie Operating Systems (OS). It is essential for a computer scientist to know what operating systems are, what they do and how they are designed. The module will cover the following topics: Processes in OS, synchronization, Interprocess communication, CHEduling, deadlocks, memory management, virtual memory, secondary storage, device management and security.

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**CMP3742 HUMAN COMPUTER INTERFACE AND COMPUTER ETHICS**

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**Module title:** HUMAN COMPUTER INTERFACE AND COMPUTER ETHICS  
**Code:** CMP3742  
**NQF level:** 7  
**Contact hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
**Credits:** 8

**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 2 hour exam)

**Prerequisites:** **CMP3652** Software Engineering II

**Module description:** This module introduces the student to Human Computer Interaction (HCI). HCI is concerned with understanding, designing, implementing and evaluating user-interfaces so that they better support users in carrying out their tasks. It also highlights the importance of IT professionals in making ethically informed decisions that are within the boundaries of relevant legal systems and professional codes of conduct. The module will cover the following topics: -User and task analysis, human factors, ergonomics, accessibility standards and cognitive psychology. The module also examines the various ethical issues surrounding computers and expected from computer professionals including piracy, hacking, viruses, responsibility and liability for the use of software and invasion of privacy.

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**CMP3762 COMPUTER GRAPHICS**

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**Module title:** COMPUTER GRAPHICS  
**Code:** CMP3762  
**NQF level:** 7  
**Contact hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
**Credits:** 8

**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 2 hour exam)

**Prerequisites:** **CMP3612** Data Structures and Algorithms

**Module description:** This module introduces the student to the basic principles of graphical systems. Graphical systems have become an increasingly important area within computer science, and the purpose of this module is to investigate the principles, techniques and tools that have enabled advances in Computer graphics. Implementation is a central component of the module, but its mathematical underpinnings will also be emphasized. The module will cover the following topics: -Graphical Algorithms, Graphical user-interface design, Choosing interaction styles and interaction techniques, HCI aspects of interface design, Dynamics of color, Structuring a view for effective understanding. Raster and Vector graphics systems, Video display devices, Physical and logical input devices, Issues facing the developer of graphical systems Computer animation and Multimedia Techniques.

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**CMP3712 INTERNET TECHNOLOGIES AND APPLICATIONS**

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**Module title:** INTERNET TECHNOLOGIES AND APPLICATIONS  
**Code:** CMP3712  
**NQF level:** 7  
**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 3 hour exam)

**Co-requisites:** **CMP3721** Computer Networks

**Module Description:** This module is intended to teach students the technologies governing the working of the Internet and its relationship with the World Wide Web (WWW). The following topics will be covered: Review of the OSI model; Internet protocols - TCP and TCP/IP; TCP/IP as the de-facto Internet protocol; HTML and XHTML codes; Use HTML to create a simple web page; Use the Internet to search for other scripting languages; Client applications; Standards for Client applications; Types of security; Security Implementation; Digital certificates; Digital signatures; Secure protocols; Use of Dreamweaver application; Use My Sql, Oracle or Ms-Access to create a database; Link at least 3 tables in the database; Primary and foreign keys; ASP technology; PHP technology; Database linkage to Website; Electronic payment systems; Internet fraud; Conveniences of using credit cards; Risks of using credit cards; Culture in Electronic Commerce; Contracts; Legal issues related to usage of the Internet;

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**CMP3702 RESEARCH METHODOLOGY II**

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**Module Title:** RESEARCH METHODOLOGY II  
**Code:** CMP 3702  
**NQF Level:** 7  
**Contact Hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
**Credits:** 8  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%**

**Co-Requisites:** **CMP3701** Research Methodology I

**Module Description:** This module provides the framework for the development of the necessary skills that are essential for conducting and reporting the results of a research. The emphasis is on the development of methods for doing research both for scientific contribution in the field of computer science and in the development of computing and information related projects. The module will cover the following topics: -  
Types of Quantitative Research Designs; Quasi-Experimental Research; Non-experimental Research; Validity of Conclusions; Suitability of Research Designs; Internal Validity and Threats; External Validity and Threats. Systematic Observation and Quantitative Measurement, Measurement Theory, Construct Validity of the Dependent Variable, Reliability, Pilot Study in the Development of an Instrument, Measuring Instruments, Developing and Constructing Questionnaires, Interview CHEdules, and Attitude Items, Ethical Considerations. Qualitative Research Design, Historical Research, The Phenomenological Approach, Qualitative Methods, Case Study Research, Participant Observation, Unstructured and In-depth Interviews and Focus Groups, Participatory Research, Action Research, Content Analysis. Statistical Validity and Techniques, Statistical Techniques and Coding, Presenting the Results, Report Writing, The Sections of a Research Report, Conventions, Grammar, and Style, Evaluation Criteria for a Research Report.

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**THIRD YEAR INFORMATION TECHNOLOGY MODULES**

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**CME3731 INTRODUCTION TO NETWORK SECURITY**

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**Module title:** INTRODUCTION TO NETWORK SECURITY  
**Code:** CME3731  
**NQF level:** 7  
**Contact hours:** 4 lecture periods/week; 3 hour practical session per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (Minimum of 2 tests and 2 assignments)  
Final Examinations **50%** (1x 3 hour examination)

**Pre-requisites:** **CME3612** Networking and Emerging Technologies

**Module description:** The course covers theory and practice of Network security, focusing in particular on the security aspects of the web and Internet. It prepares the student for the security issues and concerns they will face in professional environments. It starts with an overview of TCP/IP stacks, their strengths and weaknesses, followed by topics like intrusion detection, worm modeling and detection, VPNs, IPSEC, PKIs etc. It surveys cryptographic tools used to provide security, such as shared key encryption (DES, 3DES, RC-4/5/6, etc.); public key encryption, key exchange, and digital signature (Diffie-Hellmann, RSA, DSS, etc.). It then reviews how these tools are utilized in the internet protocols and applications such as Kerberos, SSL, IPSEC, TLS, PGP, S/MIME, SET, and others. System security issues, such as viruses, intrusion, firewalls, and others will also be covered. Last but not least, wireless security issues will also be discussed. Application of cryptographic protocols for secure communication across a network.

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**CME 3732 ADVANCED WEB PROGRAMMING**

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|---------------------------|--|
| <b>Module title:</b>      | <b>ADVANCED WEB PROGRAMMING</b>  |
| <b>Code:</b>              | <b>CME 3732</b>  |
| <b>NQF level:</b>         | 7  |
| <b>Contact hours:</b>     | 4 lecture periods/week; 3 hour practical session per week for 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (Minimum of 2 tests and 2 assignments)<br>Final Examinations <b>50%</b> (1x 3 hour examination) |
| <b>Prerequisites:</b>     | <b>CME 3512</b> Introduction to Web design<br><b>CMP 3512</b> Programming Fundamentals II  |

**Module Description:** This module is intended to teach the students advanced features in web programming. The following topical areas will be covered: Introduction to XML; How XML can be used; XML Syntax; XML Elements; XML Attributes; XML Validation; XML Validator; XML Browser support; Viewing XML in Browsers; Displaying XML with CSS; Displaying XML with XSL; XML embedded in HTML. Advanced features of XML: XML Namespaces; XML CDATA; XML Encoding; XML Server; XML Applications; XML HTTP Requests; XML Save Data to an XML File; Behaviors for HTML and XML; XML Technologies; XML Editor; XML Summary.

## FOURTH YEAR MODULES

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### CMP3810 RESEARCH PROJECT

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|---------------------------|---|
| <b>Module Title:</b>      | <b>Research Project</b>   |
| <b>Code:</b>              | <b>CMP3810</b>  |
| <b>NQF Level:</b>         | 8   |
| <b>Contact Hours:</b>     | Research Project Running for one year   |
| <b>Credits:</b>           | 32  |
| <b>Module Assessment:</b> | Continuous Assessment: <b>100%</b> Oral Presentation of Proposal: 10%Written Research Proposal: 20%Oral Presentation of Results: 20% Written Research Report: 50% |
| <b>Pre-Requisites:</b>    | Pass all third year modules   |

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

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### CMP3819 SOFTWARE PROJECT MANAGEMENT

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|--------------------------|---|
| <b>Module Title:</b>     | <b>Software Project Management</b>  |
| <b>Code:</b>             | <b>CMP3819</b>  |
| <b>NQF Level:</b>        | 8   |
| <b>Contact Hours:</b>    | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                          |
| <b>Credits:</b>          | 16  |
| <b>Module Assessment</b> | Continuous Assessment <b>50%</b> (minimum of 2 tests and 2 assignments)<br>1×3 Hrs Final Examination <b>50%</b> |
| <b>Pre-Requisites:</b>   | <b>CMP3742</b> Human Computer Interaction and Computer Ethics   |

**Module Description:** This module provides the framework for the development of the necessary skills that are essential for the management of Information Technology projects. The emphasis is on the application of the nine project management knowledge areas (project integration, scope, time, cost, quality, human resources, communication, risk, and procurement management) and the all the five process groups (initiating, planning, executing, controlling, and closing) to information technology projects. The module provides practical lessons in project management through the use of project management software. By integrating theory and practice, the module provides the concepts, skills, tools, and techniques required for information technology project management. The module will cover the following topics: -Project Management Context and Processes, A Methodology for Information Technology Management, Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resources Management, Project Communication Management, Project Risk Management, Project Procurement Management, Using Project Management Software to assist Project Management areas. Initiating a Project, Planning a Project, Executing a Project, Controlling a Project, Closing a Project.

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### CMP3821 NETWORK SYSTEMS SECURITY

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|--------------------------|---|
| <b>Module title:</b>     | <b>NETWORK SYSTEMS SECURITY</b>   |
| <b>Code:</b>             | <b>CMP3821</b>  |
| <b>NQF level:</b>        | 8   |
| <b>Contact hours:</b>    | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks                         |
| <b>Credits:</b>          | 8   |
| <b>Module Assessment</b> | Continuous Assessment <b>50%</b> (minimum of 2 tests and 2 assignments)<br>1×2 Hrs Final Examination <b>50%</b> |
| <b>Prerequisites</b>     | <b>CMP3721</b> Computer Networks  |

**Module description:** The module covers theory and practice of Network security, focusing in particular on the security aspects of the web and Internet. It prepares the student for the security issues and concerns they will face in professional environments. It starts with an overview of TCP/IP stacks, their strengths and weaknesses, followed by topics like intrusion detection, worm modeling and detection, VPNs, IPSEC, PKIs etc. It surveys cryptographic tools used to provide security, such as shared key encryption (DES, 3DES, RC-4/5/6, etc.); public key encryption, key exchange, and digital signature (Diffie-Hellmann, RSA, DSS, etc.). It then reviews how these tools are utilized in the internet protocols and applications such as Kerberos, SSL, IPSEC, TLS, PGP, S/MIME, SET, and others. System security issues, such as viruses, intrusion, firewalls, and others will also be covered. Last but not least, wireless security issues will also be discussed. Application of cryptographic protocols for secure communication across a network.

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**CMP3841 WIRELESS AND MOBILE COMPUTING**

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|--------------------------|---|
| <b>Module title:</b>     | <b>WIRELESS AND MOBILE COMPUTING</b>  |
| <b>Code:</b>             | <b>CMP3841</b>  |
| <b>NQF level:</b>        | 8   |
| <b>Contact hours:</b>    | 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks                         |
| <b>Credits:</b>          | 8   |
| <b>Module Assessment</b> | Continuous Assessment <b>50%</b> (minimum of 2 tests and 2 assignments)<br>1×2 Hrs Final Examination <b>50%</b> |

**Prerequisites****CMP3721** Computer Networks

**Module description:** This module covers fundamental techniques in design and operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, radio propagation models, error control techniques, handoff, power control, common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc), radio resource and network management. As an example for the third generation air interfaces, WCDMA is discussed in detail since it is expected to have a large impact on future wireless networks. In addition the module covers fundamental techniques about wireless communication, wireless networks, and wireless applications. It gives a good insight in the significance that wireless systems and the user's mobility have on the construction and handling of a data or telecommunication network, and also gives an overview of present technologies. The problem approach includes the transmission and network aspects of communication systems.

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**CMP3811 NUMERICAL METHODS**

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|---------------------------|--|
| <b>Module Title:</b>      | <b>NUMERICAL METHODS</b>   |
| <b>Code:</b>              | <b>CMP3811</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact Hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks<br>3-hour practical / week for 14 weeks |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (minimum of 2 tests and 2 assignments)<br>1×3 Hrs Final Examination <b>50%</b>                |

**Pre-Requisites:** **CMP3672:** Mathematics for Computer Science II Or  
**EEM3672** Intermediate Mathematical Economics

**Module Description:** This module provides the students with the necessary skills that are essential for the numerical analysis of problems with emphasis on precision of numerical representation, error analysis, numerical techniques, parallel architectures and algorithms, modeling and simulation, and scientific visualization in view to applying as the computer and available software to the solution of numerical problems. Learners who take modules in this area have an opportunity to apply these techniques in a wide range of application areas that require numerical results. These are many and cover the economic, scientific, and technical areas. The module will cover the following topics: - Finding Roots of Equations, Bisection Method, Regula Falsi or the Method of False Position, Secant Method, Newton's Method, Polynomial Equations, Systems of Nonlinear Equations, Fractal Basins of Attraction, Hybrid CHEmes, Polynomial Interpolation and Numerical Differentiation, Polynomial Interpolation, Errors in Polynomial Interpolation, Estimating Derivatives and Richardson Extrapolation, Numerical Integration, Definite Integral, Trapezoidal Rule, Newton-Cotes Rules, Romberg Integration, Adaptive Simpson's CHEme, Gaussian or Gaussian-Legendre Quadrature Formulas. Systems of Linear Equations, Gauss Elimination, Gauss Elimination with Scaled Partial Pivoting, Matrix Factorization or Decomposition, Iterative Methods, Eigenvalues and Eigenvectors. Approximation by Spline Functions, First-Degree and Second-Degree Splines, Natural Cubic Splines, B Splines, Interpolation and Approximation. Ordinary Differential Equations, Initial-Value Problem: Analytical Versus Numerical Solution, Taylor Series Methods, Runge-Kutta Methods, Stability and Adaptive Runge-Kutta and Multi-Step Methods, Systems of Ordinary Differential Equations, Methods of First-Order Systems, Higher-Order Equations and Systems, Adams-Bashforth-Moulton Methods, Boundary Value Problems for Ordinary Differential Equations. Smoothing of Data and Data Fitting, Method of Least Squares, Orthogonal Systems and Chebyshev Polynomials. Monte Carlo Methods and Simulation, Random Numbers, Numerical Integration, Simulation. Partial Differential Equations, Parabolic Problems, Hyperbolic Problems, Elliptic Problems. Numerical Optimization of Functions, Unconstrained and Constrained Optimization. One-Variable Case, Multivariate Case, Linear Programming, Standard Forms and Duality, Simplex Method, Approximate Solutions of Inconsistent Linear Systems. Algorithms for numerical methods. Pseudocode to implement those algorithms. Numerical Methods with MatLab, Numerical Methods with Visual Basic 2005, Numerical Methods with Visual C# 2005, Numerical Methods with C++, Numerical Methods with Java.



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**CMP3831 OPERATIONS RESEARCH**

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|                           |   |
|---------------------------|---|
| <b>Module Title:</b>      | <b>OPERATIONS RESEARCH</b>  |
| <b>Code:</b>              | <b>CMP3831</b>  |
| <b>NQF Level:</b>         | 8   |
| <b>Contact Hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                          |
| <b>Credits:</b>           | 16  |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (minimum of 2 tests and 2 assignments)<br>1×3 Hrs Final Examination <b>50%</b> |
| <b>Pre-Requisites</b>     | <b>CMP3672</b> Mathematics for Computer Science II Or<br><b>EEM 3672</b> Intermediate Mathematical Economics    |

**Module Description:** This module provides the students with the necessary skills that are essential for the analysis of problems with emphasis on mathematical model formulation and model building as well as the application of the computer and available software to the solution of problems using the fundamental principles of operations research. This module will cover the following topics: - Formulating and Building Linear Programming Models, Graphical Solution of Linear Programming Problems, The Simplex Algorithm and Goal Programming, Sensitivity Analysis and Duality in Linear Programming, Data Envelopment Analysis. Transportation Problems, Assignment Problems, Network Models, Integer Programming, Advanced Topics in Linear Programming. Nonlinear Programming, Introductory Concepts, Convex and Concave Functions, Solving NLPs with One Variable, Golden Section Search, Unconstrained Maximization and Minimization Problems with Several Variables, The Method of Steepest Ascent, Lagrange Multipliers, The Kuhn-Tucker Conditions, Quadratic Programming, Separable Programming, The Method of Feasible Directions, Pareto Optimality and Tradeoff Curves. Decision Making under Uncertainty, Utility Theory, Flaws in Expected Maximization of Utility: Prospect Theory and Framing Effects, Decision Trees, Baye's Rule and Decision Trees, Decision Making with Multiple Objectives, The Analytic Hierarchy Process, Game Theory. Deterministic EOQ Models, Probabilistic Inventory Models, Introduction to Stochastic Processes, Defining Markov Chains, Classification of States in a Markov Chain, Steady-State Probabilities and Mean First Passage Times, Absorbing Chains, Examples of the Application of Markov Chains. Deterministic Dynamic Programming, Examples of Application of Dynamic Programming, Formulating Dynamic Programming Recursions, The Wagner-Whitin Algorithm and the Silver-Meal Heuristic, Using Excel to Solve Dynamic Programming Problems, Probabilistic Dynamic Programming, When Current Stage Costs are Uncertain, but the Next Period's State is Certain, A Probabilistic Inventory Model, How to Maximize the Probability of a Favorable Event Occurring, Examples of Probabilistic Dynamic Programming Formulations, Markov Decision Processes. Queuing Theory and Queuing Terminology, Modeling Arrival and Service Processes, Birth-Death Processes, Queuing Systems, Finite Source Models: The Machine Repair Model, Exponential Queues in Series and in Open Networks, Queuing System with Blocked Customers Cleared, How to Tell Whether Interarrival Times and Service Time Are Exponential, Closed Queuing Networks, Priority Queuing Models, Transient Behavior of Queuing Systems. Discrete-Event Simulation, Random Numbers and Monte Carlo Simulation, Simulation with Continuous Random Variables, Statistical Analysis in Simulations, Simulation Languages, The Simulation Process, Simulation with Process Model, Simulation with the Excel Add-in @ Risk. Time Series Models, Moving Average Forecasting Methods, Simple Exponential Smoothing, Holt's Method: Exponential Smoothing with Trend, Winter's Method: Exponential Smoothing with Season, Ad Hoc Forecasting, Simple Linear Regression, Multiple Regression, Nonlinear Regression. Numerical Methods with Operations Research Packages, Simulation with SIMULA, Operations Research with Visual Basic 2005, Operations Research with Visual C# 2005, Operations Research with C++, Operations Research with Java.

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**CMP3851 DISTRIBUTED SYSTEMS**

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|                           |  |
|---------------------------|--|
| <b>Module Title:</b>      | <b>DISTRIBUTED SYSTEMS</b>   |
| <b>Code:</b>              | <b>CMP3851</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact Hours:</b>     | 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks                   |
| <b>Credits:</b>           | 16   |
| <b>Module Assessment:</b> | Continuous Assessment <b>50%</b> (minimum of 2 tests and 2 assignments)<br>1×3 Hrs Final Examination 50% |
| <b>Prerequisites</b>      | <b>CMP3721</b> Computer Networks, <b>CMP3612</b> Data Structures and Algorithms                          |

**Module Description:** The aim of this module is to provide students with an understanding of the principles, techniques, and practice in the design and implementation of distributed systems, with a particular focus on infrastructure software. The module presents the principles underlying the functioning of distributed systems; creates an awareness of the major technical challenges in distributed systems design and implementation; exposes students to current technology and to past and current research issues in the field of distributed systems and provides experience in the implementation of typical algorithms used in distributed systems. The following topics will be covered in the module; Introduction to Distributed Systems; System Architecture & Communication; Distributed Shared Memory; Distributed Objects and Middleware; Synchronization & Coordination; Replication & Consistency; Fault Tolerance; Naming, Peer-to-peer, Distributed File Systems; Parallel Programming, Clusters and Grid; Security and Research issues

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**CMP3871 ADVANCED COMPUTER SYSTEMS DESIGN**

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**Module title:** ADVANCED COMPUTER SYSTEMS DESIGN  
**Code:** CMP3871  
**NQF level:** 8  
**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Pre-Requisites:** **CMP3532** Computer Organization, **CMP3761** Computer Architecture

**Module Description:** This module covers the following topics: Computer organization and Computer architecture for the system design, Study the interfacing of different sub-systems and develop an entire CPU, Solve Maintenance, troubleshooting and software problems, Identify VLSI techniques and apply it practically applying CAD tools, Case study of telecommunication systems. Design of power supplies for systems, Interfacing electronic systems to input devices, output devices and databases. Synthesis of interfacing of electronic systems/communication systems. NMOS and CMOS VLSI sub system design, CPU design and Computer Maintenance cell.

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**CMP3802 FIELD ATTACHMENT**

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**Module Title:** FIELD ATTACHMENT  
**Code:** CMP3802  
**NQF Level:** 8  
**Contact Hours:** Filed Attachment running for 8 Weeks  
**Credits:** 8  
**Module Assessment** Continuous Assessment: **100%** Oral Presentation of field report: 20% Written Field Report: 80%  
**Pre-Requisites:** Pass all third year modules

**Module Description:** This module provides the framework for the development of the necessary interpersonal and other work related communications skills through the completion of a supervised field attachment period in the context of the major. Students will be expected to prepare a filed report and present the report. The report will be assessed by the company providing the field attachment and the Department of computer Science. The student is expected to present the field report orally and in the written form.

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**CMP3822 DATA WAREHOUSING AND DATA MINING**

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**Module title:** DATA WAREHOUSING AND DATA MINING  
**Code:** CMP3822  
**NQF level:** 8  
**Contact hours:** 2 lecture periods / week for 14 weeks; 3 hour practical session/two weeks, for 14 weeks  
**Credits:** 8  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Prerequisites:** **CMP3622** Advanced Databases

**Module Description** : This module aims to introduce the foundation of data warehousing, the theories of various data mining techniques and explore the practice of developing data mining applications. This module is one of the advanced database module series. The module is designed to be practical. As such, real-life examples of data mining issues and applications will also be used throughout the module. The following topics will be covered in the module; Data Warehouse; Data Model for Data Warehouses.; Architecture, relational OLAP, Multidimensional OLAP; Implementing Data Warehouses; data extraction, cleansing, transformation and loading, data cube computation, materialized view selection; OLAP query processing; Data Mining Fundamentals: data mining process and system architecture, relationship with data warehouse and OLAP systems; Mining Techniques and Application: association rules, mining spatial databases, mining multimedia databases, web mining, mining sequence and time-series data and text mining and Data pre-processing.

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**CMP3839 DIGITAL LIBRARIES**

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**Module title:** DIGITAL LIBRARIES  
**Code:** CMP3839  
**NQF level:** 8  
**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination 50%

**Prerequisites:** **CMP3622** Advanced Databases

**Module Description:** This module introduces the student to Digital Libraries (DLs) which are increasingly popular research area that encompass more than traditional information retrieval or database methods and techniques. It looks at the various policy and technical issues involved in building digital libraries, as well as relevant standards and practices that are broadly applicable to networked system design in general and specifically Web application design. Case studies will be performed on various DLs. The class will focus heavily on project work, especially writing and/or coding. The following topics will be covered; Introduction and Overview to Digital Libraries; Digital Library Initiatives; XML & Metadata; Digital Objects and System Architecture of Digital Libraries; Social and Economic Factors of Digital Libraries; Digital Collections & Content Organization; Access and User Interfaces to Digital Libraries; Human Factors of Digital Libraries; Digital Preservation and Future Technology and Digital Libraries.

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**CMP3882 NETWORK ADMINISTRATION**

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**Module title:** NETWORK ADMINISTRATION  
**Code:** CMP3882  
**NQF level:** 8  
**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Prerequisites:** **CMP3721** Computer Networks, **CMP3722** Operating Systems

**Module description:** This module will focus on managing and maintaining physical and logical network devices, network users, computers, and groups, and access to network resources. Modules include general system administration, core networking with extensive lab work, routing, security analysis and implementation. This module is designed to provide the student with an understanding of the fundamental concepts and tools necessary to administrate Unix based computer systems and network services. The module also aimed at providing hands on experience on Linux server setup, configuration and maintenance.

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**CMP3812 REALTIME MULTIMEDIA**

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**Module title:** REALTIME MULTIMEDIA  
**Code:** CMP3812  
**NQF level:** 8  
**Contact hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Prerequisites:** **CMP3742** Human Computer Interaction and Computer Ethics

**Module description:** The module offers a practical introduction to real-time multimedia in packet networks, and more specifically IP networks. The module will introduce transmission protocols used for the delivery of real-time multimedia as well as the protocols responsible for the setup, maintenance and release of the communication sessions. Various issues surrounding multimedia communication networks from basic signaling to service creation will also be discussed. The module will cover the following topics: -Session Initiation Protocol (Sip). Transmission Of Real-Time Multimedia In Packet Networks Using Rtp/Rtcp. Softswitches . Asterisk

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**CMP3832 ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS**

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**Module Title:** ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS  
**Code:** CMP3832  
**NQF Level:** 8  
**Contact Hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Prerequisites:** **CMP3742** Human Computer Interaction and Computer Ethics

**Module Description:** This module provides the framework for the management of IT systems in small and large organisations. The emphasis is on the examination of how information technology can be leveraged for strategic advantage by incorporating it into business strategy formulation, how to formulate IT strategies, and how to manage IT in an organization of any size. The module provides both analytical and practical lessons in the management of IT systems. By integrating theory and practice, the module provides the concepts, skills, tools, and techniques required for the management of IT Systems. The module provides a non-technical but a managerial approach to Management of IT systems. The module will cover the following topics: -Entrepreneurship: Definitions of Entrepreneurship; The entrepreneurial mind; Overview of challenges of small businesses; Starting a new business; Home based businesses; Legal and accounting concerns; Business plans; The economic characteristics of New Ventures; The Namibian context and entrepreneurial action; Critical success factors in New Venture development; Common reasons for New Venture failure; New Venture evaluation processes and feasibility testing; The 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, The Managers Views, Strategic Management of IT Systems, Sector Management of IT Systems, A Framework for Management of IT Systems, Information Technology and Strategic Advantage. Formulating Information System Strategy, Formulating IT Strategy. Formulating Information Management Strategy. Organizing IT Activities, Controlling IT Activities, Financing IT, Appraising IT, Responsibility Accounting for IT, Evaluating IT, Integrating IT and the Organization.

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**CMP3872 DATABASE PROGRAMMING**

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**Module Title:** DATABASE PROGRAMMING  
**Code:** CMP3872  
**NQF Level:** 8  
**Contact Hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Pre-Requisites:** **CMP3512** Programming Fundamentals II, **CMP3622** Advanced Databases

**Module Description:** This module provides the framework for the development of the necessary skills that are essential for developing and deploying database applications, including remote applications that run on the Web. The emphasis is on the design and development of GUIs, server development, and middle tier implementation. The module will cover the following topic: - Fundamentals of Database programming with ADO.NET, Review of databases, Structured Query Language (SQL), Transact-SQL Programming, Overview of ADO.NET Classes, Windows Application and ADO.NET. Connecting to a Database, Executing Database Commands, Using DataReader Objects to Read Results, Using DataSet to store Data, Using DataSet Objects to Modify Data, Navigating and Modifying Related Data, Using Data View Objects. Advanced Transaction Control, Web Applications Design and Implementation, ASP.NET, Using SQL Server's XML Support, Web Services.

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**CMP3852 EXPERT SYSTEMS**

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**Module Title:** EXPERT SYSTEMS  
**Code:** CMP3852  
**NQF Level:** 8  
**Contact Hours:** 4 lecture periods / week for 14 weeks; 3 hour practical session per week, for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **50%** (minimum of 2 tests and 2 assignments)  
1×3 Hrs Final Examination **50%**

**Pre-Requisites:** **CMP3771** Artificial Intelligence

**Module Description:** This module provides the framework for the development of the necessary skills that are essential for the application of Expert Systems to real life problem situations. The emphasis is on imparting the necessary theoretical knowledge and developing practical skills in the programming of expert systems. The module provides practical projects that constitute the best way of learning and developing skills in expert system through the use of industry strong expert systems tool. By integrating theory and practice, the module provides the concepts, skills, tools, and techniques required for expert systems skills development. The module will cover the following topics: -Characteristics of Expert Systems, The Development of Expert Systems Technology, Expert Systems Application and Domains, Elements of an Expert System, Programming Paradigms, Representation of Knowledge, Semantic Nets, CHemata, Frames, Methods of Inference, Reasoning under Uncertainty, Introduction to CLIPS, The CLIPS Tool, CLIPS in Expert Systems, Expert Systems Design Examples. The Design of Expert Systems, Pattern Matching, Modular Design and Execution Control. Efficiency in Rule-Based Languages, A Pattern Matching Algorithm, The Pattern Network, Built-in Pattern Matching Constraints, General Rules v/s Specific Rules, Simple Rules v/s Complex Rules, Loading and Saving Facts.

**COMPUTER SCIENCE DEPARTMENT: COURSE EQUIVALENTS**

| OLD MODULES   | NEW MODULES   |
|---|---|
| CMP3111 Computing 1A  | CMP3511 Programming Fundamentals I                    |
| CMP3112 Computing 1B  | CMP3512 Programming Fundamentals II                   |
| CMP3211 Data management and databases                       | CMP3611 Introduction to Database Systems              |
| CMP3220 Advanced and Object Oriented Programming            | CMP3631 Object Oriented Programming                   |
| CMP3212 Computer theory                                     | CMP3672 Mathematics for Computer Science II           |
| CMP3332 Operating systems                                   | CMP3612 Data Structures and Algorithms                |
| CMP3311 Software engineering I                              | CMP3641 Software Engineering I                        |
| CMP3312 Software engineering II                             | CMP3652 Software Engineering II                       |
| CMP3331 Networking and Data Communications                  | CMP3632 Foundations of Data Communications            |
| CMP3482 Artificial intelligence and Heuristics              | CMP3771 Artificial Intelligence                       |
| CMP3422 Web Development and E-commerce                      | CMP3712 Internet Technologies and Applications        |
| CMP3421 Client Server Systems and Advanced Networks         | CMP3821 Networks Systems Security                     |
| CMP3441 Numerical methods and Operational Research          | CMP3831 Operations Research                           |
| CMP3481 Parallel processing Architecture/Concurrent Systems | CMP3851 Distributed Systems                           |
| CMP3462 Advanced data management Techniques                 | CMP3871 Advanced Computer System Design               |
| CMP3442 Management of IT Systems                            | CMP3832 Entrepreneurship and Management of IT Systems |
| CMP3462 Advanced Data management Techniques                 | CMP3622 Advanced Databases                            |
| <b>No exact equivalencies - new subjects offered</b>        | 4 <sup>th</sup> year options                          |

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## G. DEPARTMENT OF GEOLOGY

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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.

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### G.1. DEPARTMENTAL REGULATIONS

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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.

#### **Advancement and Progression rules:**

From Year 1 to Year 2: To progress to the second (2<sup>nd</sup>) year of study, all first year students registered for the geology single major programme must pass **all the first (1<sup>st</sup>) 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 (3<sup>rd</sup>) 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 (4<sup>th</sup>) 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.

#### **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.

## G.1.1. BACHELOR OF SCIENCE (HONOURS) 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    | PRE/CO- REQUISITES              |
|----------|--|---------|---------------------------------|
| 1        | Computer Literacy                                    | CLC3509 | Faculty entry requirements      |
| 1        | English Communication & Study skills                 | LCE3519 | NSSC ENGLISH 'C'                |
| 1        | Chemistry 1A   | CHM3511 | Faculty entry requirements      |
| 1        | Physics for Physical Sciences I                      | PHY3511 | Faculty entry requirements      |
| 1        | Introduction to Physical Geology & Surface Processes | GLY3521 | Departmental entry requirements |
| 1        | Analytic Geometry, Complex Numbers and Matrices      | MAT3531 | Faculty entry requirements      |
| 1        | Basic Mathematics                                    | MAT3511 | Faculty entry requirements      |

| SEMESTER | MODULE NAME                      | CODE    | PRE/CO- REQUISITES              |
|----------|----------------------------------|---------|---------------------------------|
| 2        | Contemporary Social Issues       | CSI3529 | Faculty entry requirements      |
| 2        | Introduction to Earth Systems    | GLY3502 | Departmental entry requirements |
| 2        | Chemistry 1B                     | CHM3512 | Faculty entry requirements      |
| 2        | Physics for Physical Sciences II | PHY3512 | Faculty entry requirements      |
| 2        | Pre-Calculus                     | MAT3512 | Faculty entry requirements      |
| 2        | English for Academic Purposes    | LEA3519 | NSSC ENGLISH 'C'                |
| 2        | Introduction to Statistics       | STS3522 | Faculty entry requirements      |

#### YEAR 2

| SEMESTER | MODULE NAME               | CODE     | PRE/CO- REQUISITES                  |
|----------|---------------------------|----------|-------------------------------------|
| 1&2      | Field Geology I           | GLY3600  | GLY3521                             |
| 1        | Calculus I                | MAT3611  | MAT3512                             |
| 1        | Inorganic Chemistry I     | CHM3611  | CHM3511 and CHM3512                 |
| 1        | Introduction to Hydrology | GLY3621  | MAT3512, GLY3521;                   |
| 1        | Waves & Optics            | PHY3631  | PHY3511 & PHY3512                   |
| 1        | Physical chemistry I      | CHM 3631 | CHM3511, CHM3512, MAT3511 & MAT3512 |
| 1        | Earth Resources           | GLY3641  | GLY3521                             |

| SEMESTER | MODULE NAME                         | CODE    | PRE/CO- REQUISITES          |
|----------|-------------------------------------|---------|-----------------------------|
| 2        | Calculus II                         | MAT3612 | MAT3611                     |
| 2        | Stratigraphy & Geological Mapping   | GLY3612 | GLY3521; GLY3600            |
| 2        | Crystallography & Mineral Chemistry | GLY3632 | MAT3512, CHM3512            |
| 2        | Introduction to Geochemistry        | GLY3642 | MAT3512, GLY 3521, CHM3512; |
| 2        | Introduction to Petrology           | GLY3652 | GLY3521; GLY3600            |

#### YEAR 3

| SEMESTER | MODULE NAME                                | CODE      | PRE/ CO- REQUISITES        |
|----------|--|-----------|----------------------------|
| 1 & 2    | Field Geology II                           | GLY3700   | GLY3600                    |
| 1        | Coal, Petroleum and Gas*                   | GLY3701 * | GLY3521                    |
| 1        | Inorganic Chemistry II*                    | CHM3701*  | CHM3611 & MAT3512          |
| 1        | Mineralogy                                 | GLY3711   | GLY3632, CHM3512           |
| 1        | Plate Tectonics                            | GLY3721   | GLY3612; GLY3600           |
| 1        | Exploration Geochemistry and Geostatistics | GLY3749   | GLY3642; GLY3600           |
| 1        | Sedimentology & Palaeontology              | GLY3731   | GLY3521 & GLY3652          |
| 1        | Regional Geology of Namibia                | GLY3761   | GLY3521                    |
| 1        | Environmental & Engineering Geology I      | GLE3771   | GLY3642 & MAT3512; GLY3600 |

| SEMESTER | MODULE NAME                                | CODE      | PRE/CO- REQUISITES        |
|----------|--|-----------|---------------------------|
| 2        | Ordinary Differential Equations*           | MAT3642 * | MAT3512                   |
| 2        | Field Geology II                           | GLY3700   | GLY3600                   |
| 2        | Hydrogeology I                             | GLY3702   | GLY3621, GLY3642          |
| 2        | Structural Geology I                       | GLY3712   | GLY3612; MAT3612; GLY3600 |
| 2        | Igneous Petrology                          | GLY3729   | GLY3652, GLY3642; GLY3600 |
| 2        | Metamorphic Petrology                      | GLY3742   | GLY3652, GLY3642; GLY3600 |
| 2        | Exploration Geochemistry and Geostatistics | GLY 3782  | GLY3642; GLY3600          |
| 2        | Research Methodology                       | GLY3762   | GLY3600                   |
| 2        | Igneous Petrology                          | GLY3722   | GLY3652; GLY3600          |

**YEAR 4**

| SEMESTER | MODULE NAME                               | CODE      | PRE/ CO- REQUISITES                         |
|----------|---|-----------|---|
| 1        | Field Geology III                         | GLY3800   | GLY3700; GLY3810                            |
| 1        | Environmental and Engineering Geology II* | GLE3801 * | GLE3771                                     |
| 1        | Industrial Minerals and Gemstones*        | GLY3801 * | GLY3711; GLY 3700                           |
| 1        | Research Project                          | GLY3810   | All third and second year modules; GLY 3800 |
| 1        | Igneous Petrogenesis                      | GLY3821   | GLY3722, GLY3711; GLY3700                   |
| 1        | Economic Geology                          | GLY3831   | GLY3711 & GLY3721; GLY3700                  |
| 1        | Metamorphic Petrogenesis                  | GLY3841   | GLY3742, GLY3711; GLY3700                   |

| SEMESTER | MODULE NAME                        | CODE    | PRE/CO- REQUISITES                         |
|----------|------------------------------------|---------|--|
| 2        | Hydrogeology II                    | GLY3812 | GLY3702;                                   |
| 2        | Field Geology III                  | GLY3800 | GLY3700; GLY3810                           |
| 2        | Research Project                   | GLY3810 | All third and second year modules; GLY3800 |
| 2        | Exploration Geology and Geophysics | GLY3832 | GLY3712 & GLY3782, PHY3631; GLY3700        |
| 2        | Remote Sensing & GIS               | GLY3852 | GLY3712;                                   |
| 2        | Structural Geology II              | GLY3862 | GLY3712 & GLY3700                          |

\*Elective course

## FIRST YEAR MODULES

**GLY3521: INTRODUCTION TO PHYSICAL GEOLOGY AND SURFACE PROCESSES**

|                                      |   |
|--------------------------------------|---|
| <b>Module title:</b>                 | <b>Introduction to Physical Geology and Surface Processes</b>   |
| <b>Code:</b>                         | <b>GLY3521</b>  |
| <b>NQF level:</b>                    | 5   |
| <b>Contact hours:</b>                | 2 lecture hours per week; 3 practical hours per fortnight.  |
| <b>Credits:</b>                      | 8   |
| <b>Module assessment:</b>            | Continuous <b>40%</b> : At least 5 practicals, 2 tests, 1 assignment.<br>Examination <b>60%</b> : One 3 hour exam paper.  |
| <b>Prerequisites:</b>                | Faculty entry requirements for geology minor students; departmental entry requirements for geology major students   |
| <b>Module description (content):</b> | Plate Tectonics, The rock cycle, Introduction to Rocks & Minerals; Introduction to Physical Geology, Earth materials and their uses; The Environment, Natural geological hazards and mitigation measures, Geomorphology and land forms; Introduction to Aerial Photography. |

**GLY3502: INTRODUCTION TO EARTH SYSTEMS**

|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>INTRODUCTION TO EARTH SYSTEMS</b>  |
| <b>Code:</b>               | <b>GLY 3502</b>   |
| <b>NQF level:</b>          | 5   |
| <b>Contact hours:</b>      | 2 lecture hours per week; 3 practical hours per fortnight.  |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | Continuous <b>40%</b> : At least 5 practicals; 1-test and at least one assignment.<br>Examination <b>60%</b> : One 3 hour exam paper.   |
| <b>Pre-requisites:</b>     | Faculty entry requirements for geology minor students; departmental entry requirements for geology major students   |
| <b>Module Description:</b> | The Earth as a planet in space; orbit and rotational parameters; Effects of orbit and rotational parameters on glaciers; sediments; and the magnetic field; paleomagnetism; plate tectonics as a unifying principle in the rock cycle; sources of heat in the earth; evolution of planet earth through time; Energy Resources; coal, petroleum; gas; geothermal and solar energy; nuclear energy and other energy sources |

## SECOND YEAR MODULES

**GLY3600: FIELD GEOLOGY I**

|                            |  |
|----------------------------|--|
| <b>Module Title:</b>       | <b>Field Geology I</b>   |
| <b>Code:</b>               | <b>GLY3600</b>   |
| <b>NQF level:</b>          | 6  |
| <b>Contact hours:</b>      | 1 week of field mapping in a suitable area of Namibia or neighbouring country.   |
| <b>Credits:</b>            | 1  |
| <b>Module Assessment:</b>  | Continuous <b>100%</b> : Field note books, field reports and field trip participation.   |
| <b>Pre-requisites:</b>     | GLY3521 Introduction to Physical Geology & Surface Processes   |
| <b>Co-requisite:</b>       | All Geology Modules at level 6, i.e., the second academic year of studying geology as a single major.  |
| <b>Module Description:</b> | Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive. |

**GLY3621: INTRODUCTION TO HYDROLOGY**

|                                      |  |
|--------------------------------------|--|
| <b>Module title:</b>                 | <b>INTRODUCTION TO HYDROLOGY</b>   |
| <b>Code:</b>                         | <b>GLY3621</b>   |
| <b>NQF level:</b>                    | 6  |
| <b>Contact hours:</b>                | 2 lecture hours per week; 3 practical hours per fortnight.   |
| <b>Credits:</b>                      | 8  |
| <b>Module assessment:</b>            | Continuous <b>40%</b> : At least 5 practicals, 2 tests, 1 assignment.<br>Examination <b>60%</b> : One 3 hour exam paper.   |
| <b>Prerequisites:</b>                | GLY3521 Introduction to Physical Geology & Surface Processes, MAT 3512 Precalculus   |
| <b>Module description (content):</b> | The hydrologic cycle: Inventory of water resources on planet earth; elements of the hydrologic cycle; rainfall run-off relationships; stream hydrograph analysis; separation of baseflow and run-off, spring flow analysis. Infiltration & percolation: Infiltration capacity of soil; methods for determining infiltration capacity; soil moisture. Hydraulic properties of geological materials: Porosity; permeability, aquifers & confining units; confined and unconfined aquifers; homogeneity & isotropy in aquifers; geology of groundwater occurrence; primary and secondary permeability in aquifers. Principles of groundwater flow: Darcy's Law, specific discharge, average linear velocity, hydraulic head concept, potentiometric surface; equipotential lines; flow lines & transmissivity. Storage properties of aquifers: Specific storage; storativity and specific yield. Natural chemical evolution of groundwater: Hydrochemical facies; graphical methods of representation of hydrochemical facies (piper diagrams, stiff diagrams & fence diagrams); closed and open system behaviour. Overview of Hydrogeological region in Namibia. |



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**GLY3641: EARTH RESOURCES**

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**Module title:** EARTH RESOURCES  
**Code:** GLY3641  
**NQF level:** 6  
**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight.  
**Credits:** 8  
**Module assessment:** Continuous **40%:** At least 4 practicals; 1 test and 1 assignment  
Examination **60%:** One 3 hour exam paper.  
**Prerequisites:** GLY3521 Introduction to Physical Geology & Surface Processes  
**Module description:** Earth resources: types, characteristic properties and industrial uses. Mineral and energy resources: the geology of renewable and non-renewable resources -energy, metallic, and nonmetallic resources; Mineral resources of Namibia: outline of the geology, mineral and energy resources of Namibia.

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**GLY3612: STRATIGRAPHY & GEOLOGICAL MAPPING**

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**Module Title:** STRATIGRAPHY & GEOLOGICAL MAPPING  
**Code:** GLY3612  
**NQF level:** 6  
**Contact hours:** 4 lecture hours per week; 3 practical hours per week.  
**Credits:** 16  
**Module Assessment:** Continuous **40%:** At least 6 practicals; 2 tests and 1 assignment. Examination **60%:** One 3 hourExam  
**Pre-requisites:** GLY3521 Introduction to Physical Geology & Surface Processes  
**Module Description:** Principles of stratigraphy, including Walther's law; applications of stratigraphic principles and type examples; introduction to the geological time scale; geological history of Namibia; geological maps and structures; geological mapping techniques; structures due to deformation.

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**GLY3632: CRYSTALLOGRAPHY AND MINERAL CHEMISTRY**

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**Module title:** CRYSTALLOGRAPHY & MINERAL CHEMISTRY  
**Code:** GLY3632  
**NQF level:** 6  
**Contact hours:** 4 lecture hours per week; 3 practical hours per week  
**Credits:** 16  
**Module assessment:** Continuous **40%:** At least 7 practicals; 2 tests and 2 assignments.  
Examination **60%:** One 3 hour theory paper and one 3 hour practical paper.  
**Prerequisites:** MAT 3512 Precalculus, CHM3512 Chemistry 1B  
**Module description:** Crystals, lattices and Crystal symmetry; Crystal morphology; and Crystal projections; Space groups, internal order and translational symmetry; Crystal structures and Crystal chemistry. X-ray crystallography and X-ray diffraction. Mineral chemistry – minerals in the Earth's crust; chemical analytical techniques (X-ray diffraction, X-ray fluorescence, electron microprobe analysis); mineral compositions and variations; exsolutions; calculation of mineral analyses; Graphic representation of mineral composition.

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**GLY3642: INTRODUCTION TO GEOCHEMISTRY**

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**Module Title:** INTRODUCTION TO GEOCHEMISTRY  
**Code:** GLY3642  
**NQF level:** 6  
**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight.  
**Credits:** 8  
**Module Assessment:** Continuous **40%:** At least 6 practicals; 2 tests and 1 assignment.  
Examination **60%:** One 3 hour exam paper.  
**Pre-requisites:** GLY3521 Introduction to Physical Geology & Surface Processes, CHM3512 Chemistry 1B  
**Module Description:** The composition 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.

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**GLY3652: INTRODUCTION TO PETROLOGY**

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**Module Title:** INTRODUCTION TO PETROLOGY  
**Code:** GLY3652  
**NQF level:** 6  
**Contact hours:** 4 lecture hours per week; 3 practical hours per week.  
**Credits:** 16  
**Module Assessment:** Continuous **40%:** At least 6 practicals; 2 tests and 1 assignment.  
Examination **60%:** One 3 hour theory exam; one 3 hour practical Exam.  
**Pre-requisites:** GLY3521 Introduction to Physical Geology & Surface Processes  
**Module Description:** Part A: Introduction to Igneous Rocks-their textures, classification of igneous rocks, granites; monzonites; monzodiorites; silicic volcanics; syenites, trachytes; latites; diorites; andesites; gabbros; basalts; ultramafic igneous rocks; nepheline syenites; phonolites; lamprophyres; pyroclastics.  
Part B: Introduction to sedimentary rocks-sedimentary textures; argillaceous rocks; arenaceous rocks; calcareous rocks; dolomites; siliceous rocks; ferruginous rocks; carbonaceous rocks. Part C: Metamorphic rocks- metamorphism, deformation and recrystallisation; metasomatism and melting; the facies classification; progressive regional metamorphism of pelites and basic rocks.

### THIRD YEAR MODULES

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#### GLY3700: FIELD GEOLOGY II

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|----------------------------|--|
| <b>Module Title:</b>       | <b>Field Geology II</b>  |
| <b>Code:</b>               | <b>GLY3700</b>   |
| <b>NQF level:</b>          | 7  |
| <b>Contact hours:</b>      | 2-3 weeks of field mapping; logging; geochemical sampling in any given area of Namibia or neighbouring country or at a mine or exploration site. At the end of the academic year, students are expected to be attached to a mining company; exploration firm; geochemical firm; hydrogeological firm; and/or environmental firm (with a bias towards metal pollution mitigation or engineering geology). |
| <b>Credits:</b>            | 1  |
| <b>Module Assessment:</b>  | Continuous 100%: Field note books, field reports and field trip participation.   |
| <b>Pre-requisites:</b>     | GLY3600 Field Geology I  |
| <b>Co-requisite:</b>       | All Geology Modules at level 7, i.e., the second academic year of studying geology as a single major.  |
| <b>Module Description:</b> | Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive; complexly folded areas; excursions; mine visits; geochemical sampling.  |

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#### GLY3701: COAL, PETROLEUM AND GAS

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| <b>Module Title:</b>                 | <b>COAL, PETROLEUM AND GAS</b>   |
| <b>Code:</b>                         | <b>GLY3701</b>   |
| <b>NQF level:</b>                    | 7  |
| <b>Contact hours:</b>                | 2 lecture hours per week; 3 practical hours per fortnight.   |
| <b>Credits:</b>                      | 8  |
| <b>Module assessment:</b>            | Continuous <b>40%</b> : At least 4 practicals, 1 test, 1 assignment.<br>Exam <b>60%</b> : One 3 hour exam paper.   |
| <b>Prerequisites:</b>                | GLY3521 Introduction to Physical Geology and Surface Processes   |
| <b>Module description (content):</b> | Sedimentary basins and sequence stratigraphy; development of peat; climates associated with coal development; the preservation of coal; the coalification process; petrology of coal and its origins; types of coal and the environs in which they develop; methods of coal exploration; coal mining; Origin of petroleum and Gas; migration and accumulation of oil and gas; chemical characteristics of oil; source and reservoir rocks; reservoir fluids; reservoir traps; reservoir conditions; introduction to reservoir mechanics; subsurface and exploration for oil and gas; exercises in seiMIC stratigraphy. |

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#### GLY3711: MINERALOGY

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|----------------------------|---|
| <b>Module title:</b>       | <b>MINERALOGY</b>   |
| <b>Code:</b>               | <b>GLY3711</b>  |
| <b>NQF level:</b>          | 7   |
| <b>Contact hours:</b>      | 4 lecture hours per week; 3 practical hours per week  |
| <b>Credits:</b>            | 16  |
| <b>Module assessment:</b>  | Continuous <b>40%</b> : At least 7 practicals; 2 tests and 2 assignments.<br>Examination <b>60%</b> : One 3 hour theory and one 3 hour practical papers.  |
| <b>Prerequisites:</b>      | GLY3632 Crystallography and Mineral Chemistry, CHM3512 Chemistry 1B   |
| <b>Module description:</b> | 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.<br>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. |

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#### GLY3721: PLATE TECTONICS

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| <b>Module Title:</b>       | <b>PLATE TECTONICS</b>   |
| <b>Code:</b>               | <b>GLY3721</b>   |
| <b>NQF level:</b>          | 7  |
| <b>Contact hours:</b>      | 2 lecture hours per week; 3 practical hours per fortnight..  |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | Continuous <b>40%</b> : At least 4 practicals; 1-test and at least one assignment.<br>Examination <b>60%</b> : One 3 hour exam paper.  |
| <b>Pre-requisites:</b>     | GLY 3612 Stratigraphy & Geological Mapping   |
| <b>Module Description:</b> | Concept of sea floor spreading and plate consumption and generation; the Wilson cycle; plate Motions and stress distribution in plates; geomagnetism-reversals in the Earth's magnetic field, process of rock magnetization; hot spots and plumes, Super continents-how they are recognized; SeiMIC crustal structure, Benioff zone and earthquake distribution; Plate tectonic settings and rock associations; Crustal Provinces. |

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**GLY3731: SEDIMENTOLOGY & PALAEONTOLOGY**

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**Module Title:** SEDIMENTOLOGY & PALAEONTOLOGY**Code:** GLY3731**NQF level:** 7**Contact hours:** 4 lecture hours per week for 14 weeks; 1-3hour practical session per week for 14 weeks.**Credits:** 16**Module Assessment:** Continuous **40%:** At least 6 practicals; 2-tests and 1 assignment..Examination **60%:** One 3 hour theory exam; one 3 hour practical Exam.**Pre-requisites:** GLY3612 Stratigraphy & Geological Mapping and GLY 3652 Introduction to Petrology.

Module Description: Sediments cover 75% of continents and most of the ocean floor. They also host most of the mineral deposits in the world. The following topics will be covered; weathering of rocks; paleoclimates; origin and transport of sedimentary materials; deposition of siliciclastic materials; physical properties of sedimentary rocks; sedimentary textures; sedimentary structures; siliciclastic sedimentary rocks; carbonate sedimentary rocks; biochemical and carbonaceous sedimentary rocks; depositional environments; continental environments; marginal marine environments; siliciclastic marine environments; carbonate and evaporate environments; lithostratigraphy; sequence stratigraphy; magnetostratigraphy; seismic stratigraphy; biostratigraphy; Palaeontology: taphonomy; fossils and evolution; fossils and paleoecology; fossils and paleogeography; identification & classification of fossils; common fossils in geologic time.

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**GLY3761: REGIONAL GEOLOGY OF NAMIBIA**

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**Module title:** REGIONAL GEOLOGY OF NAMIBIA**Code:** GLY3761**NQF level:** 7**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight.**Credits:** 8**Module assessment:** Continuous **40%:** At least 5 practicals, 2 tests, 1 assignment.Examination **60%:** One 3 hour exam paper.**Prerequisites:** GLY3521 Introduction to Physical Geology & Surface Processes

**Module description (content):** Regional Geology of Southern Africa. Cratons and cratonic evolution of Southern Africa, mobile belts of Southern Africa. Geology of Namibia, from the Archaean to the Pleistocene. Mineral deposits of Southern Africa according to tectonic settings.

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**GLE3771: ENVIRONMENTAL & ENGINEERING GEOLOGY I**

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**Module title:** ENVIRONMENTAL & ENGINEERING GEOLOGY I**Code:** GLE3771**NQF level:** 7**Contact hours:** 4 lecture hours per week; 3 practical hours per week**Credits:** 16**Module assessment:** Continuous **40%:** At least 7 practicals, 2 tests, 1 assignment.Examination **60%:** One 3 hour exam paper.**Prerequisites:** MAT3512 Precalculus, GLY3642 Introduction to Geochemistry

**Module description (content):** Environmental geochemistry; Types of contaminants in natural water resources; anthropogenic sources of Geochemistry of weathering, equilibrium constants and pollution buffering in different rock types. Groundwater pollution. Engineering properties of rocks and rock masses. Geotechnical site investigations in sedimentary, igneous and metamorphic rocks; Soil description for engineering processes; Reservoirs & Dams structures; Slope stability.

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**GLY3702: HYDROGEOLOGY I**

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**Module title:** HYDROGEOLOGY I**Code:** GLY3702**NQF level:** 7**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight.**Credits:** 8**Module assessment:** Continuous **40%:** At least 5 practicals, 2 tests, 1 assignment.Examination **60%:** One 3 hour exam paper.**Prerequisites:** GLY3621 Introduction to Hydrology, GLY3642 Introduction to Geochemistry

**Module description (content):** Groundwater flow equations & flow net analysis; Piezometers, piezometer nests and potentiometric surface map; Regional groundwater flow systems; Ground recharge mechanisms and estimation techniques (Chloride Mass Balance Method, stable isotope method, Hydrograph analysis technique); Aquifer Hydraulics: Theis Equation; computing drawdown caused by a pumping well; determining aquifer parameters from Time-Drawdown data; slug tests, intersecting pumping cones and well interference; effect of hydrogeologic boundaries; aquifer test design; well loss; well efficiency; well specific capacity & optimum pumping rates. Solute transport in aquifers: Diffusion; advection; dispersion; retardation; sorption reactions; redox reactions; cation exchange; carbonate dissolution & precipitation reactions. The advection-dispersion equation; mass transport with reaction; first order kinetic reactions; equilibrium sorption reactions.

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**GLY3712: STRUCTURAL GEOLOGY I**

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**Module Title:** STRUCTURAL GEOLOGY I

**Code:** GLY3712

**NQF level:** 7

**Contact hours:** 4 lecture hours per week; 3 practical hours per week..

**Credits:** 16

**Module Assessment:** Continuous **40%:** At least 6 practicals; 2-tests and 1 assignment.  
Examination **60%:** One 3 hour theory exam; one 3 hour practical exam.

**Pre-requisites:** GLY3612 Stratigraphy & Geological Mapping and MAT3612 Calculus II

**Module Description:** The module will cover the following topics: Analysis of stress:- its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes. Analysis of Strain:- the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Material response to Stress:- brittle behaviour, brittle-ductile behaviour, ductile behaviour, classes of material response to stress and strain. Microstructures:- crystal defects, microstructural development at various grades, deformation mechanisms and associated textures. Primary Structures:- bedding, unconformities, sedimentary versus tectonic 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.

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**GLY3722: IGNEOUS PETROLOGY**

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**Module Title:** IGNEOUS PETROLOGY

**Code:** GLY3722

**NQF level:** 7

**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight..

**Credits:** 8

**Module Assessment:** Continuous **40%:** At least 5 practicals; 1 test and 1 assignment.  
Examination **60%:** One 2 hour theory exam; one 2 hour practical Exam.

**Pre-requisites:** GLY3652 Introduction to Petrology, GLY3642 Introduction to Geochemistry

**Module Description:** Nature and scope of petrology; Classification of rocks; Rocks and Earth Structures. The Igneous Rocks: Structures and textures; Chemistry, mineralogy and classification. The Phase rule and Phase diagrams. Petrogenesis, movement and modification of magmas. Common igneous rocks: basalts; rhyolites, andesites, granites, granodiorites, alkaline rocks and carbonatites.

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**GLY3742: METAMORPHIC PETROLOGY**

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**Module Title:** METAMORPHIC PETROLOGY

**Code:** GLY3742

**NQF level:** 7

**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight..

**Credits:** 8

**Module Assessment:** Continuous **40%:** At least 6 practicals; 2 tests and 1 assignment.  
Examination **60%:** One 2 hour theory exam; one 2 hour practical Exam.

**Pre-requisites:** GLY3652 Introduction to Petrology, GLY3642 Introduction to Geochemistry

**Module Description:** Basics of metamorphism:- grade, metamorphic zones and facies, Pressure-Temperature depth time paths, types of metamorphism and the geothermal and geobaric gradients. Study progressive metamorphism of pelites and basic rocks for the greenschist, amphibolite, granulite and eclogite facies. Fundamental relations of thermodynamics, producing P-T paths from mineral assemblages; The use of the petrogenetic grid Calculation of AFM and ACF diagrams Calculation of Mineral formulas. Examination of the Duhem theorem and facies concept, activities and mixing, Gibbs Free Energy

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**GLY3782: EXPLORATION GEOCHEMISTRY AND GEOSTATISTICS**

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**Module title:** Exploration Geochemistry and Geostatistics

**Code:** GLY3782

**NQF level:** 7

**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight.

**Credits:** 8

**Module assessment:** Continuous **40%:** At least 7 practicals; 2 tests and 1 assignment.  
Examination **60%:** One 3 hour exam paper.

**Prerequisites:** GLY3642 Introduction to Geochemistry

**Module description:** Exploration geochemistry: primary and secondary dispersion aureoles and anomalies; geochemical sampling, analysis and interpretation; geochemical patterns of mineral deposits. Geostatistics and geostatistical methods of ore reserve estimation. Laws of distribution for ore deposits; Kriging and error estimation. The module will only cover Linear Geostatistics at this level. Case studies of various deposit types.

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**GLY3762: RESEARCH METHODOLOGY**

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| <b>Module Title:</b>       | <b>RESEARCH METHODOLOGY</b>  |
| <b>Code:</b>               | <b>GLY3762</b>   |
| <b>NQF level:</b>          | 7  |
| <b>Contact hours:</b>      | 2 lecture hours per week; 3 practical hours per fortnight.   |
| <b>Credits:</b>            | 8  |
| <b>Module Assessment:</b>  | Continuous 100% : 5 assessed assignments, 1 test. Examination: Not applicable  |
| <b>Pre-requisites:</b>     | GLY3600 Field Geology I  |
| <b>Module Description:</b> | 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 study/project) design. Data collection, Documenting research data and other records. Presentation of data in scientific reports/theses/dissertation. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review. Report writing. Giving a good oral presentation (including use of powerpoint). |

**FOURTH YEAR MODULES**

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**GLY3800: FIELD GEOLOGY III**

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| <b>Module Title:</b>       | <b>Field Geology III</b>  |
| <b>Code:</b>               | <b>GLY3800</b>  |
| <b>NQF level:</b>          | 8   |
| <b>Contact hours:</b>      | 4 weeks of field mapping; logging; geochemical sampling in any given area of Namibia or neighbouring country.   |
| <b>Credits:</b>            | 2   |
| <b>Module Assessment:</b>  | Continuous 100%: Field note books, field reports and field trip participation.  |
| <b>Pre-requisites:</b>     | GLY3700 Field Geology II  |
| <b>Co-requisite:</b>       | GLY3810 Research Project  |
| <b>Module Description:</b> | Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive; complexly folded areas; excursions; mine visits; geochemical sampling. During the year, a student may be attached to mining company; exploration firm; geochemical firm; hydrogeological firm; engineering geology company and/or environmental firm with a bias towards metal pollution mitigation as part of the requirements for the Project. |

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**GLE3801: ENVIRONMENTAL & ENGINEERING GEOLOGY II\***

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| <b>Module title:</b>                 | <b>ENVIRONMENTAL &amp; ENGINEERING GEOLOGY II</b>  |
| <b>Code:</b>                         | <b>GLE3801</b>   |
| <b>NQF level:</b>                    | 8  |
| <b>Contact hours:</b>                | 2 hrs lectures per week (14 weeks) & 1x3 hours practical per week for 7 weeks  |
| <b>Credits:</b>                      | 8  |
| <b>Module assessment:</b>            | Continuous <b>40%</b> : At least 5 practicals, 2 tests, 1 assignment.<br>Examination <b>60%</b> : One 3 hour exam paper.   |
| <b>Prerequisites:</b>                | GLE 3771 Environmental & Engineering Geology I   |
| <b>Module description (content):</b> | Stress distribution and elastic theory; soil mechanics; analysis of rock slopes; excavation methods and design; control, maintenance and protection of rock slopes; the influence of groundwater and weathering on rock slope stability. Standard practice in Site Investigation. Engineering solutions to construction problems arising from ground conditions (soils and rocks). Earth materials in relation to engineering; ground engineering problems including ground improvement, mining settlement; foundation engineering; retaining structures; groundwater control . Assessment of contaminated land and water; risk assessment and the legal framework; reclamation and remediation of contaminated sites; the nature of contaminants; ground improvement methods and risk-based strategies for land reclamation and containment of pollutants; potential environmental effects of landfill waste disposal; Pollution associated with metalliferous deposits, acid mine drainage and its remediation, pollution associated with gold deposits, dangers and its remediation, pollution associated with industrial pollutants of petroleum origin and its remediation. Environmental Impact Assessment, including the aims and objectives of EIA, design and implementation of EIA, screening and scoping, impact prediction and mitigation. |

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**GLY3801: INDUSTRIAL MINERALS AND GEMSTONES\***

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|----------------------------|---|
| <b>Module Title:</b>       | <b>INDUSTRIAL MINERALS AND GEMSTONES</b>  |
| <b>Code:</b>               | <b>GLY3801</b>  |
| <b>NQF level:</b>          | 8   |
| <b>Contact hours:</b>      | 2 lecture hours per week; 3 practical hours per fortnight.  |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | Continuous <b>40%</b> : At least 6 practicals; 2-tests and 1 assignment. Examination <b>60%</b> : One 3 hour exam paper.  |
| <b>Pre-requisites:</b>     | GLY3641 Earth Resources, GLY3711 Mineralogy   |
| <b>Module Description:</b> | The module will cover two parts; first industrial minerals, the second gemstones. Under industrial minerals the following topics will be covered: Importance of Industrial Minerals; Standard of living Index as determined by industrial minerals usage; aggregates and construction materials; cement and concrete; glass; gypsum; fluorite; clays in general; kaolinite; smectites and montmorillonites; 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. |

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**GLY3810: RESEARCH PROJECT**

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>Research Project</b>   |
| <b>Code:</b>               | <b>GLY3810</b>  |
| <b>NQF level:</b>          | 8   |
| <b>Contact hours:</b>      | 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.                        |
| <b>Credits:</b>            | 32  |
| <b>Module Assessment:</b>  | Continuous 100%: Report <b>60%</b> , Presentation 15%, Oral Exam 25%  |
| <b>Pre-requisites:</b>     | All third and second year modules   |
| <b>Co-requisite:</b>       | GLY3800 Field Geology III   |
| <b>Module Description:</b> | The module will be based on a research topic chosen by a student in the previous year. The field work will be compulsory, and one of the products in the project will normally be production of a geological map and cross-section. |

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**GLY3821: IGNEOUS PETROGENESIS**

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|                            |   |
|----------------------------|---|
| <b>Module title:</b>       | <b>IGNEOUS PETROGENESIS</b>   |
| <b>Code:</b>               | <b>GLY3821</b>  |
| <b>NQF level:</b>          | 8   |
| <b>Contact hours:</b>      | 2 lecture hours per week for 14 weeks; 1x3 hour practical session per fortnight for 14 weeks  |
| <b>Credits:</b>            | 8   |
| <b>Module assessment:</b>  | Continuous <b>40%</b> : At least 7 practicals; 2 test and 2 assignment<br>Examination <b>60%</b> : 2 hour theory and 2 hour practical papers.   |
| <b>Prerequisites:</b>      | GLY3722 Igneous Petrology, GLY3711 Mineralogy   |
| <b>Module description:</b> | Magmas, magmatism and global tectonic processes. Igneous rocks as petrogenetic indicators. Partial melting processes: primary magma, fractionation, fractional crystallization, convection and mixing, crustal contamination. Magmatism within plates and at plate boundaries. Palaeotectonic settings. |

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**GLY3831: ECONOMIC GEOLOGY**

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|                            |  |
|----------------------------|--|
| <b>Module title:</b>       | <b>ECONOMIC GEOLOGY</b>  |
| <b>Code:</b>               | <b>GLY3831</b>   |
| <b>NQF level:</b>          | 8  |
| <b>Contact hours:</b>      | 4 lecture hours per week; 3 practical hours per week   |
| <b>Credits:</b>            | 16   |
| <b>Module assessment:</b>  | Continuous 40%: At least 7 practicals; 2 tests and 2 assignment.<br>Examination <b>60%</b> : One 3 hour theory paper and one 3 hour practical paper.   |
| <b>Prerequisites:</b>      | GLY3711 Mineralogy and GLY3721 Plate Tectonics   |
| <b>Module description:</b> | 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. |

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**GLY3841: METAMORPHIC PETROGENESIS**

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|                            |   |
|----------------------------|---|
| <b>Module Title:</b>       | <b>METAMORPHIC PETROGENESIS</b>   |
| <b>Code:</b>               | <b>GLY3841</b>  |
| <b>NQF level:</b>          | 8   |
| <b>Contact hours:</b>      | 2 lecture hours per week for 14 weeks; 1-3hour practical session per fortnight for 14 weeks.  |
| <b>Credits:</b>            | 8   |
| <b>Module Assessment:</b>  | Continuous <b>40%</b> : At least 6 practicals; 2-tests and 1 assignment.<br>Examination: <b>60%</b> : One 2 hour theory exam; one 2 hour practical Exam.  |
| <b>Pre-requisites:</b>     | GLY3742 Metamorphic Petrology, GLY3711 Mineralogy   |
| <b>Module Description:</b> | Mineral chemistry and mineral sites; exchange vectors and P-T-d relationships. Chemical thermodynamics:- equilibrium in metamorphic systems, species, phases, components, kinetics, state variables and their transformation, Fundamental relations of thermodynamics.Examination of the Duhem theorem and facies concept, activities and mixing, Gibbs Free Energy, Enthalpy and Equilibrium constant. Thermogeobarometry. Metamorphic reactions:- in basic rocks, pelites and in carbonates. The facies concept, the AFM diagram, ACF diagram, the X-CO <sub>2</sub> diagram for carbonates, $\mu$ - $\mu$ diagrams for mineral assemblages and the petrogenetic grid. Mineral chemistry and geothermobarometry. <ul style="list-style-type: none"><li>• Upper Amphibolite facies, Eclogite facies; Granulite facies; blue schist facies and metamorphism of hydrothermally altered rocks.</li><li>• Metamorphism, tectonics and pressure-temperature-time-depth paths.</li><li>• Heat flow in the crust.</li></ul> |

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**GLY3812: HYDROGEOLOGY II**

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**Module title:** HYDROGEOLOGY II  
**Code:** GLY3812  
**NQF level:** 8  
**Contact hours:** 4 hrs lectures per week & 1x3 hours practical per week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous **40%** - At least 7 practicals, 2 tests, 1 assignment.  
Examination **60%** - 1x 3 hrs theory paper, 1 x 3hrs practical paper  
**Prerequisites:** GLY3702 Hydrogeology I

**Module description (content):** Groundwater flow modelling: Types of groundwater flow models; governing equations, numerical & analytical techniques, conceptual model design, boundary conditions; initial conditions; steady state & transient simulations; model calibration; sensitivity analysis; predictive modelling; finite difference & finite element models, different types of computer codes; Introduction to modelling with MODFLOW. Groundwater age dating: Carbon-14 method; tritium method; chlorine-36 method; Chlorofluorocarbons; oxygen-18 and deuterium. Contaminant hydrogeology: contaminant plumes; field tracer tests; multiphase fluid systems. Groundwater and ore deposits: Roll-front uranium deposits, lead-zinc deposits, saline soils & evaporates. Groundwater Exploration, development & management: Groundwater resource evaluation, groundwater budgets, conjunctive use groundwater & surface water. Groundwater pollution processes.

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**GLY3832: EXPLORATION GEOLOGY AND GEOPHYSICS**

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**Module title:** EXPLORATION GEOLOGY AND GEOPHYSICS  
**Code:** GLY3832  
**NQF level:** 8  
**Contact hours:** 4 lecture hours per week for 14 weeks; 1x3 hour practical session per week for 14 weeks  
**Credits:** 16  
**Module assessment:** Continuous **40%**: At least 7 practicals; 2 test and 2 assignment  
Examination **60%**: One 3 hour theory exam; one 3 hour practical exam.  
**Prerequisites:** GLY3712 Structural Geology I, GLY3782 Exploration geochemistry and geostatistics, PHY3631 Waves & Optics

**Module description:** Exploration techniques: Geological mapping and prospecting. Application of photogeology and remote sensing in mineral exploration. Deep sampling methods: pitting and trenching, auger drilling, hand-held percussion drills, Wagon and Banka drilling; .Mineral resource evaluation and ore reserve estimation using conventional methods. Exploration geophysics: principles and applications of seiMIC, magnetic, gravity, resistivity, electromagnetic induced polarization and radiometric techniques.

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**GLY3852: REMOTE SENSING AND GIS**

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**Module Title:** REMOTE SENSING AND GIS  
**Code:** GLY 3852  
**NQF level:** 8  
**Contact hours:** 4 lecture hours per week; 3 practical hours per week.  
**Credits:** 16  
**Module Assessment:** Continuous Assessment **40%**: At least 6 practicals; 2-tests and 1 assignment.  
Examination **60%**: One 3 hour theory exam; one 3 hour practical Exam.  
**Pre-requisites:** GLY3712 Structural Geology I

**Module Description:** This module will cover the following themes: The Electromagnetic spectrum .Remote sensing systems, how they function and life times. .Data acquisition and storage on Remote Sensing Systems. Interpretation of Remote Sensing Images . Image Processing and filtering.Photogeology-interpretation and analysis. Applications of Remote Sensing in Earth and Atmospheric sciences .GIS platforms. Digital mapping techniques. Image analysis using GIS and modeling with GIS.

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**GLY3862: STRUCTURAL GEOLOGY II**

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**Module Title:** STRUCTURAL GEOLOGY II  
**Code:** GLY 3862  
**NQF level:** 8  
**Contact hours:** 2 lecture hours per week; 3 practical hours per fortnight.  
**Credits:** 8  
**Module Assessment:** Continuous **40%**: At least 6 practicals; 1 test and 1 assignment.  
Examination **60%**: One 3 hour exam paper.  
**Pre-requisites:** GLY3712 Structural Geology I, GLY3700 Field Geology II

**Module Description:** The module will cover the following topics: Microstructures and microtectonics: Advanced analysis of stress:- its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes.Further topics in Strain analysis:- the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Cross-section balancing for regions and smaller areas.Construction of block diagrams; depth to detachment and regional shortening calculations; uplift rates, continents and super continents, cycles of the Earths' magnetic field . Advanced geometrical analysis and stereographic projections for boreholes: scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas.  
Heat flow in the earths' interior. Geochronology as applied to deformation and crustal evolution

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**GEOLOGY DEPARTMENT: COURSE EQUIVALENTS**

| <b>OLD CURRICULUM MODULES FAILED</b>       | <b>NEW CURRICULUM MODULES TO BE TAKEN</b>                  |
|--|--|
| GLY3211 Physical Geology                   | GLY3521 Physical Geology and Surface Processes             |
| GLY3202 Crystallography                    | GLY3632 Crystallography & Mineral Chemistry                |
| GLY3212 Stratigraphy & Geological Mapping  | GLY3612 Stratigraphy & Geological Mapping                  |
| GLY3200 Field Geology I                    | GLY3600 Field Geology I                                    |
| GLY3301 Mineralogy                         | GLY3711 Mineralogy   |
| GLY3331 Sedimentology and Paleontology     | GLY3731 Sedimentology and Paleontology                     |
| GLY3341 Principles of Geochemistry         | GLY3642 Introduction to Geochemistry                       |
| GLY3302 Petrology                          | GLY3652 Introduction to Petrology                          |
| GLY3322 Plate Tectonics                    | GLY3721 Plate Tectonics                                    |
| GLY3332 Structural Geology                 | GLY3712 Structural Geology I                               |
| GLY3300 Field Geology II                   | GLY3700 Field Geology II                                   |
| GLY3411 Igneous & Metamorphic Petrogenesis | GLY3722 Igneous Petrology & GLY 3742 Metamorphic Petrology |
| GLY3431 Economic Geology                   | GLY3831 Economic Geology                                   |
| GLY3432 Exploration Geology & Geophysics   | GLY3832 Exploration Geology & Geophysics                   |
| GLY3422 Hydrogeology                       | GLY3702 Hydrogeology I                                     |
| GLY3402 Remote Sensing & GIS               | GLY3852 Remote Sensing and GIS                             |
| GLY3400 Field Geology III                  | GLY3800 Field Geology III                                  |



## H. 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**.

### H.1. MATHEMATICS MAJOR

#### H.1.1. B.Sc. (HONOURS) MAJOR AND MINORS, CURRICULUM AND PREREQUISITES

**QUALIFICATION: B.Sc. (Honours) Mathematics Major and Statistics Minor (11BMAS)**

Students opting for a major in **Mathematics** (with Statistics minor) must take all of the following modules:

#### YEAR 1

| SEMESTER                 | MODULE  | CODE    | PRE-/COREQUISITES             |
|--------------------------|---|---------|-------------------------------|
| 1                        | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1                        | Basic Mathematics                               | MAT3511 | Faculty entry requirements    |
| 1                        | Computer Literacy                               | CLC3509 | University entry requirements |
| 1                        | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | Faculty Entry Requirements    |
| <b>Statistics Minor:</b> |   |         |                               |
| 1                        | Descriptive Statistics                          | STS3531 | Faculty Entry Requirements    |
| 1                        | Programming Fundamentals I                      | CMP3511 | Departmental Entry Test       |
| 1                        | Fundamentals of Digital Electronics             | CMP3531 | Departmental Entry Test       |

| SEMESTER                 | MODULE                        | CODE    | PRE-/COREQUISITES                  |
|--------------------------|-------------------------------|---------|------------------------------------|
| 2                        | English for Academic Purposes | LEA3519 | Co-requisite: LCE3519              |
| 2                        | Contemporary Social Issues    | CSI3529 | University Entry Requirements      |
| 2                        | Precalculus                   | MAT3512 | Faculty Entry Requirements         |
| 2                        | Introduction to Probability   | STS3532 | Faculty entry requirements         |
| <b>Statistics Minor:</b> |                               |         |                                    |
| 2                        | Programming Fundamentals II   | CMP3512 | CMP3511 Programming Fundamentals I |

#### YEAR 2

| SEMESTER                 | MODULE                 | CODE    | PRE-/COREQUISITES                                    |
|--------------------------|------------------------|---------|--|
| 1                        | Calculus I             | MAT3611 | [MAT3511 and MAT3512] or [MAT3531 and MAT3512]       |
| 1                        | Sets and Numbers       | MAT3601 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| 1                        | Numerical Methods      | MAT3621 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| <b>Statistics Minor:</b> |                        |         |  |
| 1                        | Probability Theory     | STS3611 | STS 3532 and MAT3512                                 |
| 1                        | Statistical Estimation | STS3631 | STS3532  |
| 1                        | Software Engineering I | CMP3641 | CMP3511  |

| SEMESTER                 | MODULE                                | CODE    | PRE-/COREQUISITES                                    |
|--------------------------|---------------------------------------|---------|--|
| 2                        | Calculus II                           | MAT3612 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 2                        | Ordinary Differential Equations       | MAT3642 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 2                        | Elementary Linear Algebra             | MAT3652 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| <b>Statistics Minor:</b> |                                       |         |  |
| 2                        | Statistical Inference                 | STS3632 | STS3532  |
| 2                        | Introduction to Statistical Computing | STS3612 | STS3531  |

**YEAR 3**

| SEMESTER                | MODULE                         | CODE    | PRE-/COREQUISITES                               |
|-------------------------|--------------------------------|---------|---|
| 1                       | Real Analysis I                | MAT3731 | [MAT3611 or MAT3612] and MAT3601                |
| 1                       | Linear Algebra I               | MAT3711 | MAT3601 and MAT3652                             |
| 1                       | Numerical Analysis I           | MAT3701 | [MAT3611 and MAT3621] or [MAT3612 and MAT 3621] |
| 1                       | Set Theory                     | MAT3721 | MAT3601   |
| 1                       | Partial Differential Equations | MAT3741 | [MAT3611 or MAT3612], MAT3621 and MAT 3642      |
| <b>Statistic Minor:</b> |                                |         |   |
| 1                       | Sampling Techniques            | STS3731 | STS3531   |
| 1                       | Distribution Theory            | STS3721 | STS3611, MAT3611 and MAT3612                    |

| SEMESTER                 | MODULE                                      | CODE    | PRE-/COREQUISITES                |
|--------------------------|---|---------|----------------------------------|
| 2                        | Real Analysis II                            | MAT3732 | [MAT3611 or MAT3612] and MAT3601 |
| 2                        | Linear Algebra II                           | MAT3712 | MAT3601 and MAT3652              |
| 2                        | Vector Analysis                             | MAT3622 | [MAT3611 or MAT3612] and MAT3601 |
| 2                        | Number Theory                               | MAT3722 | MAT3601                          |
| <b>Statistics Minor:</b> |   |         |                                  |
| 2                        | Nonparametric and Categorical Data Analysis | STS3712 | STS3632                          |

**YEAR 4**

| SEMESTER | MODULE             | CODE    | PRE-/COREQUISITES                        |
|----------|--------------------|---------|--|
| 1        | Research Project   | MAT3810 | All Mathematics modules up to third year |
| 1        | General Topology   | MAT3811 | MAT3731 or MAT3732                       |
| 1        | Algebra            | MAT3831 | MAT3711 or MAT3712                       |
| 1        | Complex Analysis I | MAT3851 | MAT3731 or MAT3732                       |

| SEMESTER | MODULE                | CODE    | PRE-/COREQUISITES                              |
|----------|-----------------------|---------|--|
| 2        | Research Project      | MAT3810 | All Mathematics modules up to third year       |
| 2        | Normed Vector Spaces  | MAT3822 | [MAT3731 or MAT3712] and [MAT3711 or MAT 3712] |
| 2        | Category Theory       | MAT3802 | All Mathematics modules up to third year       |
| 2        | Numerical Analysis II | MAT3832 | MAT3611, MAT3612 and MAT3701                   |
|          | Complex Analysis II   | MAT3852 | MAT3731 or MAT3732                             |

**QUALIFICATION: B.Sc. (Honours) Mathematics Major and Computer Science Minor Minor (11BMAC)**Students opting for a major in **Mathematics** (with Computer Science minor) must take all of the following modules:**YEAR 1**

| SEMESTER                       | MODULE  | CODE    | PRE-/COREQUISITES             |
|--------------------------------|---|---------|-------------------------------|
| 1                              | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1                              | Basic Mathematics                               | MAT3511 | Faculty entry requirements    |
| 1                              | Computer Literacy                               | CLC3509 | University entry requirements |
| 1                              | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | Faculty Entry Requirements    |
| <b>Computer Science Minor:</b> |   |         |                               |
| 1                              | Programming Fundamentals I                      | CMP3511 | Departmental Entry Test       |
| 1                              | Fundamentals of Digital Electronics             | CMP3531 | Departmental Entry Test       |

| SEMESTER                       | MODULE                        | CODE    | PRE-/COREQUISITES                  |
|--------------------------------|-------------------------------|---------|------------------------------------|
| 2                              | English for Academic Purposes | LEA3519 | Co-requisite: LCE3519              |
| 2                              | Contemporary Social Issues    | CSI3529 | University Entry Requirements      |
| 2                              | Precalculus                   | MAT3512 | Faculty Entry Requirements         |
| 2                              | Introduction to Probability   | STS3532 | Faculty entry requirements         |
| <b>Computer Science Minor:</b> |                               |         |                                    |
| 2                              | Programming Fundamentals II   | CMP3512 | CMP3511 Programming Fundamentals I |
| 2                              | Computer Organization         | CMP3532 | Departmental Entry Test            |

**YEAR 2**

| SEMESTER                       | MODULE                           | CODE    | PRE-/COREQUISITES                                    |
|--------------------------------|----------------------------------|---------|--|
| 1                              | Calculus I                       | MAT3611 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 1                              | Sets and Numbers                 | MAT3601 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| 1                              | Numerical Methods                | MAT3621 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| <b>Computer Science Minor:</b> |                                  |         |  |
| 1                              | Introduction to Database Systems | CMP3611 | CMP3532 and CMP 3511                                 |
| 1                              | Object Oriented Programming      | CMP3631 | CMP 3511   |
| 1                              | Software Engineering I           | CMP3641 | CMP 3511   |

| SEMESTER                       | MODULE                             | CODE    | PRE-/COREQUISITES                                    |
|--------------------------------|------------------------------------|---------|--|
| 2                              | Calculus II                        | MAT3622 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 2                              | Ordinary Differential Equations    | MAT3642 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 2                              | Elementary Linear Algebra          | MAT3652 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| <b>Computer Science Minor:</b> |                                    |         |  |
| 2                              | Data Structure and Algorithms      | CMP3612 | CMP3631  |
| 2                              | Foundations of Data Communications | CMP3632 | CMP 3532 Computer Organization                       |

**YEAR 3**

| SEMESTER                       | MODULE                         | CODE    | PRE-/COREQUISITES                                  |
|--------------------------------|--------------------------------|---------|--|
| 1                              | Real Analysis I                | MAT3731 | [MAT 3611 or MAT 3612] and MAT 3601                |
| 1                              | Linear Algebra I               | MAT3711 | MAT 3601 and MAT 3652                              |
| 1                              | Numerical Analysis I           | MAT3701 | [MAT 3611 and MAT 3621] or [MAT 3612 and MAT 3621] |
| 1                              | Set Theory                     | MAT3721 | MAT 3601   |
| 1                              | Partial Differential Equations | MAT3741 | [MAT 3611 or MAT 3612], MAT 3621 and MAT 3642      |
| <b>Computer Science Minor:</b> |                                |         |  |
| 1                              | Artificial Intelligence        | CMP3771 | CMP 3511 Programming Fundamentals I                |

| SEMESTER                       | MODULE             | CODE    | PRE-/COREQUISITES                   |
|--------------------------------|--------------------|---------|-------------------------------------|
| 2                              | Real Analysis II   | MAT3732 | [MAT 3611 or MAT 3612] and MAT 3601 |
| 2                              | Linear Algebra II  | MAT3712 | MAT 3601 and MAT 3652               |
| 2                              | Vector Analysis    | MAT3622 | [MAT 3611 or MAT 3612] and MAT 3601 |
| 2                              | Number Theory      | MAT3722 | MAT 3601                            |
| <b>Computer Science Minor:</b> |                    |         |                                     |
| 2                              | Operating Systems  | CMP3712 | CMP 3532 or CMP 3612                |
| 2                              | Advanced Databases | CMP3622 | CMP3611                             |

#### YEAR 4

| SEMESTER | MODULE             | CODE    | PRE-/COREQUISITES                        |
|----------|--------------------|---------|--|
| 1        | Research Project   | MAT3810 | All Mathematics modules up to third year |
| 1        | General Topology   | MAT3811 | MAT 3731 or MAT 3732                     |
| 1        | Algebra            | MAT3831 | MAT 3711 or MAT 3712                     |
| 1        | Complex Analysis I | MAT3851 | MAT 3731 or MAT 3732                     |

#### QUALIFICATION: B.Sc. (Honours) Mathematics Major and Physics Minor (11BMAP)

Students opting for a major in **Mathematics** with (Physics minor) must take all of the following modules:

#### YEAR 1

| SEMESTER              | MODULE  | CODE     | PRE-/COREQUISITES             |
|-----------------------|---|----------|-------------------------------|
| 1                     | English Communication & Study Skills            | LCE3519  | University entry requirements |
| 1                     | Basic Mathematics                               | MAT3511  | Faculty entry requirements    |
| 1                     | Computer Literacy                               | CLC 3509 | University entry requirements |
| 1                     | Analytic Geometry, Complex Numbers and Matrices | MAT3531  | Faculty Entry Requirements    |
| 1                     | Descriptive Statistics                          | STS3531  | Faculty Entry Requirements    |
| <b>Physics Minor:</b> |   |          |                               |
| 1                     | Physics for Physical Sciences I                 | PHY3511  | Departmental Entry Test       |

| SEMESTER              | MODULE                          | CODE    | PRE-/COREQUISITES             |
|-----------------------|---------------------------------|---------|-------------------------------|
| 2                     | English for Academic Purposes   | LEA3519 | Co-requisite: LCE3519         |
| 2                     | Contemporary Social Issues      | CSI3529 | University Entry Requirements |
| 2                     | Precalculus                     | MAT3512 | Faculty Entry Requirements    |
| 2                     | Introduction to Probability     | STS3532 | Faculty entry requirements    |
| <b>Physics Minor:</b> |                                 |         |                               |
| 2                     | Physics for Physical Science II | PHY3512 | Departmental Entry Test       |

#### YEAR 2

| SEMESTER              | MODULE              | CODE    | PRE-/COREQUISITES                                    |
|-----------------------|---------------------|---------|--|
| 1                     | Calculus I          | MAT3611 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 1                     | Sets and Numbers    | MAT3601 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| 1                     | Numerical Methods   | MAT3621 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| 1                     | Probability Theory  | STS3611 | STS3532 and MAT3512                                  |
| <b>Physics Minor:</b> |                     |         |  |
| 1                     | Waves and Optics    | PHY3631 | PHY3511 and PHY3512                                  |
| 1                     | Classical Mechanics | PHY3611 | MAT3512, PHY3511 and MAT3511                         |

| SEMESTER              | MODULE                          | CODE    | PRE-/COREQUISITES                                    |
|-----------------------|---------------------------------|---------|--|
| 2                     | Calculus II                     | MAT3622 | [MAT3511 and MAT3512] or [MAT3531 and MAT3512]       |
| 2                     | Ordinary Differential Equations | MAT3642 | [MAT3511 and MAT 3512] or [MAT3531 and MAT3512]      |
| 2                     | Elementary Linear Algebra       | MAT3652 | Any two following modules: MAT3511, MAT3531, MAT3512 |
| <b>Physics Minor:</b> |                                 |         |  |
| 2                     | Electromagnetism                | PHY3612 | MAT3511, MAT3512 and PHY3512                         |
| 2                     | Modern Physics I                | PHY3602 | MAT3511, MAT3512, PHY3511 and PHY3512                |

#### YEAR 3

| SEMESTER              | MODULE                         | CODE    | PRE-/COREQUISITES                               |
|-----------------------|--------------------------------|---------|---|
| 1                     | Real Analysis I                | MAT3731 | [MAT3611 or MAT3612] and MAT3601                |
| 1                     | Linear Algebra I               | MAT3711 | MAT3601 and MAT3652                             |
| 1                     | Numerical Analysis I           | MAT3701 | [MAT3611 and MAT3621] or [MAT3612 and MAT 3621] |
| 1                     | Set Theory                     | MAT3721 | MAT3601   |
| 1                     | Partial Differential Equations | MAT3741 | [MAT3611 or MAT3612], MAT3621 and MAT 3642      |
| <b>Physics Minor:</b> |                                |         |   |
| 1                     | Electrodynamics                | PHY3711 | MAT3612 and PHY3612                             |

| SEMESTER              | MODULE                | CODE    | PRE-/COREQUISITES                     |
|-----------------------|-----------------------|---------|---------------------------------------|
| 2                     | Real Analysis II      | MAT3732 | [MAT3611 or MAT3612] and MAT3601      |
| 2                     | Linear Algebra II     | MAT3712 | MAT3601 and MAT3652                   |
| 2                     | Vector Analysis       | MAT3622 | [MAT3611 or MAT3612] and MAT3601      |
| 2                     | Number Theory         | MAT3722 | MAT3601                               |
| <b>Physics Minor:</b> |                       |         |                                       |
| 2                     | Theoretical Mechanics | PHY3712 | PHY3611, MAT3621, MAT3642 and MAT3652 |
| 2                     | Electronics I         | PHY3702 | PHY3512                               |

#### YEAR 4

| SEMESTER | MODULE             | CODE    | PRE-/COREQUISITES                        |
|----------|--------------------|---------|--|
| 1        | Research Project   | MAT3810 | All Mathematics modules up to third year |
| 1        | General Topology   | MAT3811 | MAT3731 or MAT3732                       |
| 1        | Algebra            | MAT3831 | MAT3711 or MAT3712                       |
| 1        | Complex Analysis I | MAT3851 | MAT3731 or MAT3732                       |

| SEMESTER | MODULE                | CODE    | PRE-/COREQUISITES                              |
|----------|-----------------------|---------|--|
| 2        | Research Project      | MAT3810 | All Mathematics modules up to third year       |
| 2        | Normed Vector Spaces  | MAT3822 | [MAT3731 or MAT3712] and [MAT3711 or MAT 3712] |
| 2        | Category Theory       | MAT3802 | All Mathematics modules up to third year       |
| 2        | Numerical Analysis II | MAT3832 | MAT3611, MAT3612 and MAT3701                   |
| 2        | Complex Analysis II   | MAT3852 | MAT3731 or MAT3732                             |

| SEMESTER | MODULE                | CODE    | PRE-/COREQUISITES                              |
|----------|-----------------------|---------|--|
| 2        | Research Project      | MAT3810 | All Mathematics modules up to third year       |
| 2        | Normed Vector Spaces  | MAT3822 | [MAT3731 or MAT3712] and [MAT3711 or MAT 3712] |
| 2        | Category Theory       | MAT3802 | All Mathematics modules up to third year       |
| 2        | Numerical Analysis II | MAT3832 | MAT3611, MAT3612 and MAT3701                   |
| 2        | Complex Analysis II   | MAT3852 | MAT3731 or MAT3732                             |

### H.1.2. B.SC. HONOURS MATHEMATICS CURRICULUM MODULE DESCRIPTIONS

#### FIRST YEAR MODULES:

##### MAT3511: BASIC MATHEMATICS

**Module name:** BASIC MATHEMATICS  
**Code:** MAT3511  
**NQF level:** 5  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** Faculty Entry Requirements  
**Module description:** Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement. Algebraic expressions: simplification, expansion, polynomials, remainder and factor theorem, partial fractions. Trigonometry: trigonometric functions, basic trigonometric identities. The absolute value, linear equations, linear inequalities, quadratic equations, quadratic inequalities. Functions: domain, codomain, image, preimage, even function, odd function. Sequences: the geometric sequence, the arithmetic sequence. The Binomial Theorem.

##### MAT3531: ANALYTIC GEOMETRY, COMPLEX NUMBERS AND MATRICES

**Module name:** ANALYTIC GEOMETRY, COMPLEX NUMBERS AND MATRICES  
**Code:** MAT3531  
**NQF level:** 5  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** Faculty Entry Requirements  
**Module description:** Points and lines in a plane: the distance formula, the triangle inequality, parallel and perpendicular lines, circles and tangent lines. Conic sections: ellipse, parabola, hyperbola. Vectors in two and three dimensions: addition of vectors, multiplication by a scalar, magnitude, dot product, cross product. Matrices: addition, multiplication, scalar multiplication and transpose (for up to 3×3 dimension), determinant and inverse (with emphasis on 2 × 2), solutions of systems of linear equations by Cramer's rule (for 2 × 2), and by Gaussian elimination method (for up to 3 × 3 matrices). Complex numbers: operations on complex numbers, the complex conjugate, Argand diagram, modulus-argument form, de Moivre's formula, fundamental theorem of algebra.

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**MAT3512: PRECALCULUS**

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**Module name:** PRECALCULUS  
**Code:** MAT3512  
**NQF level:** 5  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** Faculty Entry Requirements

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

**SECOND YEAR MODULES**

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**MAT3601: SETS AND NUMBERS**

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**Module name:** SETS AND NUMBERS  
**Code:** MAT3601  
**NQF level:** 6  
**Contact hours:** 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  
**Credits:** 8  
**Assessment:** Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).  
**Prerequisite:** Any two of the following three modules: Basic Mathematics (**MAT3511**), Analytic Geometry, Complex Numbers and Matrices (**MAT 3531**), Precalculus (**MAT 3512**).

**Module description:** Basic logic: propositions and predicates conjunction, disjunction, negation, implication, contrapositive, equivalence. Methods of proof: direct, contrapositive, contradiction, induction. Sets: symmetric difference of two sets, de Morgan's laws, power set, partition, cartesian product, definition of a binary relation, functions as binary relations, preorder. Real numbers: natural numbers, integers, positional number systems, induction.

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**MAT3611: CALCULUS I**

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**Module name:** CALCULUS I  
**Code:** MAT3611  
**NQF level:** 6  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** [**MAT3511** (Basic Mathematics) and **MAT3512** (Precalculus)] OR [**MAT3531** (Analytic Geometry, Complex Numbers and Matrices)]

**Module description:** Limits and continuity of functions: limit at a point, improper limit, continuity. Derivatives: definition, rules of differentiation, chain rule, derivatives of higher order, derivative of the inverse function, Arc functions (inverse trigonometric functions), hyperbolic functions, area functions (inverse hyperbolic functions). Exponential and logarithmic functions. Some applications of the exponential functions: growth and decay, Rolle's Theorem, Mean Value theorem. Applications of the derivative: l'Hospital's rule, related rates, concavity. Integration: antiderivatives, integration by substitution, the fundamental theorem of calculus, area of a region bounded by graphs.

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**MAT3652: ELEMENTARY LINEAR ALGEBRA**

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**Module name:** ELEMENTARY LINEAR ALGEBRA  
**Code:** MAT3652  
**NQF level:** 6  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** Any two of the following three modules: Basic Mathematics (**MAT3511**), Analytic Geometry, Complex Numbers and Matrices (**MAT3531**), Precalculus (**MAT3512**).

**Module description:** Matrices: determinant, inverse and Cramer's rule (for up to  $3 \times 3$  dimension), eigenvalues and eigenvectors, adjoint, symmetric and skew-symmetric matrices, orthogonal matrices. Linear algebra in  $R^2$ ,  $R^3$  and  $R^n$ : subspace, linear combination, linearly independent and linearly dependent vectors, span, basis, dimension. Points, lines, planes and hyperplanes in  $R^2$ ,  $R^3$  and  $R^n$ . orthogonality, angle.

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**MAT3612 CALCULUS II**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>CALCULUS II</b>   |
| <b>Code:</b>          | <b>MAT3612</b>   |
| <b>NQF level:</b>     | 6  |
| <b>Contact hours:</b> | 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks   |
| <b>Credits:</b>       | 16   |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 3 tests), examination <b>50%</b> (3 hours examination paper).   |
| <b>Prerequisite:</b>  | <b>[MAT3511]</b> (Basic Mathematics) and <b>MAT3512</b> (Precalculus)] or <b>[MAT3531]</b> (Analytic Geometry, Complex Numbers and Matrices) and <b>MAT3512</b> (Precalculus)] |

**Module description:** Integration: Riemann sums, approximations of the Riemann integral using the trapezoidal rule and Simpson's rule. Integration techniques: integration by parts, integration of rational functions. Improper integrals, Applications of the Riemann integral: volume of a solid of revolution, arc length, surface of revolution. Partial differentiation, chain rule, directional derivative. Classification of critical points for two-variable functions, Sequences and series of numbers: the limit of a sequence, absolutely convergent series, tests of convergence. Power series: radius of convergence, interval of convergence, Taylor series, binomial theorem. Double integration, iteration, use of polar coordinates, application of double integration to finding area and volume.

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**MAT3621 NUMERICAL METHODS**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>NUMERICAL METHODS</b>   |
| <b>Code:</b>          | <b>MAT3621</b>   |
| <b>NQF level:</b>     | 6  |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  |
| <b>Credits:</b>       | 8  |
| <b>Assessment:</b>    | Continuous assessment 50% (at least 2 tests), examination <b>50%</b> (2 hours examination paper).  |
| <b>Prerequisite:</b>  | Any two of the following three modules: <b>MAT3511</b> (Basic Mathematics), <b>MAT3531</b> (Analytic Geometry, Complex Numbers and Matrices), <b>MAT3512</b> (Precalculus) |

**Module description:** Basics Of MATLAB: arithmetic, decision, functions, graphs (2-3) dimension. Vector (Array) and Matrix Operations: arithmetic, inverse, determinant, Leslie. Limit of Function: limit, sequence, recurrence relation. Processes: discrete, continuous, and stochastic. Differentiation: Euler, difference methods (linear first and second order). Integration: trapezium, midpoint and Simpson.

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**MAT 3642 ORDINARY DIFFERENTIAL EQUATIONS**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>ORDINARY DIFFERENTIAL EQUATIONS</b>   |
| <b>Code:</b>          | <b>MAT 3642</b>  |
| <b>NQF level:</b>     | 6  |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  |
| <b>Credits:</b>       | 8  |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 2 tests), examination <b>50%</b> (2 hours examination paper).   |
| <b>Prerequisite:</b>  | <b>[MAT3511]</b> (Basic Mathematics) and <b>MAT3512</b> (Precalculus)] OR <b>[MAT3531]</b> (Analytic Geometry, Complex Numbers and Matrices) and <b>MAT3512</b> (Precalculus)] |

**Module description** First order equations: initial value problems, separable, exact, homogeneous linear equations: integrating factor. Second order equations: linear homogeneous with constant coefficients: distinct, complex and repeated roots of the characteristic equation; nonhomogeneous equations; method of undetermined coefficients and variation of parameters. Series solution of second order linear equations. Bessel's equation. The Laplace transform: solution of initial value problems, inverse Laplace transform. System of first order linear equations, homogeneous linear system with constant coefficients, nonhomogeneous linear systems.

**THIRD YEAR MODULES**

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**MAT3741 PARTIAL DIFFERENTIAL EQUATIONS**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>PARTIAL DIFFERENTIAL EQUATIONS</b>  |
| <b>Code:</b>          | <b>MAT3741</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  |
| <b>Credits:</b>       | 8  |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 2 tests), examination <b>50%</b> (2 hours examination paper).   |
| <b>Prerequisite:</b>  | MAT3621 (Numerical Methods), MAT3642 (Ordinary Differential Equations) and at least one of the following modules [MAT3611 (Calculus I) or MAT3612 (Calculus II)] |

**Module description:** First order equations: basic properties of the linear equations, solutions of linear equations, the general first order nonlinear equation, applications. Linear second order equations in two independent variables: classification of linear second order equations into parabolic, hyperbolic and elliptic equations. Separation of variables. Examples: the one-dimensional wave equation, the vibrating string, boundary conditions associated with the wave equation.

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**MAT3731: REAL ANALYSIS I**

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|-----------------------|--|
| <b>Module name:</b>   | <b>REAL ANALYSIS I</b>   |
| <b>Code:</b>          | <b>MAT3731</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks   |
| <b>Credits:</b>       | 16   |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 3 tests), examination <b>50%</b> (3 hours examination paper).   |
| <b>Prerequisite:</b>  | Calculus I ( <b>MAT3611</b> ) and Sets and numbers ( <b>MAT3601</b> ) or [Calculus II ( <b>MAT3612</b> ), and Sets and numbers ( <b>MAT3601</b> )] |

**Module description:** The real numbers: upper and lower bounds of a set, supremum and infimum, completeness property of  $\mathbb{R}$ , Archimedean property of  $\mathbb{R}$ , intervals. Sequences and series of real numbers: bounded sequences, monotonic sequences, the limit of a sequence, limit rules, subsequences, theorem of Bolzano–Weierstrass, Cauchy sequences, completeness of  $\mathbb{R}$ , convergent and absolutely convergent series, convergence tests. The limit of a function at a point, limit rules, continuous functions, intermediate value theorem, maximum–minimum theorem, uniform continuity. Differentiation: definition of differentiability, rules of differentiation, mean value theorem, theorem of Taylor.

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**MAT3701 NUMERICAL ANALYSIS I**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>NUMERICAL ANALYSIS I</b>  |
| <b>Code:</b>          | <b>MAT3701</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks<br>1 tutorial per week for 14 weeks   |
| <b>Credits:</b>       | 8  |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 2 tests), examination 50% (2 hours examination paper).  |
| <b>Prerequisite:</b>  | [ <b>MAT3611</b> (Calculus I) and <b>MAT3621</b> (Numerical Methods)] or [ <b>MAT3612</b> (Calculus II) and <b>MAT 3621</b> (Numerical Methods)] |

**Module description:** Computer arithmetic: binary numbers, floating–point arithmetic, the various kinds of errors, propagation of errors. Solving of non–linear equations. Systems of linear equations: Gauss and Gauss–Jordan algorithm, LU decomposition, the condition of a matrix and error estimation. Iterative methods for non – linear systems: Jacobi iteration, Convergence Near Fixed Points, Seidel iteration, error analysis. Interpolation and curve fitting.

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**MAT3721: SET THEORY**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>SET THEORY</b>  |
| <b>Code:</b>          | <b>MAT3721</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  |
| <b>Credits:</b>       | 8  |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 2 tests), examination <b>50%</b> (2 hours examination paper). |
| <b>Prerequisite:</b>  | Sets and Numbers (MAT3601)   |

**Module description:** Ordered pairs and the product of two sets. Functions: definition of a function as a set of ordered pairs, images and preimages, injective, surjective and bijective functions, families of sets, Axiom of Choice. Binary relations: equivalence relations, equivalence classes, transversals, order relations, upper and lower bounds, greatest and least elements, maximal and minimal elements, Zorn's Lemma. Equipotent sets: countable sets, product of two countable sets, countability of  $\mathbb{Q}$ , uncountability of  $\mathbb{R}$ .

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**MAT3711: LINEAR ALGEBRA I**

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>LINEAR ALGEBRA I</b>  |
| <b>Code:</b>          | <b>MAT3711</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks                                       |
| <b>Credits:</b>       | 16   |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 3 tests), examination <b>50%</b> (3 hours examination paper). |
| <b>Prerequisite:</b>  | Sets and Numbers (MAT3601), Elementary Linear Algebra (MAT3652)  |

**Module description:** Vector spaces: definition and examples, subspaces, operations on subspaces, span of a set of vectors, complement of a subspace, Dedekind's law, linearly independent set of vectors, basis and dimension, dimension formula for subspaces. Linear mappings: image and preimage of a subspace, kernel, image, rank and defect, isomorphism, coset, factor space, homomorphism theorem, dimension formula for linear mappings, linear form, the dual.



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**MAT3732: REAL ANALYSIS II**

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**Module name:** REAL ANALYSIS II  
**Code:** MAT3732  
**NQF level:** 7  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination 50% (3 hours examination paper).  
**Prerequisite:** Sets and Numbers (MAT3601) and at least one of the modules Calculus I (MAT3611) and Calculus II (MAT3612).

**Module description:** The Riemann integral: upper and lower Darboux sums, Riemann integrability, rules of integration, the fundamental theorem of calculus, Lebesgue's theorem on Riemann integrability. The Euclidean metric of  $\mathbb{R}^n$ . neighborhoods, open and closed subsets, limit of a sequence, theorem of Bolzano–Weierstrass, completeness of  $\mathbb{R}^n$ . The limit of a function at a point, limit rules, continuous functions. Partial differentiation: gradient, divergence, curl, partial derivatives of higher order. Differentiability of vector-valued functions of several variables: Jacobi matrix,  $C^1$  – functions, chain rule.

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**MAT3622: VECTOR ANALYSIS**

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**Module name:** VECTOR ANALYSIS  
**Code:** MAT3622  
**NQF level:** 6  
**Contact hours:** 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  
**Credits:** 8  
**Assessment:** Continuous assessment 50% (at least 2 tests), examination **50%** (2 hours examination paper).  
**Prerequisite:** Sets and Numbers (MAT3601) and at least one of the modules Calculus I (MAT3611) and Calculus II (MAT3612)

**Module description:** Vector fields, Line, surface and volume integrals, parametric representation of surfaces, Green's theorem, Stokes theorem, Divergence theorem, applications.

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**MAT3722: NUMBER THEORY**

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**Module name:** NUMBER THEORY  
**Code:** MAT3722  
**NQF level:** 7  
**Contact hours:** 2 lectures per week for 14 weeks  
1 tutorial per week for 14 weeks  
**Credits:** 8  
**Assessment:** Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).  
**Prerequisite:** Sets and Numbers (MAT3601)

**Module description:** Divisibility of integers, Euclidean division, greatest common divisor and least common multiple of a set of integers, Euclid's algorithm, primes numbers,  $p$ -exponents, the Fundamental Theorem of Arithmetic.

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**MAT3712: LINEAR ALGEBRA II**

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**Module name:** LINEAR ALGEBRA II  
**Code:** MAT3712  
**NQF level:** 7  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** Sets and Numbers (MAT3601), Elementary Linear Algebra (MAT3652)

**Module description:** Endomorphisms: involution, projection, eigenvalue, eigenvector, eigenspace. Matrix theory: representation of a linear mapping by a matrix, change of basis, similar matrices. Euclidean vector spaces: scalar product, norm of a vector, Cauchy–Schwarz inequality, orthogonal basis, orthonormal basis, orthogonal mappings. Determinantal forms, determinant of an endomorphism, characteristic polynomial.

## FOURTH YEAR MODULES

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### MAT3811: GENERAL TOPOLOGY

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**Module name:** GENERAL TOPOLOGY  
**Code:** MAT3811  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment 50% (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** Real Analysis I (MAT3731) or Real Analysis II (MAT3732)  
**Module description:** Topological spaces: topologies on a set, topological space, open set, closed set, boundary, neighbourhood, neighbourhood filter, accumulation point, derived set, dense set, nowhere dense set, cluster points and limits of a sequence, separation axioms, continuous function, connected subset, connected subsets of the real line, quasicompact space, compact space, theorem of Heine–Borel. Metric spaces: metric on a set, metric space, topology induced by a metric, distance between a point and a subset, Cauchy sequence, completeness.

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### MAT3831: ALGEBRA

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**Module name:** ALGEBRA  
**Code:** MAT3831  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination 50% (3 hours examination paper).  
**Prerequisite:** Linear Algebra I (MAT3711) or Linear Algebra II (MAT3712)  
**Module description:** Binary operations: properties of binary operations, powers, semigroup, monoid. Groups: definition and examples, subgroup, subgroup generated by a subset, cyclic group, finitely generated group, homomorphism, normal subgroup, factor group, isomorphism, automorphism, homomorphism theorem, conjugacy classes of an element, conjugacy class of a subgroup. Rings: definition and examples, endomorphism ring of an abelian group, characteristic, subring, homomorphism, ideal, isomorphism, homomorphism theorem, principal ideal domain, polynomial ring.

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### MAT3851: COMPLEX ANALYSIS I

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**Module name:** COMPLEX ANALYSIS I  
**Code:** MAT3851  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment 50% (at least 3 tests), examination 50% (3 hours examination paper).  
**Prerequisite:** MAT3731 or MAT3732  
**Module description:** The field  $\mathbb{C}$  of the complex numbers: construction of  $\mathbb{C}$ , absolute value, modulus–argument form, roots of unity, non–orderability of  $\mathbb{C}$ , complex number plane. Sequences and series: bounded sequence, convergent sequence, theorem of Bolzano–Weierstrass, completeness of  $\mathbb{C}$ , convergent series, absolutely convergent series, rearrangement of a series, product of two series, Cauchy product.

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### MAT3822: NORMED VECTOR SPACES

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**Module name:** NORMED VECTOR SPACES  
**Code:** MAT3822  
**NQF level:** 8  
**Contact hours:** 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  
**Credits:** 8  
**Assessment:** Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).  
**Prerequisite:** (MAT3731 or MAT3732) and (MAT3711 or MAT3712)  
**Module description:** Definition of a normed vector space and examples, closed subspaces, continuity of linear mappings, Banach spaces, Hilbert spaces, the dual of a normed vector space, theorem of Hahn–Banach.

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### MAT3832: NUMERICAL ANALYSIS II

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**Module name:** NUMERICAL ANALYSIS II  
**Code:** MAT3832  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** MAT3611 (Calculus I), MAT3612 (Calculus II) and MAT3701 (Numerical Analysis I)  
**Module description:** Approximation: linear and nonlinear approximations, uniform approximation, Legendre and Chebychev polynomials, splines, discrete least-squares and the QR–factorizations, Norms and the analysis of errors. Optimization: first and second order Taylor approximations, the steepest descent method, zeroing the gradient and the conjugate gradient method. Numerical integration: Newton–Cotes formulae, Romberg method, Gaussian quadrature. Ordinary Differential Equations: Euler method, Runge–Kutta method, Numerical Methods for Boundary Value Problems: shooting method and finite difference method.

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**MAT3852: COMPLEX ANALYSIS II**

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**Module name:** COMPLEX ANALYSIS II

**Code:** MAT3852

**NQF level:** 8

**Contact hours:** 4 lectures per week for 14 weeks

2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** MAT3731 or MAT3732

**Module description:** Differentiation: definition, rules of differentiation, Cauchy–Riemann equations. Holomorphic functions: definition, mean value inequality. Power series: set of convergence, radius of convergence, Abel's Lemma, differentiability of the sum of a power series, exponential function, circular functions, Euler's formula. Integral of a continuous complex-valued function, rules of integration, standard estimate, fundamental theorem, path, operation on paths, rectifiable path, piecewise  $C^1$ -path, path integral, Goursat's Lemma, star-shaped region, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, analyticity of holomorphic functions, Liouville's theorem, fundamental theorem of algebra, isolated singularities, Laurent series, residue, residue theorem.

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**MAT3802: CATEGORY THEORY**

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**Module name:** CATEGORY THEORY

**Code:** MAT3802

**NQF level:** 8

**Contact hours:** 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks

**Credits:** 8

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

**Prerequisite:** All mathematics modules up to third year.

**Module description:** Definition and examples of categories, sections, retractions, monic and epic morphisms, functors, natural transformations, products and coproducts, representable functors, Yoneda's lemma.

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**MAT3810: RESEARCH PROJECT**

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**Module name:** RESEARCH PROJECT

**Code:** MAT3810

**NQF level:** 8

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 32

**Assessment:** Continuous assessment **100%** 30% (Assignments)

Examination 70% (oral presentation of written project 20%, written project 80%)

**Prerequisite:** All modules of mathematics up to third year level.

**Module description:** The student will be requested to study a specific problem in mathematics. Although, depending on the magnitude of the problem, the student might not be able to solve the problem, he is expected to find out how much is known about that problem. In the process the student will learn some mathematics required to understand and to solve the problem.

### H.1.3 DEPARTMENT OF MATHEMATICS: COURSE EQUIVALENTS

| OLD MODULES                                  | NEW MODULES (STARTED 2008)                               |
|--|--|
| MTS3101: Mathematics 1A                      | MAT3511: Basic Mathematics                               |
| MTS3121: Analytic Geometry & Complex Numbers | MAT3531: Analytic Geometry, Complex numbers and Matrices |
| MTS3132: Foundation Mathematics              | MAT3512: Precalculus                                     |
| MTS3112: Mathematics 1B                      | None   |
| MTS3211: Calculus I                          | MAT3611: Calculus I                                      |
| MTS3232: Calculus II                         | MAT3612: Calculus II                                     |
| MTS3201: Sets and Numbers                    | MAT3601: Sets and Numbers                                |
| MTS3222: Elementary Linear Algebra           | MAT3652: Elementary Linear Algebra                       |
| None   | MAT3621: Numerical Methods                               |
| MTS3321: Linear Algebra I                    | MAT3711: Linear Algebra I                                |
| MTS3312: Linear algebra II                   | MAT3712: Linear algebra II                               |
| MTS3311: Real Analysis I                     | MAT3731: Real Analysis I                                 |
| MTS3322: Real Analysis II                    | MAT3732: Real Analysis II                                |
| MTS3381: Ordinary Differential Equations     | MAT3642: Ordinary Differential Equations                 |
| MTS3362: Numerical Analysis I                | MAT3701: Numerical Analysis I                            |
| None   | MAT3622: Vector Analysis                                 |
| None   | MAT3722: Number Theory                                   |
| None   | MAT3721 Set Theory                                       |
| MTS3411: Algebra                             | MAT3831: Algebra   |
| MTS3431: General Topology                    | MAT3811: General Topology                                |
| MTS3432: Complex Analysis                    | MAT3851: Complex Analysis I                              |
| None   | MAT3852: Complex Analysis II                             |
| MTS3412: Numerical Analysis II               | MAT3832: Numerical Analysis II                           |
| MTS3422: Partial Differential Equations      | MAT3741: Partial Differential Equations                  |
| None   | MAT3822: Normed Vector Spaces                            |
| None   | MAT3802: Category Theory                                 |
| None   | MAT3810: Research Project                                |

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**H.2. B.Sc. IN FINANCIAL MATHEMATICS (HONOURS)**

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**H.2.1. B.Sc. IN FINANCIAL MATHEMATICS (HONOURS): CURRICULUM AND PREREQUISITES**

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**QUALIFICATION: B.Sc.in Financial Mathematics (Honours) (11BFMA)**Students opting for B.Sc. in **Financial Mathematics** (Honours) must take all the following modules:**YEAR 1**

| SEMESTER | MODULE  | CODE    | PRE-/COREQUISITES             |
|----------|---|---------|-------------------------------|
| 1        | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1        | Basic Mathematics                               | MAT3511 | Faculty entry requirements    |
| 1        | Computer Literacy                               | CLC3509 | University entry requirements |
| 1        | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | Faculty Entry Requirements    |
| 1        | Basic Microeconomics                            | EMI3571 | Faculty Entry Requirements    |

| SEMESTER | MODULE                        | CODE    | PRE-/COREQUISITES             |
|----------|-------------------------------|---------|-------------------------------|
| 2        | English for Academic Purposes | LEA3519 | Co-requisite: LCE3519         |
| 2        | Contemporary Social Issues    | CSI3529 | University Entry Requirements |
| 2        | Precalculus                   | MAT3512 | Faculty Entry Requirements    |
| 2        | Basic Financial Mathematics   | MAF3532 | Faculty entry requirements    |
| 2        | Mathematical Statistics       | MAF3552 | Faculty entry requirements    |
| 2        | Basic Macroeconomics          | EMA3572 | Faculty entry requirements    |

**YEAR 2**

| SEMESTER | MODULE                  | CODE    | PRE-/COREQUISITES                                  |
|----------|-------------------------|---------|--|
| 1        | Calculus I              | MAT3611 | Any two full modules of Math courses in First year |
| 1        | Probability theory      | STS3611 | MAF3532  |
| 1        | Numerical Methods       | MAT3621 | MAT3531  |
| 1        | Financial Mathematics I | MAF3651 | MAF3532  |
| 1        | Economics I             | MAF3671 | EMA3572, EMI3571                                   |

| SEMESTER | MODULE                          | CODE    | PRE-/COREQUISITES                                  |
|----------|---------------------------------|---------|--|
| 2        | Calculus II                     | MAT3612 | Any two full modules of Math courses in First year |
| 2        | Ordinary Differential Equations | MAT3642 | MAT3531, MAT3512                                   |
| 2        | Financial Mathematics II        | MAF3652 | MAF3532  |
| 2        | Economics II                    | MAF3672 | EMA3572,EMI3571                                    |
| 2        | Statistical Inference           | STS3632 | MAF3532  |

**YEAR 3**

| SEMESTER | MODULE                         | CODE    | PRE-/COREQUISITES                |
|----------|--------------------------------|---------|----------------------------------|
| 1        | Real Analysis I                | MAT3731 | MAT3611 and MAT3612              |
| 1        | Assets and Liabilities         | MAF3751 | MAF 3651 and MAF3652             |
| 1        | Numerical Analysis I           | MAT3701 | [MAT3611 or MAT3612] and MAT3621 |
| 1        | Partial Differential Equations | MAT3741 | [MAT3611 or MAT3612] and MAT3642 |
| 1        | Distribution Theory            | STS3721 | STS3611, STS3632                 |

| SEMESTER | MODULE                | CODE    | PRE-/COREQUISITES   |
|----------|-----------------------|---------|---------------------|
| 2        | Real Analysis II      | MAT3732 | MAT3611 and MAT3612 |
| 2        | Mathematical Modeling | MAF3752 | MAT3642 and MAT3621 |
| 2        | Financial modeling    | MAF3782 | MAT3642 and MAT3621 |
| 2        | Risk Theory           | MAF3732 | MAF3651 and MAF3652 |
| 2        | Programming           | MAF3742 | MAT3621             |
| 2        | Research Methodology  | MAF3722 | STS3611, STS3632    |

**YEAR 4**

| SEMESTER | MODULE               | CODE    | PRE-/COREQUISITES            |
|----------|----------------------|---------|------------------------------|
| 1        | Research Project     | MAF3810 | All modules up to third year |
| 1        | Dynamical systems    | MAF3881 | MAF3751 and MAF3732          |
| 1        | Risk management      | MAF3831 | MAF3751 and MAF3732          |
| 1        | Stochastic processes | STS3831 | STS3721 and MAF3732          |
| 1        | Mathematical methods | MAF3821 | MAF3671 and MAF3672          |
|          |                      |         |                              |

| SEMESTER | MODULE                          | CODE    | PRE-/COREQUISITES            |
|----------|---------------------------------|---------|------------------------------|
| 2        | Research Project                | MAF3810 | All modules up to third year |
| 2        | Stochastic calculus and Finance | MAF3812 | MAF3751 and MAF3732          |
| 2        | Operations research             | MAF3842 | STS3721 and MAF3732          |
| 2        | Numerical Analysis II           | MAT3832 | MAT3732 and MAT3701          |
| 2        | International business Finance  | MAF3862 | MAF3732 and MAF3751          |

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## H.2.2. B.SC. IN FINANCIAL MATHEMATICS (HONOUR CURRICULUM MODULE DESCRIPTIONS)

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### FIRST YEAR MODULES:

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#### MAT3511: BASIC MATHEMATICS

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**Module name:** BASIC MATHEMATICS

**Code:** MAT3511

**NQF level:** 5

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** Faculty Entry Requirements

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

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#### MAT3531: ANALYTIC GEOMETRY, COMPLEX NUMBERS AND MATRICES

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**Module name:** ANALYTIC GEOMETRY, COMPLEX NUMBERS AND MATRICES

**Code:** MAT3531

**NQF level:** 5

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** Faculty Entry Requirements

**Module description:** Points and lines in a plane: the distance formula, the triangle inequality, parallel and perpendicular lines, circles and tangent lines. Conic sections: ellipse, parabola, hyperbola. Vectors in two and three dimensions: addition of vectors, multiplication by a scalar, magnitude, dot product, cross product. Matrices: addition, multiplication, scalar multiplication and transpose (for up to  $3 \times 3$  dimension), determinant and inverse (with emphasis on  $2 \times 2$ ), solutions of systems of linear equations by Cramer's rule (for  $2 \times 2$ ), and by Gaussian elimination method (for up to  $3 \times 3$  matrices). Complex numbers: operations on complex numbers, the complex conjugate, Argand diagram, modulus-argument form, de Moivre's formula, fundamental theorem of algebra.

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#### MAT3512: PRECALCULUS

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**Module name:** PRECALCULUS

**Code:** MAT3512

**NQF level:** 5

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** Faculty Entry Requirements

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

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**MAF 3552: MATHEMATICAL STATISTICS**

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**Module name:** MATHEMATICAL STATISTICS

**Code:** MAT3552

**NQF level:** 5

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** Faculty Entry Requirements

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

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**MAF 3532: BASIC FINANCIAL MATHEMATICS**

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**Module name:** BASIC FINANCIAL MATHEMATICS

**Code:** MAT3532

**NQF level:** 5

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** Faculty Entry Requirements

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

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**SECOND YEAR MODULES**

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**MAT3611: CALCULUS I**

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**Module name:** CALCULUS I

**Code:** MAT3611

**NQF level:** 6

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** [MAT3511 (Basic Mathematics) and MAT3512 (Precalculus)] OR

[MAT3531 (Analytic Geometry, Complex Numbers and Matrices)]

**Module description:** Limits and continuity of functions: limit at a point, improper limit, continuity. Derivatives: definition, rules of differentiation, chain rule, derivatives of higher order, derivative of the inverse function, Arc functions (inverse trigonometric functions), hyperbolic functions, area functions (inverse hyperbolic functions). Exponential and logarithmic functions. Some applications of the exponential functions: growth and decay, Rolle's Theorem, Mean Value theorem. Applications of the derivative: l'Hospital's rule, related rates, concavity. Integration: antiderivatives, integration by substitution, the fundamental theorem of calculus, area of a region bounded by graphs.

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**MAF3651: FINANCIAL MATHEMATICS I**

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**Module name:** FINANCIAL MATHEMATICS I

**Code:** MAT3651

**NQF level:** 6

**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks

**Credits:** 16

**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

**Prerequisite:** MAF3532

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

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**MAF3671: ECONOMICS I**

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

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

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**MAT3612 CALCULUS II**

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**Module name:** CALCULUS II  
**Code:** MAT3612  
**NQF level:** 6  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** [MAT3511 (Basic Mathematics) and MAT3512 (Precalculus)] or [MAT3531 (Analytic Geometry, Complex Numbers and Matrices) and MAT3512 (Precalculus)]

**Module description:** Integration: Riemann sums, approximations of the Riemann integral using the trapezoidal rule and Simpson's rule. Integration techniques: integration by parts, integration of rational functions. Improper integrals, Applications of the Riemann integral: volume of a solid of revolution, arc length, surface of revolution. Partial differentiation, chain rule, directional derivative. Classification of critical points for two-variable functions, Sequences and series of numbers: the limit of a sequence, absolutely convergent series, tests of convergence. Power series: radius of convergence, interval of convergence, Taylor series, binomial theorem. Double integration, iteration, use of polar coordinates, application of double integration to finding area and volume.

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**MAT3621 NUMERICAL METHODS**

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**Module name:** NUMERICAL METHODS  
**Code:** MAT3621  
**NQF level:** 6  
**Contact hours:** 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  
**Credits:** 8  
**Assessment:** Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).  
**Prerequisite:** Any two of the following three modules: MAT3511 (Basic Mathematics), MAT3531 (Analytic Geometry, Complex Numbers and Matrices), MAT3512 (Precalculus)

**Module description:** Basics Of MATLAB: arithmetic, decision, functions, graphs (2-3) dimension. Vector (Array) and Matrix Operations: arithmetic, inverse, determinant, Leslie. Limit of Function: limit, sequence, recurrence relation. Processes: discrete, continuous, and stochastic. Differentiation: Euler, difference methods (linear first and second order). Integration: trapezium, midpoint and Simpson.

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**MAT3642 ORDINARY DIFFERENTIAL EQUATIONS**

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**Module name:** ORDINARY DIFFERENTIAL EQUATIONS  
**Code:** MAT3642  
**NQF level:** 6  
**Contact hours:** 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  
**Credits:** 8  
**Assessment:** Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).  
**Prerequisite:** [MAT3511 (Basic Mathematics) and MAT3512 (Precalculus)] OR [MAT3531 (Analytic Geometry, Complex Numbers and Matrices) and MAT3512 (Precalculus)]

**Module description** First order equations: initial value problems, separable, exact, homogeneous linear equations: integrating factor. Second order equations: linear homogeneous with constant coefficients: distinct, complex and repeated roots of the characteristic equation; nonhomogeneous equations; method of undetermined coefficients and variation of parameters. Series solution of second order linear equations. Bessel's equation. The Laplace transform: solution of initial value problems, inverse Laplace transform. System of first order linear equations, homogeneous linear system with constant coefficients, nonhomogeneous linear systems.



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**MAF 3652: FINANCIAL MATHEMATICS II**

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

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

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**MAF 3671: ECONOMICS II**

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

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

### THIRD YEAR MODULES

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#### MAT3741 PARTIAL DIFFERENTIAL EQUATIONS

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|                       |  |
|-----------------------|--|
| <b>Module name:</b>   | <b>PARTIAL DIFFERENTIAL EQUATIONS</b>  |
| <b>Code:</b>          | <b>MAT3741</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks  |
| <b>Credits:</b>       | 8  |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 2 tests), examination <b>50%</b> (2 hours examination paper).   |
| <b>Prerequisite:</b>  | MAT3621 (Numerical Methods), MAT3642 (Ordinary Differential Equations) and at least one of the following modules [MAT3611 (Calculus I) or MAT3612 (Calculus II)] |

**Module description:** First order equations: basic properties of the linear equations, solutions of linear equations, the general first order nonlinear equation, applications. Linear second order equations in two independent variables: classification of linear second order equations into parabolic, hyperbolic and elliptic equations. Separation of variables. Examples: the one-dimensional wave equation, the vibrating string, boundary conditions associated with the wave equation.

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#### MAT3731: REAL ANALYSIS I

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|-----------------------|--|
| <b>Module name:</b>   | <b>REAL ANALYSIS I</b>   |
| <b>Code:</b>          | <b>MAT3731</b>   |
| <b>NQF level:</b>     | 7  |
| <b>Contact hours:</b> | 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks   |
| <b>Credits:</b>       | 16   |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 3 tests), examination <b>50%</b> (3 hours examination paper).   |
| <b>Prerequisite:</b>  | Calculus I ( <b>MAT3611</b> ) and Sets and numbers ( <b>MAT3601</b> ) or [Calculus II ( <b>MAT3612</b> ), and Sets and numbers ( <b>MAT3601</b> )] |

**Module description:** The real numbers: upper and lower bounds of a set, supremum and infimum, completeness property of  $\mathbb{R}$ , Archimedean property of  $\mathbb{R}$ , intervals. Sequences and series of real numbers: bounded sequences, monotonic sequences, the limit of a sequence, limit rules, subsequences, theorem of Bolzano–Weierstrass, Cauchy sequences, completeness of  $\mathbb{R}$ , convergent and absolutely convergent series, convergence tests. The limit of a function at a point, limit rules, continuous functions, intermediate value theorem, maximum–minimum theorem, uniform continuity. Differentiation: definition of differentiability, rules of differentiation, mean value theorem, theorem of Taylor.

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#### MAT3701 NUMERICAL ANALYSIS I

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|                       |   |
|-----------------------|---|
| <b>Module name:</b>   | <b>NUMERICAL ANALYSIS I</b>   |
| <b>Code:</b>          | <b>MAT3701</b>  |
| <b>NQF level:</b>     | 7   |
| <b>Contact hours:</b> | 2 lectures per week for 14 weeks 1 tutorial per week for 14 weeks   |
| <b>Credits:</b>       | 8   |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 2 tests), examination <b>50%</b> (2 hours examination paper).  |
| <b>Prerequisite:</b>  | [ <b>MAT3611</b> (Calculus I) and <b>MAT3621</b> (Numerical Methods)] or [ <b>MAT3612</b> (Calculus II) and <b>MAT3621</b> (Numerical methods)] |

**Module description:** Computer arithmetic: binary numbers, floating–point arithmetic, the various kinds of errors, propagation of errors. Solving of non-linear equations. Systems of linear equations: Gauss and Gauss–Jordan algorithm, LU decomposition, the condition of a matrix and error estimation. Iterative methods for non-linear systems: Jacobi iteration, Convergence Near Fixed Points, Seidel iteration, error analysis. Interpolation and curve fitting.

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#### MAF 3751: ASSETS AND LIABILITIES

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

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

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**MAF 3732: REAL ANALYSIS II**

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|                       |   |
|-----------------------|---|
| <b>Module name:</b>   | <b>REAL ANALYSIS II</b>   |
| <b>Code:</b>          | <b>MAT3732</b>  |
| <b>NQF level:</b>     | 7   |
| <b>Contact hours:</b> | 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  |
| <b>Credits:</b>       | 16  |
| <b>Assessment:</b>    | Continuous assessment <b>50%</b> (at least 3 tests), examination <b>50%</b> (3 hours examination paper).  |
| <b>Prerequisite:</b>  | Sets and Numbers (MAT3601) and at least one of the modules Calculus I (MAT3611) and Calculus II (MAT3612) |

**Module description:** The Riemann integral: upper and lower Darboux sums, Riemann integrability, rules of integration, the fundamental theorem of calculus, Lebesgue's theorem on Riemann integrability. The Euclidean metric of  $\mathbb{R}^n$ . neighborhoods, open and closed subsets, limit of a sequence, theorem of Bolzano–Weierstrass, completeness of  $\mathbb{R}^n$ . The limit of a function at a point, limit rules, continuous functions. Partial differentiation: gradient, divergence, curl, partial derivatives of higher order. Differentiability of vector-valued functions of several variables: Jacobi matrix,  $C^1$  – functions, chain rule.

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**MAF 3752: MATHEMATICAL MODELING**

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

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

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**MAF3782: FINANCIAL MODELING**

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

**Module description:** The module will examine the tools built in to Excel and VBA and their use in financial modeling. The tools will be introduced 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.

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**MAF3732: RISK THEORY**

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

**Module description** Loss distribution (Lognormal, Weibul, Gamma, Pareto, Negative Exponential and the like) and MLE's (Maximum Likelihood 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, likelihood 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, Bayes criteria); Generalized Linear Models.

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**MAF3742: PROGRAMMING**

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

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

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**MAF3722: RESEARCH METHODOLOGY**

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

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

## FOURTH YEAR MODULES

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### MAF3881: DYNAMICAL SYSTEMS

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

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

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### MAF3831: RISK MANAGEMENT

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**Module name:** RISK MANAGEMENT  
**Code:** MAF3831  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** MAF3751, MAF3732

**Module description** Market risk: foreign exchange futures, swaps and options. Pricing relationships and contract structures. Measuring risk exposures and using derivatives to manage risks. Interest rate futures, FRAs, swaps and options. Alternative methods for estimating yield curves. Use of the yield curve for pricing cash flows. Using derivatives to manage risk. Financial engineering using derivatives. Liquidity risk. Value at Risk. Estimating Var including extreme value theory and alternative simulation methods.

Credit Risk: credit rating, events of default, default probabilities. Structural and Reduced form models of credit risk. Structural models: Merton and KMV models. Bond Models: credit spreads. Transition probabilities. Correlations and default dependencies. Estimating losses given default. Copula approaches to estimating defaults. Portfolio models of credit risk. Creditmetrics, CreditRisk+, KMV. Stress testing. Managing credit risk using credit derivatives. Limitations and risk of credit derivatives. Combining market and credit risks.

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### MAF3821: MATHEMATICAL METHODS

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

**Module description:** Linear regression (univariate, bivariate, multivariate), 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.

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### MAT3832: NUMERICAL ANALYSIS II

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**Module name:** NUMERICAL ANALYSIS II  
**Code:** MAT3832  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 16  
**Assessment:** Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).  
**Prerequisite:** MAT3611 (Calculus I), MAT3612 (Calculus II) and MAT3701 (Numerical Analysis I)

**Module description:** Approximation: linear and nonlinear approximations, uniform approximation, Legendre and Chebychev polynomials, splines, discrete least-squares and the QR-factorizations, Norms and the analysis of errors. Optimization: first and second order Taylor approximations, the steepest descent method, zeroing the gradient and the conjugate gradient method. Numerical integration: Newton-Cotes formulae, Romberg method, Gaussian quadrature. Ordinary Differential Equations: Euler method, Runge-Kutta method, Numerical Methods for Boundary Value Problems: shooting method and finite difference method.

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**MAF3812: STOCHASTIC CALCULUS AND FINANCE**

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

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**MAF3842: OPERATIONS RESEARCH**

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

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**MAF3862: INTERNATIONAL BUSINESS FINANCE**

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

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**MAF3810: RESEARCH PROJECT**

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**Module name:** RESEARCH PROJECT  
**Code:** MAF3810  
**NQF level:** 8  
**Contact hours:** 4 lectures per week for 14 weeks 2 tutorials per week for 14 weeks  
**Credits:** 32  
**Assessment:** Continuous assessment **100%** 30% (Assignments)  
Examination 70% (oral presentation of written project 20%, written project 80%)  
**Prerequisite:** All modules up to third year level.  
**Module description:** The student will be required to undertake a research project and submit a dissertation. Students will work under the supervision on a research project of their own choice relevant to the industry that they will be attached to work on the project.

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**I. DEPARTMENT OF PHYSICS**

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**I.1 PHYSICS MAJOR**

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**I.1.1. B.Sc. HONOURS MAJORS AND MINORS, CURRICULUM AND PREREQUISITES**

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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    | PRE-/CO-REQUISITES  |
|----------|---|---------|---|
| 1        | English Communication & Study Skills          | LCE3519 | University entry requirements   |
| 1        | Computer Literacy                             | CLC3509 | University entry requirements   |
| 1        | Physics for Physical Sciences I               | PHY3511 | NSSC/IGCSE Physical Science <b>and</b> Mathematics ( <b>C-symbols</b> ) |
| SEMESTER | MINOR MODULES                                 |         |   |
| 1        | Basic Mathematics                             | MAT3511 | Faculty entry requirements  |
| 1        | Analytic Geometry, Matrices & Complex Numbers | MAT3531 | Faculty entry requirements  |
| 1        | Programming Fundamentals I                    | CMP3511 | Departmental Entry Test   |

| SEMESTER | MODULE                           | CODE    | PRE-/CO-REQUISITES  |
|----------|----------------------------------|---------|---|
| 2        | English for Academic Purposes    | LEA3519 | Co-requisite: LCE3519   |
| 2        | Contemporary Social Issues       | CSI3529 | University Entry Requirements   |
| 2        | Physics for Physical Sciences II | PHY3512 | NSSC/IGCSE Physical Science <b>and</b> Mathematics ( <b>C-symbols</b> ) |
| SEMESTER | MINOR MODULES                    |         |   |
| 2        | Precalculus                      | MAT3512 | NSSC/IGCSE Mathematics  |
| 2        | Programming Fundamentals II      | CMP3512 | CMP3511 Programming Fundamentals I                                      |

**YEAR 2**

| SEMESTER | MODULE                      | CODE    | PRE-/CO-REQUISITES                                       |
|----------|-----------------------------|---------|--|
| 1        | Classical Mechanics         | PHY3611 | PHY3511, MAT3511, MAT3512                                |
| 1        | Waves & Optics              | PHY3631 | PHY3511, PHY3512   |
| SEMESTER | Minor modules               |         |  |
| 1        | Sets & Numbers              | MAT3601 | Any <b>two</b> from following: MAT3511, MAT3512, MAT3531 |
| 1        | Calculus I                  | MAT3611 | Either [MAT3511 & MAT3512] <b>or</b> [MAT3512 & MAT3531] |
| 1        | Numerical Methods           | MAT3621 | Any <b>two</b> from following: MAT3511, MAT3512, MAT3531 |
| 1        | Object Oriented Programming | CMP3631 | CMP3511  |

| SEMESTER | MODULE                          | CODE    | PRE-/CO-REQUISITES                                       |
|----------|---------------------------------|---------|--|
| 2        | Electromagnetism                | PHY3612 | PHY3512, MAT3511, MAT3512                                |
| 2        | Modern Physics I                | PHY3602 | PHY3511, PHY3512, MAT3511, MAT3512                       |
| SEMESTER | Minor modules                   |         |  |
| 2        | Calculus II                     | MAT3612 | Either [MAT3511 & MAT3512] <b>or</b> [MAT3512 & MAT3531] |
| 2        | Ordinary Differential Equations | MAT3642 | Either [MAT3511 & MAT3512] <b>or</b> [MAT3512 & MAT3531] |
| 2        | Elementary Linear Algebra       | MAT3652 | Any <b>two</b> from following: MAT3511, MAT3512, MAT3531 |
| 2        | Data Structures & Algorithms    | CMP3612 | CMP3631  |

**YEAR 3**

| SEMESTER             | MODULE                          | CODE    | PRE-/CO-REQUISITES                                |
|----------------------|---------------------------------|---------|---|
| 1                    | Electrodynamics                 | PHY3711 | PHY3612, MAT3612                                  |
| 1                    | Thermodynamics & Kinetic Theory | PHY3701 | PHY3611, MAT3612                                  |
| 1                    | Computational Physics with C++  | PHY3721 | MAT3612   |
| <b>Minor modules</b> |                                 |         |   |
| 1                    | Real Analysis I                 | MAT3731 | [MAT3611 <b>or</b> MAT3612]<br><b>and</b> MAT3601 |
| 1                    | Linear Algebra I                | MAT3711 | MAT3601, MAT3652                                  |

| SEMESTER             | MODULE                | CODE    | PRE-/CO-REQUISITES                                |
|----------------------|-----------------------|---------|---|
| 2                    | Theoretical Mechanics | PHY3712 | PHY3611, MAT3612, MAT3642, MAT3652                |
| 2                    | Modern Physics II     | PHY3732 | PHY3602   |
| 2                    | Electronics I         | PHY3702 | PHY3512   |
| 2                    | Research Methodology  | PHY3722 | PHY3612   |
| <b>Minor modules</b> |                       |         |   |
| 2                    | Real Analysis II      | MAT3732 | [MAT3611 <b>or</b> MAT3612]<br><b>and</b> MAT3601 |

A student may replace the full module **MAT3732 (Real Analysis II)** with the combination of **two** half modules (**MAT3622 Vector Analysis** **and** **MAT3722 (Number Theory)**).

**YEAR 4**

| SEMESTER | MODULE                   | CODE     | PRE-/CO-REQUISITES   |
|----------|--------------------------|----------|--|
| 1        | Quantum Mechanics        | PHY3811  | PHY3712, PHY3732   |
| 1        | Statistical Mechanics    | PHY3831  | PHY3611, PHY3701   |
| 1        | Research Project         | PHY3810  | PHY3711, PHY3712   |
| 1        | Advanced Electrodynamics | PHY3809  | PHY3711  |
| 1        | Plasma Physics           | PHY3821  | PHY3711  |
| 1        | *Energy Physics          | *PHY3861 | *PHY3701 (This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.) |

| SEMESTER | MODULE                           | CODE     | PRE-/COREQUISITES |
|----------|----------------------------------|----------|-------------------|
| 2        | Solid State Physics              | PHY3812  | PHY3701, PHY3732  |
| 2        | Research Project                 | PHY3810  | PHY3711, PHY3712  |
| 2        | Nuclear Physics                  | PHY3802  | PHY3732           |
| 2        | Optics and Laser Physics         | PHY3822  | PHY3631, PHY3711  |
| 2        | Astrophysics                     | PHY3842  | PHY3732           |
| 2        | Advanced Potential Field Methods | PHY3862  | PHY3711           |
| 2        | *Electronics II                  | *PHY3829 | PHY3702           |

\*(This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.)



**QUALIFICATION: B.Sc. Honours Physics Major and Geology Minor (11BPHG)**

Students opting for a major in **Physics** (with Geology minor) must take all of the following modules:

**YEAR 1**

| SEMESTER              | MODULE   | CODE    | PRE-/COREQUISITES   |
|-----------------------|--|---------|---|
| 1                     | English Communication & Study Skills                   | LCE3519 | University entry requirements   |
| 1                     | Basic Mathematics                                      | MAT3511 | NSSC/IGCSE Mathematics  |
| 1                     | Computer Literacy                                      | CLC3509 | University entry requirements   |
| 1                     | Physics for Physical Science I                         | PHY3511 | NSSC/IGCSE Physical Science <b>and</b> Mathematics <b>(C-symbols)</b> |
| 1                     | Analytic Geometry, Complex Numbers and Matrices        | MAT3531 | NSSC/IGCSE Mathematics  |
| <b>Geology Minor:</b> |  |         |   |
| 1                     | Introduction to Physical Geology and surface processes | GLY3521 | NSSC/IGCSE Maths <b>(C-symbol)</b>                                    |

| SEMESTER              | MODULE                          | CODE    | PRE-/COREQUISITES   |
|-----------------------|---------------------------------|---------|---|
| 2                     | English for Academic Purposes   | LEA3519 | Co-requisite: LCE3519   |
| 2                     | Contemporary Social Issues      | CSI3529 | University Entry Requirements   |
| 2                     | Pre-calculus                    | MAT3512 | NSSC/IGCSE Mathematics  |
| 2                     | Physics for Physical Science II | PHY3512 | NSSC/IGCSE Physical Science <b>and</b> Mathematics <b>(C-symbols)</b> |
| 2                     | Introduction to Probability     | STS3532 | NSSC/IGCSE Maths <b>(C-symbol)</b>                                    |
| <b>Geology Minor:</b> |                                 |         |   |
| 2                     | Introduction to Earth systems   | GLY3502 | NSSC/IGCSE Maths <b>(C-symbol)</b>                                    |

**YEAR 2**

| SEMESTER              | MODULE                    | CODE    | PRE-/COREQUISITES   |
|-----------------------|---------------------------|---------|---|
| 1                     | Classical Mechanics       | PHY3611 | PHY3511; MAT3511; MAT3512                                   |
| 1                     | Waves and Optics          | PHY3631 | PHY3211; PHY3512  |
| 1                     | Calculus I                | MAT3611 | [MAT3511 & MAT3512] <b>or</b> [MAT3531 & MAT3512]           |
| 1                     | Sets and Numbers          | MAT3601 | any two of the following modules: MAT3511; MAT3531; MAT3512 |
| 1                     | Numerical Methods         | MAT3621 | Any two of the following modules: MAT3511; MAT3531; MAT3512 |
| <b>Geology Minor:</b> |                           |         |   |
| 1                     | Introduction to hydrology | GLY3621 | <b>GLY3521</b> & MAT3512                                    |
| 1                     | Earth Resources           | GLY3641 | <b>GLY3521</b>  |

| SEMESTER              | MODULE                              | CODE    | PRE-/COREQUISITES   |
|-----------------------|-------------------------------------|---------|---|
| 2                     | Electromagnetism                    | PHY3612 | PHY3512; MAT3511; MAT3512                                   |
| 2                     | Modern Physics I                    | PHY3602 | PHY3511; PHY3512; MAT3511; MAT3512                          |
| 2                     | Calculus II                         | MAT3612 | [MAT3511 & MAT3512] <b>or</b> [MAT3531 & MAT3512]           |
| 2                     | Elementary Linear Algebra           | MAT3652 | Any two of the following modules: MAT3511; MAT3531; MAT3512 |
| 2                     | Ordinary Differential Equations     | MAT3642 | [MAT3511 & MAT 3512] <b>or</b> [MAT3531 & MAT3512]          |
| <b>Geology Minor:</b> |                                     |         |   |
| 2                     | Geological Mapping and Stratigraphy | GLY3612 | <b>GLY3521</b>  |

**YEAR 3**

| SEMESTER              | MODULE                            | CODE    | PRE-/COREQUISITES                       |
|-----------------------|-----------------------------------|---------|---|
| 1                     | Electrodynamics                   | PHY3711 | PHY3612; MAT3612                        |
| 1                     | Thermodynamics and Kinetic Theory | PHY3701 | PHY3611; MAT3612                        |
| 1                     | Computational Physics with C++    | PHY3721 | MAT3612                                 |
| 1                     | Real Analysis I                   | MAT3731 | MAT3611 <b>or</b> MAT3612<br>MAT3601    |
| <b>Geology Minor:</b> |                                   |         |   |
| 1                     | Coal, Petroleum and Gas           | GLY3701 | GLY3521 <b>&amp;</b> <del>GLY3600</del> |
| 1                     | Plate Tectonics                   | GLY3721 | GLY3612 <b>&amp;</b> <del>GLY3600</del> |

| SEMESTER              | MODULE                | CODE    | PRE-/COREQUISITES                  |
|-----------------------|-----------------------|---------|------------------------------------|
| 2                     | Theoretical Mechanics | PHY3712 | PHY3611; MAT3612; MAT3642; MAT3652 |
| 2                     | Modern Physics II     | PHY3732 | PHY3602                            |
| 2                     | Electronics I         | PHY3702 | PHY3512                            |
| 2                     | Research Methodology  | PHY3722 | PHY3722                            |
| <b>Geology Minor:</b> |                       |         |                                    |
| 2                     | Structural Geology I  | GLY3712 | GLY3612 & MAT3612 GLY3600          |

#### YEAR 4

| SEMESTER  | MODULE                   | CODE     | PRE-/COREQUISITES |
|---|--------------------------|----------|-------------------|
| 1   | Quantum Mechanics        | PHY3811  | PHY3712; PHY3732  |
| 1   | Statistical Mechanics    | PHY3831  | PHY3611; PHY3701  |
| 1   | Research Project         | PHY3810  | PHY3711; PHY3712  |
| 1   | Advanced Electrodynamics | PHY3809  | PH 3711           |
| <b>Electives: Choose Any One Modules (Subject to Dept Approval)</b> |                          |          |                   |
| 1   | Plasma Physics           | PHY3821  | PHY3711           |
| 1   | *Energy Physics          | *PHY3861 | PHY3701           |

| SEMESTER  | MODULE                           | CODE     | PRE-/COREQUISITES |
|---|----------------------------------|----------|-------------------|
| 2   | Solid State Physics              | PHY3812  | PHY3701; PHY3732  |
| 2   | Research Project                 | PHY3810  | PHY3711; PHY3712  |
| 2   | Advanced Potential Field Methods | PHY3862  | PHY3711           |
| <b>Electives: Choose Any Three Modules (Subject to Dept Approval)</b> |                                  |          |                   |
| 2   | Nuclear Physics                  | PHY3802  | PHY3732           |
| 2   | Optics and Laser Physics         | PHY3822  | PHY3631; PHY3711  |
| 2   | Astrophysics                     | PHY3842  | PHY3732           |
| 2   | *Electronics II                  | *PHY3829 | PHY3702           |

\*This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.

**QUALIFICATION: B.Sc. Honours Physics Major and Computer Science Minor (11BPHC)**

Students opting for a major in **Physics** (with Computer Science minor) must take all of the following modules:

#### YEAR 1

| SEMESTER             | MODULE  | CODE    | PRE-/CO-REQUISITES  |
|----------------------|---|---------|---|
| 1                    | English Communication & Study Skills          | LCE3519 | University entry requirements   |
| 1                    | Computer Literacy                             | CLC3509 | University entry requirements   |
| 1                    | Physics for Physical Sciences I               | PHY3511 | NSSC/IGCSE Physical Science <b>and</b> Mathematics ( <b>C-symbols</b> ) |
| 1                    | Basic Mathematics                             | MAT3511 | Faculty entry requirements  |
| 1                    | Analytic Geometry, Matrices & Complex Numbers | MAT3531 | Faculty entry requirements  |
| <b>Minor modules</b> |   |         |   |
| 1                    | Programming Fundamentals I                    | CMP3511 | Departmental Entry Test   |

| SEMESTER             | MODULE                           | CODE    | PRE-/CO-REQUISITES  |
|----------------------|----------------------------------|---------|---|
| 2                    | English for Academic Purposes    | LEA3519 | Co-requisite: LCE3519   |
| 2                    | Contemporary Social Issues       | CSI3529 | University Entry Requirements   |
| 2                    | Physics for Physical Sciences II | PHY3512 | NSSC/IGCSE Physical Science <b>and</b> Mathematics ( <b>C-symbols</b> ) |
| 2                    | Precalculus                      | MAT3512 | NSSC/IGCSE Mathematics  |
| <b>Minor modules</b> |                                  |         |   |
| 2                    | Programming Fundamentals II      | CMP3512 | CMP3511 Programming Fundamentals I                                      |

**YEAR 2**

| SEMESTER             | MODULE                      | CODE    | PRE-/CO-REQUISITES  |
|----------------------|-----------------------------|---------|---|
| 1                    | Classical Mechanics         | PHY3611 | PHY3511, MAT3511, MAT3512                                   |
| 1                    | Waves & Optics              | PHY3631 | PHY3511, PHY3512  |
| 1                    | Sets & Numbers              | MAT3601 | Any <b>two</b> from following: MAT3511, MAT3512, MAT3531    |
| 1                    | Calculus I                  | MAT3611 | Either [MAT3511 & MAT3512]<br><b>or</b> [MAT3512 & MAT3531] |
| 1                    | Numerical Methods           | MAT3621 | Any <b>two</b> from following: MAT3511, MAT3512, MAT3531    |
| <b>Minor modules</b> |                             |         |   |
| 1                    | Object Oriented Programming | CMP3631 | CMP3511   |

| SEMESTER             | MODULE                          | CODE    | PRE-/CO-REQUISITES  |
|----------------------|---------------------------------|---------|---|
| 2                    | Electromagnetism                | PHY3612 | PHY3512, MAT3511, MAT3512                                   |
| 2                    | Modern Physics I                | PHY3602 | PHY3511, PHY3512, MAT3511, MAT3512                          |
| 2                    | Calculus II                     | MAT3612 | Either [MAT3511 & MAT3512]<br><b>or</b> [MAT3512 & MAT3531] |
| 2                    | Ordinary Differential Equations | MAT3642 | Either [MAT3511 & MAT3512]<br><b>or</b> [MAT3512 & MAT3531] |
| 2                    | Elementary Linear Algebra       | MAT3652 | Any <b>two</b> from following: MAT3511, MAT3512, MAT3531    |
| <b>Minor modules</b> |                                 |         |   |
| 2                    | Data Structures & Algorithms    | CMP3612 | CMP3631   |

**YEAR 3**

| SEMESTER             | MODULE                          | CODE    | PRE-/CO-REQUISITES                                |
|----------------------|---------------------------------|---------|---|
| 1                    | Electrodynamics                 | PHY3711 | PHY3612, MAT3612                                  |
| 1                    | Thermodynamics & Kinetic Theory | PHY3701 | PHY3611, MAT3612                                  |
| 1                    | Computational Physics with C++  | PHY3721 | MAT3612   |
| 1                    | Real Analysis I                 | MAT3731 | [MAT3611 <b>or</b> MAT3612]<br><b>and</b> MAT3601 |
| <b>Minor modules</b> |                                 |         |   |
| 1                    | Artificial Intelligence         | CMP3771 | CMP3511   |

| SEMESTER             | MODULE                | CODE    | PRE-/CO-REQUISITES                 |
|----------------------|-----------------------|---------|------------------------------------|
| 2                    | Theoretical Mechanics | PHY3712 | PHY3611, MAT3612, MAT3642, MAT3652 |
| 2                    | Modern Physics II     | PHY3732 | PHY3602                            |
| 2                    | Electronics I         | PHY3702 | PHY3512                            |
| 2                    | Research Methodology  | PHY3722 | PHY3612                            |
| <b>Minor modules</b> |                       |         |                                    |
| 2                    | Operating Systems     | CMP3722 | CMP3532 <b>or</b> CMP3612          |
| 2                    | Computer Graphics     | CMP3762 | CMP3612                            |

A student may replace the full module **MAT3732 (Real Analysis II)** with the combination of **two** half modules (**MAT3622**) **Vector Analysis** and **MAT3722 (Number Theory)**.

**YEAR 4**

| SEMESTER | MODULE                   | CODE     | PRE-/CO-REQUISITES   |
|----------|--------------------------|----------|--|
| 1        | Quantum Mechanics        | PHY3811  | PHY3712, PHY3732   |
| 1        | Statistical Mechanics    | PHY3831  | PHY3611, PHY3701   |
| 1        | Research Project         | PHY3810  | PHY3711, PHY3712   |
| 1        | Advanced Electrodynamics | PHY3809  | PHY3711  |
| 1        | Plasma Physics           | PHY3821  | PHY3711  |
| 1        | *Energy Physics          | *PHY3861 | *PHY3701 (This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.) |

| SEMESTER | MODULE                           | CODE     | PRE-/COREQUISITES   |
|----------|----------------------------------|----------|---|
| 2        | Solid State Physics              | PHY3812  | PHY3701, PHY3732  |
| 2        | Research Project                 | PHY3810  | PHY3711, PHY3712  |
| 2        | Nuclear Physics                  | PHY3802  | PHY3732   |
| 2        | Optics and Laser Physics         | PHY3822  | PHY3631, PHY3711  |
| 2        | Astrophysics                     | PHY3842  | PHY3732   |
| 2        | Advanced Potential Field Methods | PHY3862  | PHY3711   |
| 2        | *Electronics II                  | *PHY3829 | PHY3702 (This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.) |

**QUALIFICATION: B.Sc. Honours Physics Major and Chemistry Minor (11BPHH)**

Students opting for a major in **Physics** (with Chemistry minor) must take all of the following modules:

**YEAR 1**

| SEMESTER                | MODULE  | CODE     | PRE-/COREQUISITES   |
|-------------------------|---|----------|---|
| 1                       | English Communication & Study Skills            | LCE3519  | University entry requirements   |
| 1                       | Basic Mathematics                               | MAT3511  | NSSC/IGCSE Mathematics  |
| 1                       | Computer Literacy                               | CLC 3509 | University entry requirements   |
| 1                       | Physics for Physical Science I                  | PHY3511  | NSSC/IGCSE Physical Science <b>and</b> Mathematics <b>(C-symbols)</b> |
| 1                       | Analytic Geometry, Complex Numbers and Matrices | MAT3531  | NSSC/IGCSE Mathematics  |
| <b>Chemistry Minor:</b> |   |          |   |
| 1                       | Chemistry 1A                                    | CHM3511  | Faculty Entry Requirements  |

| SEMESTER                | MODULE                          | CODE    | PRE-/COREQUISITES   |
|-------------------------|---------------------------------|---------|---|
| 2                       | English for Academic Purposes   | LEA3519 | Co-requisite: LCE3519   |
| 2                       | Contemporary Social Issues      | CSI3529 | University Entry Requirements   |
| 2                       | Pre-calculus                    | MAT3512 | NSSC/IGCSE Mathematics  |
| 2                       | Physics for Physical Science II | PHY3512 | NSSC/IGCSE Physical Science <b>and</b> Mathematics <b>(C-symbols)</b> |
| <b>Chemistry Minor:</b> |                                 |         |   |
| 2                       | Chemistry 1B                    | CHM3512 | Faculty Entry Requirements  |

**YEAR 2**

| SEMESTER                | MODULE               | CODE    | PRE-/COREQUISITES   |
|-------------------------|----------------------|---------|---|
| 1                       | Classical Mechanics  | PHY3611 | PHY 3511; MAT 3511; MAT 3512                                |
| 1                       | Waves and Optics     | PHY3631 | PHY 3211; PHY 3512  |
| 1                       | Calculus I           | MAT3611 | [MAT3511 & MAT 3512] <b>or</b> [MAT3531 & MAT3512]          |
| 1                       | Sets and Numbers     | MAT3601 | any two of following modules: MAT3511; MAT3531; MAT3512     |
| 1                       | Numerical Methods    | MAT3621 | Any two of the following modules: MAT3511; MAT3531; MAT3512 |
| <b>Chemistry Minor:</b> |                      |         |   |
| 1                       | Physical Chemistry I | CHM3631 | CHM 3511, CHM3512,, MAT3511 and MAT3512                     |

| SEMESTER                | MODULE                          | CODE    | PRE-/COREQUISITES   |
|-------------------------|---------------------------------|---------|---|
| 2                       | Electromagnetism                | PHY3612 | PHY 3512; MAT 3511; MAT 3512                                |
| 2                       | Modern Physics I                | PHY3602 | PHY 3511; PHY 3512; MAT 3511; MAT 3512                      |
| 2                       | Calculus II                     | MAT3612 | [MAT3511 & MAT 3512] <b>or</b> [MAT3531 & MAT3512]          |
| 2                       | Elementary Linear Algebra       | MAT3652 | Any two of the following modules: MAT3511; MAT3531; MAT3512 |
| 2                       | Ordinary Differential Equations | MAT3642 | [MAT3511 & MAT 3512] <b>or</b> [MAT3531 & MAT3512]          |
| <b>Chemistry Minor:</b> |                                 |         |   |
| 2                       | Organic Chemistry I             | CHM3612 | CHM3511 and CHM3512   |

**YEAR 3**

| SEMESTER                | MODULE                            | CODE    | PRE-/COREQUISITES                          |
|-------------------------|-----------------------------------|---------|--|
| 1                       | Electrodynamics                   | PHY3711 | PHY3612; MAT3612                           |
| 1                       | Thermodynamics and Kinetic Theory | PHY3701 | PHY3611; MAT3612                           |
| 1                       | Computational Physics with C++    | PHY3721 | MAT3612                                    |
| 1                       | Real Analysis I                   | MAT3731 | 1. MAT3611 <b>or</b> MAT3612<br>2. MAT3601 |
| <b>Chemistry Minor:</b> |                                   |         |  |
| 1                       | Organic Chemistry II              | CHM3711 | CHM3612                                    |

| SEMESTER                | MODULE                | CODE     | PRE-/COREQUISITES                  |
|-------------------------|-----------------------|----------|------------------------------------|
| 2                       | Theoretical Mechanics | PHY3712  | PHY3611; MAT3612; MAT3642; MAT3652 |
| 2                       | Modern Physics II     | PHY3732  | PHY3602                            |
| 2                       | Electronics I         | PHY3702  | PHY3512                            |
| 2                       | Research Methodology  | PHY 3722 | PHY3722                            |
| <b>Chemistry Minor:</b> |                       |          |                                    |
| 2                       | Physical Chemistry II | CHM3712  | CHM3631, MAT3611 and MAT3612       |

**YEAR 4**

| SEMESTER  | MODULE                   | CODE     | PRE-/COREQUISITES |
|---|--------------------------|----------|-------------------|
| 1   | Quantum Mechanics        | PHY3811  | PHY3712; PHY3732  |
| 1   | Statistical Mechanics    | PHY3831  | PHY3611; PHY3701  |
| 1   | Research Project         | PHY3810  | PHY3711; PHY3712  |
| 1   | Advanced Electrodynamics | PHY3809  | PHY3711           |
| <b>Electives: Choose Any One Modules (Subject to Dept Approval)</b> |                          |          |                   |
| 1   | Plasma Physics           | PHY3821  | PHY3711           |
| 1   | *Energy Physics          | *PHY3861 | PHY3701           |

| SEMESTER   | MODULE                           | CODE     | PRE-/COREQUISITES |
|--|----------------------------------|----------|-------------------|
| 2  | Solid State Physics              | PHY3812  | PHY3701; PHY3732  |
| 2  | Research Project                 | PHY3810  | PHY3711; PHY3712  |
| <b>Electives: Choose Any Four Modules (Subject to Dept Approval)</b> |                                  |          |                   |
| 2  | Nuclear Physics                  | PHY3802  | PHY3732           |
| 2  | Optics and Laser Physics         | PHY3822  | PHY3631; PHY3711  |
| 2  | Astrophysics                     | PHY3842  | PHY3732           |
| 2  | Advanced Potential Field Methods | PHY3862  | PHY3711           |
| 2  | *Electronics II                  | *PHY3829 | PHY3702           |

\*This elective will be offered when there is expertise within the department and could be taken instead of any other half-module course in the semester.

**PHYSICS SERVICE COURSES**

| SEMESTER | MODULE                       | CODE     | PRE-/COREQUISITES                  |
|----------|------------------------------|----------|------------------------------------|
| I        | Physics for Life Sciences I  | PHY3501  | NSSC Physical Science              |
| II       | Physics for Radiographers    | PHY3402  | -                                  |
| II       | Physics for Life Sciences II | PHY3532  | NSSC Physical Science, PHY3501     |
| II       | Electricity and Magnetism    | SPHE3642 | PHY3512, MAT3511, MAT3512          |
| I        | Modern Physics for Educators | SPHE3751 | PHY3511, PHY3512, MAT3511, MAT3512 |

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**I.1.2 B.SC.PHYSICS CURRICULUM MODULE DESCRIPTIONS**

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**FIRST YEAR MODULES**

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**PHY3511: PHYSICS FOR PHYSICAL SCIENCES I**

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|                                      |  |
|--------------------------------------|--|
| <b>Module title:</b>                 | <b>PHYSICS FOR PHYSICAL SCIENCES I</b>   |
| <b>Code:</b>                         | <b>PHY3511</b>   |
| <b>NQF level:</b>                    | 5  |
| <b>Contact hours:</b>                | 56 Lectures and 14 Practical Sessions/Tutorials  |
| <b>Credits:</b>                      | 16   |
| <b>Module assessment:</b>            | Continuous Assessment ( <b>50%</b> ) and 1 x 3-hour Exam Paper ( <b>50%</b> )<br>Continuous Assessment will consist of class tests, tutorial tests/assignments and practical reports.  |
| <b>Pre-requisites:</b>               | NSSC Physical Science and Mathematics (C-symbols)  |
| <b>Module description (content):</b> | 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. |

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**PHY3501: PHYSICS FOR LIFE SCIENCES I**

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|                                      |  |
|--------------------------------------|--|
| <b>Module title:</b>                 | <b>PHYSICS FOR LIFE SCIENCES I</b>   |
| <b>Code:</b>                         | <b>PHY3501</b>   |
| <b>NQF level:</b>                    | 5  |
| <b>Contact hours:</b>                | 28 Lectures and 14 Practical Sessions/Tutorials  |
| <b>Credits:</b>                      | 8  |
| <b>Module assessment:</b>            | Continuous Assessment ( <b>50%</b> ) and 1 x 3-hour Exam Paper ( <b>50%</b> )<br>Continuous Assessment will consist of class tests, tutorial tests/assignments and practical reports.  |
| <b>Pre-requisites:</b>               | IGCSE Physical Science   |
| <b>Module description (content):</b> | This module is to introduce Life science students to physics concepts and applications that will be useful to them in their undergraduate studies and carrier. The module is not for physical science students as it is not equivalent to PHY3511. The course will cover the following topics:<br>Units and significant figures; Motion in one dimension, average velocity, acceleration, freely falling bodies; Vectors and scalars, addition and subtraction of vectors in one and two dimensions, multiplication of vectors, component method of vector addition; Projectiles; Force and weight, Newton's laws and applications, free-body diagrams, friction, motion on inclined planes; Uniform circular motion, period and frequency of motion, centripetal force, banking of curves; Newton's law of Universal gravitation, gravity near the Earth's surface, satellites; Kepler's laws; Work done by a constant force, kinetic energy, work-energy theorem, potential energy, conservation of Mechanical energy, power; Momentum, impulse, conservation of energy and momentum in collisions, elastic and inelastic collisions in one dimension. |

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**PHY3512: PHYSICS FOR PHYSICAL SCIENCES II**

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|---------------------------------------|--|
| <b>Module Title:</b>                  | <b>PHYSICS FOR PHYSICAL SCIENCES II</b>  |
| <b>Code:</b>                          | <b>PHY3512</b>   |
| <b>NQF Level:</b>                     | 5  |
| <b>Contact Hours:</b>                 | 4 Lectures per week for 14 weeks, Practical Time: 14 sessions (42 hours)   |
| <b>Credits:</b>                       | 16   |
| <b>Module assessment:</b>             | Continuous assessment ( <b>50%</b> , Minimum 2 tests, 4 assignments and practical reports) Examination ( <b>50%</b> , 1 x 3- hour paper)   |
| <b>Pre-requisites:</b>                | IGCSE Physical Science and Mathematics (C-symbols)   |
| <b>Module description (contents):</b> | This module introduces the phenomena associated with electrostatics (charges at rest) and magnetostatics (the magnetic effects associated with steady currents). It also introduces and develops the use of the electric and magnetic field vectors and relates them by considering electromagnetic induction at a classical level. The connection between these fields and conventional circuit parameters R, C and L is developed, together with the techniques to deal with elementary transient phenomena. Sound, basic geometrical optics and radioactivity and its detection are also covered. The contents of this course include: Electric charge; insulators and conductors; Electric force and coulomb's law, Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Basic geometrical optics; Radioactivity and its detection; Sound. |

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**PHY3532: PHYSICS FOR LIFE SCIENCES II**

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|---------------------------|---|
| <b>Module Title:</b>      | <b>PHYSICS FOR LIFE SCIENCES II</b>   |
| <b>Code:</b>              | <b>PHY3532</b>  |
| <b>NQF Level:</b>         | 5   |
| <b>Contact Hours:</b>     | 4 Lectures per week for 14 weeks, Practical Time: 14 sessions (42 hours)  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment ( <b>50%</b> , Minimum 2 tests, 4 assignments and practical reports) and Examination ( <b>50%</b> , 1 x 3-hour paper) |
| <b>Pre-requisites:</b>    | IGCSE Physical Science  |
| <b>Co-requisites:</b>     | Physics for Life Sciences I   |

**Module description (contents):** This module introduces life science students to concepts of physics and their application to real life situations, new topics that were not dealt with in PHY 3501 are introduced (i.e., on electricity, magnetism and radioactivity). The module is not for physical science students as it is not equivalent to PHY3512. The content of this course is good enough to help the life science students throughout their undergraduate work and careers. The following topics will also be covered: Electric charge; insulators and conductors; Electric force and coulomb's law, Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Temperature, gas and thermal expansion; Basic geometrical optics; Radioactivity and its detection.

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**PHY3402: PHYSICS FOR RADIOGRAPHERS**

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|                           |   |
|---------------------------|---|
| <b>Module Title:</b>      | <b>PHYSICS FOR RADIOGRAPHERS</b>  |
| <b>Code:</b>              | <b>PHY3402</b>  |
| <b>NQF Level:</b>         | 4   |
| <b>Contact Hours:</b>     | 28  |
| <b>Credits:</b>           | 8   |
| <b>Module assessment:</b> | Continuous assessment <b>50%</b> , one 2 hour exam <b>50%</b> . Continuous assessment is based on class tests, assignments and minimum 7 practical sessions |
| <b>Pre-requisites:</b>    | none  |

**Module Description:** Electromagnetic radiation; elementary quantum theory; atomic structure; atomic nucleus; radioactive decay - half-life, law of radioactive decay, activity of a radioactive sample; detectors of radioactive particles; X- and Gamma-rays and their interactions with matter – photo-absorption, Compton scattering, pair-production; homogeneous and heterogeneous beams, x-ray spectra; intensity of x- and gamma-radiation as a function of distance to the source and as a function of the thickness of the absorber; attenuation coefficients; half-value layer; filters; effects of the different absorption modes on the clarity and quality of a radiographic image; dosimetry - absorbed dose; exposure; dosimetric devices; maximum permissible doses.

**SECOND YEAR MODULES**

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**PHY3611: CLASSICAL MECHANICS**

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|---------------------------|--|
| <b>Module title:</b>      | <b>CLASSICAL MECHANICS</b>   |
| <b>Code:</b>              | <b>PHY3611</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 56 Lectures and 14 Practical Sessions/Tutorials  |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous Assessment (50%) and one 3-hour Exam Paper ( <b>50%</b> ).<br>Continuous assessment will consist of class tests, assignments and practical reports. |
| <b>Pre-requisites:</b>    | PHY3511: Physics for Physical Sciences I, MAT3511: Basic Mathematics and<br>MAT3512: Precalculus   |

**Module description (content):** Vectors, vector operations & the calculus of vectors; straight line and general motion particles; polar co-ordinates; rigid bodies: rotating about a fixed axis & planar motion; reference frames; inertial frames and the law of inertia; Laws of: mutual interaction, multiple interactions, universal gravitation; mass distributions; principle of equivalence; rectilinear motion in a force field; constrained rectilinear motion; resisting media; projectiles; circular motion; classical SHM: damped & forced; coupled oscillations and normal modes; energy principle; rectilinear motion; conservative fields; orbits in a central field: orbital motion, path equation, Hohmann transfer orbits, attractive & repulsive inverse square fields; Rutherford scattering; non-linear oscillations and phase space; phase plane in dynamics; limit cycles; driven non-linear oscillations; degrees of freedom; rigid bodies; linear momentum; rocket motion; collision theory; zero-momentum frame; 2-body problem; scattering; integrable mechanical systems; moment of a force; angular momentum; planar rigid body motion; Rigid body statics;

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**PHY3631: WAVES AND OPTICS**

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**Module Title:** WAVES AND OPTICS  
**Code:** PHY3631  
**NQF Level:** 6  
**Contact Hours:** 4 Lectures per week for 14 weeks, Practical Time: 14 sessions (42 hours)  
**Credits:** 16  
**Module Assessment:** Continuous [50%], Minimum 2 tests and 2 assignments. Exam [50%], 1 x 3-hour paper  
**Pre-requisites:** PHY3511: Physics for physical sciences I and PHY3512: Physics for physical sciences II  
**Module description (contents):** This course will provide opportunity to students to understand how waves behave in nature. They will know various phenomena involving rectilinear propagation of light and wave nature of light. The course contents are as follows: Mathematical description of wave motion; Fourier analysis of wave motion; Differential equation of wave motion; Elastic waves in solid rod; Waves in string and liquid; Electromagnetic wave and interaction with matter. Huygen's principle; Malu's theorem; Fermat's principle; Reflection and refraction of plane waves; Wave geometry; Reflection and refraction at spherical surfaces; Lens, prisms, dispersion and chromatic aberrations; Interference, diffraction and polarization.

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**PHY3612: ELECTROMAGNETISM**

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**Module Title:** ELECTROMAGNETISM  
**Code:** PHY3612  
**NQF Level:** 6  
**Credits:** 16  
**Contact Time:** 56 hours. Practical Time: 14 sessions (42 hours)  
**Assessment:** Continuous [50%] Minimum 2 tests and 2 assignments  
Exam [50%] 1 x 3-hour paper  
**Pre-requisites:** PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus.  
**Model description (contents):** This module will provide students how the charges at rest and at motion behave. This course will be calculus based and students will develop the skill to obtain different equations and solve related problems. The contents of the course are: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohms law; Resistance, Joule effect and emf; Magnetic interaction; Lorentz force; Electromagnetic field of a moving charge; Electric flux of a moving charge; Magnetic field and electric current; Magnetostatics; Ampere's law; Time dependent electric field; Maxwell's equations.

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**PHY3602: MODERN PHYSICS I**

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**Module title:** MODERN PHYSICS I  
**Code:** PHY3602  
**NQF Level:** 6  
**Contact hours:** 28 Lectures and 7 Practical Sessions  
**Credits:** 8  
**Module assessment:** Continuous assessment (class tests, assignments and practical reports) 50%, two-hour exam 50%  
**Pre-requisites:** PHY3511: Physics for Physical sciences I, PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus  
**Module description (content):** Particles and waves in classical physics; introduction to special relativity; blackbody radiation; Planck's quantization; Photoelectric effect; Compton effect; atomic structure; spectral lines of Hydrogen; the nuclear atom; Bohr's theory; correspondence principle; Franck-Hertz experiment; Characteristic x-rays; de Broglie wavelengths; particle-wave duality; Heisenberg uncertainty relation; Schrödinger equation for a free particle; the potential Step.

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**PHE3642: ELECTRICITY AND MAGNETISM**

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**Module title:** ELECTRICITY AND MAGNETISM  
**Code:** PHE3642  
**NQF Level:** 6  
**Contact Time:** 28 Lectures and 7 Practical sessions (21 hours)  
**Credits:** 8  
**Module Assessment:** Continuous assessment (class tests, assignments and practical reports) 50%, two-hour exam 50%  
**Pre-requisites:** PHY3512: Physics for Physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus.  
**Module description (content):** The content of the module will cover the following: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohms law; DC circuits; Magnetic field and flux, Lorentz force; Ampere's law; Electromagnetic induction and ac circuits.



### THIRD YEAR MODULES

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#### PHY3711: ELECTRODYNAMICS

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|--------------------------------------|--|
| <b>Module title:</b>                 | <b>ELECTRODYNAMICS</b>   |
| <b>Code:</b>                         | <b>PHY3711</b>   |
| <b>NQF Level:</b>                    | 7  |
| <b>Contact hours:</b>                | 4 lectures per week for 14 weeks, supplemented by 14 practical/tutorial sessions (minimum 3 hour per session) and extra classes  |
| <b>Credits:</b>                      | 16 NQF credits   |
| <b>Module assessment:</b>            | Continuous assessment (minimum of 4 class tests, 4 assignments and practical reports) 50%, three hour written exam 50%   |
| <b>Pre-requisites:</b>               | PHY3612: Electromagnetism and MAT3612: Calculus II   |
| <b>Module description (content):</b> | 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. |

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#### PHY3701: THERMODYNAMICS AND KINETIC THEORY

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|----------------------------|--|
| <b>Module title:</b>       | <b>THERMODYNAMICS AND KINETIC THEORY</b>   |
| <b>Code:</b>               | <b>PHY3701</b>   |
| <b>NQF Level:</b>          | 7  |
| <b>Contact hours:</b>      | 28   |
| <b>Credits:</b>            | 8  |
| <b>Module assessment:</b>  | Continuous assessment (50% weight), one 2 hour exam (50% weight)<br>Continuous assessment is based on class tests, assignments and minimum 7 practical sessions  |
| <b>Pre-requisites:</b>     | PHY3611: Classical Mechanics and MAT3612: Calculus II  |
| <b>Module Description:</b> | Fundamental concepts - zeroth law, temperature, equilibrium; equations of state - ideal gases, real gases; First Law of Thermodynamics - internal energy, heat, reversible quasi-static processes, work, heat capacity, heat engines; Second Law of Thermodynamics - Carathéodory theorem, absolute temperature, entropy, entropy changes, Clapeyron inequality; Carnot theorem, heat engines; thermodynamic potentials and Maxwell relations - internal energy, enthalpy, Helmholtz and Gibbs functions; phase transitions; kinetic theory - Maxwell's velocity distribution, Boltzmann distribution; applications. |

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#### PHY3721: COMPUTATIONAL PHYSICS WITH C++

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|--------------------------------------|--|
| <b>Module title:</b>                 | <b>COMPUTATIONAL PHYSICS WITH C++</b>  |
| <b>Code:</b>                         | <b>PHY3721</b>   |
| <b>NQF level:</b>                    | 7  |
| <b>Contact hours:</b>                | 28 Lectures and 7 Practical Sessions   |
| <b>Credits:</b>                      | 8  |
| <b>Module assessment:</b>            | Continuous Assessment (50%) and one 3-hour Exam Paper.<br>Continuous assessment will consist of class tests and computational assignments.   |
| <b>Pre-requisites:</b>               | MAT3612: Calculus II   |
| <b>Module description (content):</b> | Introduction to C++; statements; expressions; variables: local and global; constants: literal and symbolic; data-types; basic stream I/O: iostream; operators; program flow: for, while, if, switch, etc.; functions; arrays; pointers & references; stream I/O: iostream, ostream and stringstream; C/C++ standard libraries; OOP basics: C++ classes; constructors & destructors; operator overloading; simple inheritance; Computational Physics techniques: iteration, recursion, dynamic creation of arrays; coding the : Thomas Algorithm, Euler and Runge-Kutta methods, Crank-Nicolson, ADI and LOD finite difference methods; random numbers and pseudo-random number generators; random-walk methods and Monte-Carlo basics applied to diffusion problems; analysis and visualisation of data. |

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#### SPHE3751: MODERN PHYSICS FOR EDUCATORS

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|                                      |   |
|--------------------------------------|---|
| <b>Module title:</b>                 | <b>MODERN PHYSICS FOR EDUCATORS</b>   |
| <b>Code:</b>                         | <b>PHE3751</b>  |
| <b>NQF Level:</b>                    | 7   |
| <b>Contact hours:</b>                | 4 Lectures per week and 1 (3h) Practical Sessions per week  |
| <b>Credits:</b>                      | 16  |
| <b>Module assessment:</b>            | Continuous assessment (class tests, assignments and practical reports) 50%,<br>Three-hour exam 50%  |
| <b>Pre-requisites:</b>               | PHY3511: Physics for Physical sciences I, PHY3512: Physics for Physical sciences II,<br>PHY3611: Classical Mechanics, MAT3511: Basic Mathematics and MAT3512: Precalculus.  |
| <b>Module description (content):</b> | 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. |

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**PHY3712: THEORETICAL MECHANICS**

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**Module title:** THEORETICAL MECHANICS

**Code:** PHY3712

**NQF level:** 7

**Contact hours:** 56 Lectures and 14 Practical Sessions/Tutorials

**Credits:** 16

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

**Pre-requisites:** PHY3611: Classical Mechanics, MAT3612 Calculus II: Numerical Methods, MAT3642: Ordinary Differential Equations and MAT3652: Elementary Linear Algebra.

**Module description (content):** Lagrangian methods; constraints; generalised coordinates; D'Alembert's principle; Lagrange's equations; moving constraints; Lagrangian; generalised momenta; symmetry and conservation principles; The calculus of variations; minimisation problems; Euler-Lagrange equation; variational & Hamilton's principles; Hamilton's equations; phase space; systems of first order ODEs; Legendre transforms; Hamilton's equations; Hamiltonian phase space; Liouville's theorem and recurrence; general theory of small oscillations; Stable equilibrium and small oscillations; general theory of normal modes; existence; normal mode problems; orthogonality; general small oscillations; normal coordinates; Rigid body kinematics; rotation about a fixed axis & general rigid body kinematics; rotating reference frames; single & multi-particle system in a non-inertial frame; Tensor algebra and the inertia tensor: orthogonal transformations; coordinate transformations; tensors & tensor algebra; inertia tensor; symmetric tensor; rigid body dynamics; bodies with axial symmetry; Lagrangian dynamics of rigid bodies; Euler's equation; unsymmetrical rigid bodies.

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**PHY3732 MODERN PHYSICS II**

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**Module title:** MODERN PHYSICS II

**Code:** PHY3732

**NQF Level:** 7

**Contact hours:** 56 Lectures and 14 Practical Sessions

**Credits:** 16

**Module assessment:** Continuous assessment (class tests, assignments) 50%, three hours written exam 50%

**Pre-requisites:** PHY3602: Modern Physics I

**Module description (content):** Special relativity; departure from Newtonian dynamics; Einstein and Lorentz transformations; Minkowski diagram; Lorentz contraction and time dilation; relativistic kinematics and relativistic dynamics; four vectors; wave mechanics, particles and potential; particles in a box ; Schrödinger equation; particle in a finite potential well; barrier penetration; spin and Pauli exclusion principle; L-S coupling; Zeeman effect; stimulated emission.

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**PHY3702: ELECTRONICS I**

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**Module Title:** ELECTRONICS I

**Code:** PHY3702

**NQF Level:** 7

**Contact hours:** 28 hours theory: 2 Lectures/Week  
1x3 hours Practical session per week

**Credits:** 8

**Module Assessment:** Continuous: 50%, Examination: 50% (1 x 2 hour exam)

**Pre-requisites:** PHY3512: Physics for Physical Sciences II

**Module description:** This module introduces the basic concepts of analogue electronics and illustrates its applications through examples using such as diodes, BJT's and FET and operational amplifiers. Introduction to semi-conductor theory, intrinsic, p & n type doping, extrinsic semiconductors, conduction processes; Semiconductors diodes and diodes applications, devices transistors, biasing of transistors, load line and the Q-point and its stability; Small signal equivalent circuits and frequency response; p-n-p-n devices, thyristors, diacs and triacs, IC's, logic operation of integrated circuits; Operational amplifier characteristics, Op-amps practical applications, electronic control circuits and feedback concept; Digital circuits, analogy circuits, hybrid (digital plus analogue) circuits; Standard logic functions and gates - AND, OR, NOT, NAND, NOR, XOR, XNOR; truth tables; Boolean theorems; laws and rules; truth table; Boolean algebra and simplification of basic logic networks circuits; Basic combinational logic circuits, flip-flops and their applications.

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**PHY3722: RESEARCH METHODOLOGY**

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**Module title:** RESEARCH METHODOLOGY

**Code:** PHY3722

**NQF Level:** 7

**NPSC:** Not applicable

**Contact hours:** 2 lectures per week for 14 weeks

**Credits:** 8 NQF credits

**Module assessment:** 100% modulework (assignments & a typed report on literature review on some physic topic)

**Pre-requisites:** PHY3612: Electromagnetism

**Module description (content):** Although the actual topics will be adapted to the students research area the following topics will be "generally" covered in this module: various philosophies of Science; Research Proposals (Guidance to writing good project proposals); Basic research skills (e.g. library research, literature review, article analysis etc.); Research Strategy: Planning, Designing and Implementing; Data collection and interpretation methods; Data Reduction, Error analysis (error propagation); Data analysis; Report writing; Communication, skills required to communicate research findings to a broader audience, presentations (oral & written), peer reviewing, refereed journals; Ethics and Legal Issues (e.g. plagiarism); Basics of Quantitative Research (concerned with the tabulation or numeric relevance of various kinds of behaviour ("measuring")); Basics of Qualitative Research (concerned with understanding the processes, which underlie various behavioural patterns (Answering the question "why?").

## FOURTH YEAR MODULES

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### PHY3811: QUANTUM MECHANICS

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>QUANTUM MECHANICS</b>   |
| <b>Code:</b>              | <b>PHY3811</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks and 14 Practical/Tutorial sessions   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment ( <b>50%</b> ) and one 3-hour Examination ( <b>50%</b> ). Continuous assessment consists of a minimum of 4 assignments, 2 tests and practical reports. |
| <b>Pre-requisites:</b>    | PHY3712: Theoretical Mechanics and PHY3732: Modern Physics II.   |

**Module description:** This course is to have students learn the fundamentals of quantum mechanics. Students will be introduced to many new concepts and techniques in the course. The course will cover the following topics: Mathematical primer; Historical review; The postulates of quantum mechanics, state functions and expectation values, time development of state functions; Dirac notation, eigenvalues and eigenfunctions; Hermitian operators and applications; Commutator relations and compatible observables; Time development of expectation values, Ehrenfest's principle and applications, constants of motion, conservation of energy, momentum and parity; The harmonic oscillator, creation and annihilation operators; Angular momentum, commutation properties of the components of angular momentum, simultaneous eigenfunctions; Total angular momentum, commutation relations for the components of total angular momentum, ladder operators; Elements of matrix mechanics, Pauli spin matrices, spin wave functions; The Slater determinant; Time-independent Perturbation theory, degenerate perturbation theory, the Stark effect; Variational method; Scattering.

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### PHY3831: STATISTICAL MECHANICS

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>STATISTICAL MECHANICS</b>  |
| <b>Code:</b>              | <b>PHY3831</b>  |
| <b>NQF Level:</b>         | 8   |
| <b>Contact hours:</b>     | 56 Lectures and 14 Practical Sessions   |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment (class tests, assignments) <b>50%</b> , three hours written exam <b>50%</b> |
| <b>Pre-requisites:</b>    | PHY3611: Classical Mechanics and PHY3701: Thermodynamics and Kinetic Theory                       |

**Module description (content):** Macroscopic and microscopic view point of systems, classical and statistical probability; statistics and distribution function, significance of Lagrangian multipliers; the Bose-Einstein statistics, the Fermi-Dirac statistics, the Maxwell-Boltzmann statistics; the Bose-Einstein distribution function, the Fermi-Dirac distribution function, the Maxwell-Boltzmann distribution function; thermodynamic properties of a system; applications of statistics to gases, monatomic ideal gas; the distribution of molecular velocities, Maxwell-Boltzmann speed distribution, ideal gas in gravitational fields; the principle of equipartition of energy, specific heat capacity of a diatomic gas; applications of quantum statistics to other systems; the Einstein theory of the specific heat capacity of a solid; the Debye theory of the specific heat capacity of a solid; Blackbody radiation, paramagnetism, negative temperatures; the electron gas.

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### PHY3810: RESEARCH PROJECT

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|                           |  |
|---------------------------|--|
| <b>Module title:</b>      | <b>RESEARCH PROJECT</b>  |
| <b>Code:</b>              | <b>PHY3810</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | Frequent meetings (as determined by the Department) with supervisor(s) amounting to a minimum of 112 hours.  |
| <b>Credits:</b>           | 32   |
| <b>Module assessment:</b> | 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). |
| <b>Pre-requisites:</b>    | PHY3711: Electrodynamics and PHY3712 : Theoretical Mechanics   |

**Module description (content):** This one-year module constitutes the research and report writing for an available project within the various fields of physics. The actual content of the module will depend on the topic of research selected by the student, from the available specialized fields within the department. The student will submit a written dissertation (or thesis) of the project upon completion of the research activities.

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### PHY3809: ADVANCED ELECTRODYNAMICS

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|---------------------------|--|
| <b>Module title:</b>      | <b>ADVANCED ELECTRODYNAMICS</b>  |
| <b>Code:</b>              | <b>PHY3809</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week for 14 weeks, and 7 practical sessions of 3 hours each.  |
| <b>Credits:</b>           | 8 NQF credits  |
| <b>Module assessment:</b> | Continuous assessment (minimum of 2 tests, 2 assignments and practical reports) <b>50%</b> , written examination 50% |
| <b>Pre-requisites:</b>    | PHY3711: Electrodynamics   |

**Module description (content):** This module is a follow-up on the module Electrodynamics and constitute the following topics: Conservation laws in electrodynamics; Vector and scalar potential formulation; Coulomb and Lorentz transformations; Retarded potentials and Jefimenko's equations; Liénard-Wiechert potentials; Electric and magnetic dipole radiation, power radiated; Linear Antennas; Electrodynamics and relativity – relativistic magnetism, field transformation, field tensor.

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**PHY3821: PLASMA PHYSICS**

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|---------------------------|--|
| <b>Module title:</b>      | <b>PLASMA PHYSICS</b>  |
| <b>Code:</b>              | <b>PHY3821</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 28 Lectures and 7 Practical Sessions   |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous Assessment ( <b>50%</b> ) and 1 2-hour Exam Paper ( <b>50%</b> )<br>Continuous Assessment will consist of class tests, assignments and practical reports. |
| <b>Pre-requisites:</b>    | PHY3711: Electrodynamics   |

**Module description (content):** Plasmas: definitions, Debye shielding, plasma parameter, criteria; Single-particle motion: uniform, non-uniform and time-varying **E**- and **B**-fields; guiding-centre drifts; adiabatic invariants; plasmas as fluids; fluid equation of motion; fluid drifts perpendicular and parallel to **B**; plasma approximation; Waves in plasmas: plasma oscillations; electron plasma waves; sound waves; ion waves; comparisons; electrostatic electron and ion oscillations perpendicular to **B**; lower hybrid frequency; cut-offs and resonances; hydromagnetic waves; magnetosonic waves; CMA diagram; Diffusion in weakly ionised gases and fully ionised plasmas; decay of a plasma by diffusion; steady state solutions; recombination; Collisions in fully ionised plasmas; single-fluid MHD equations; Böhm- & neoclassical diffusion; hydromagnetic equilibrium; diffusion of magnetic field into a plasma; Classification of instabilities; Kinetic theory and its equations: Boltzmann-, Vlasov-, & Fokker-Planck equations.

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**PHY3861: ENERGY PHYSICS**

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|---------------------------|--|
| <b>Module title:</b>      | <b>ENERGY PHYSICS</b>  |
| <b>Code:</b>              | <b>PHY3861</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lecture periods per week for 14 weeks and 7 Practical/Tutorial sessions  |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment ( <b>50%</b> ) and one 2-hour Examination ( <b>50%</b> ). Continuous assessment consists of a minimum of 3 assignments, 2 tests and practical reports. |
| <b>Pre-requisites:</b>    | PHY3701: Thermodynamics and Kinetic Theory   |

**Module description:** This course is to make students learn about different energy sources. The topics to be covered in the course are: Solar Energy: Radiation laws, the Sun, attenuation of solar radiation by the atmosphere; direct, diffuse and global radiation; solar radiation horizontal and inclined surfaces, measurement of solar radiation; fundamentals of heat transfer, optics of collectors, reflection and refraction at dielectric interfaces, transmittance and reflectance of glazings, selective absorber coatings, concentrators, solar heating panels and conversion of solar energy to electricity. Wind power: Wind resources, measurement of wind speed, types of turbine, momentum theory and dynamic matching. Hydro power: Types of turbines, the Pelton wheel, calculation of efficiency, shape factor and generation of electricity. Geothermal energy: Thermal and hyperthermal fields, heat flow in the earth, harnessing geothermal energy. Biofuels: biomass production, wood, combustion and stoves, secondary fuels such as charcoals, ethanol, biogas, producer gas and vegetable oils. Ocean Power Systems: Wave energy, tidal power, ocean thermal energy conversion. Nuclear Power: Fission and fusion, introduction to reactor physics, nuclear power plants, radioactive waste and radiation protection.

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**PHY3812: SOLID STATE PHYSICS**

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|---------------------------|--|
| <b>Module title:</b>      | <b>SOLID STATE PHYSICS</b>   |
| <b>Code:</b>              | <b>PHY3812</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 4 lecture periods per week for 14 weeks and 14 Practical/Tutorial sessions   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment ( <b>50%</b> ) and one 3-hour Examination ( <b>50%</b> ). Continuous assessment consists of a minimum of 4 assignments, 2 tests and practical reports. |
| <b>Pre-requisites:</b>    | PHY3701: Thermodynamics and Kinetic Theory and PHY3732: Modern Physics II.   |

**Module description:** This course is to have students learn about the properties of solids such as simple crystals, semiconductors and superconductors. The course will cover the following topics: Crystal structure; Fundamental types of lattices, crystal planes; Diffraction of waves by crystals, Bragg law, reciprocal lattice vectors, diffraction conditions, Laue equations, structure factor; Forces between atoms and molecules, forces due to the ionic and covalent bonds, van der Waals forces, dipole-dipole forces; Elastic properties of solids, Young's modulus in terms of inter-atomic force constant, Bulk modulus of an ionic solid, generalized relation between bulk modulus and lattice energy; Lattice dynamics, vibrations of crystals with monatomic basis and with two atoms per primitive basis; Thermal properties, phonon heat capacity, density of states, Einstein model, Debye model, Umklapp processes; Electrons in metals, the free electron Fermi gas, electrical conductivity, Ohm's law, Hall effect; Nearly free electron model, energy bands, Bloch functions, Kronig-penney model; Semiconductors, band gaps, Intrinsic carrier concentration, impurity conductivity, donor and acceptor states; Superconductivity, destruction of superconductivity, Meissner effect, type I and type II superconductors, London equation, the BCS theory.

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**PHY3802: NUCLEAR PHYSICS**

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**Module title:** NUCLEAR PHYSICS  
**Code:** PHY3802  
**NQF Level:** 8  
**Contact hours:** 2 lecture periods per week for 14 weeks and 7 Practical/Tutorial sessions  
**Credits:** 8  
**Module assessment:** Continuous assessment (50%) and one 2-hour Examination (50%). Continuous assessment consists of a minimum of 3 assignments, 2 tests and practical reports.

**Pre-requisites:** PHY3732: Modern Physics II

**Module description :** Nuclear Structure, nuclear radius, nomenclature; Decay of the nucleus, alpha decay, beta decay, gamma decay, spontaneous fission; Radioactivity, radioactive growth and decay, transient equilibrium, secular equilibrium, radioactive decay series, carbon dating; Chart of Nuclides; Nuclear reactions, elastic scattering, inelastic scattering, reaction of transmutation, radiative capture, photodisintegration, induced fission; Interaction of radiation with matter, photoelectric effect, pair production, Compton scattering, calculation of energy transferred in Compton scattering using relativistic equations; The liquid drop model, variation of binding energy per nucleon with mass number; Weizsacher's semi-empirical mass formula; The shell model; Nuclear energy, nuclear reactors, introductory reactor physics, nuclear power plants; Nuclear instrumentation, radiation detectors, accelerators; Two body systems and nuclear force: properties of nuclear forces, the deuteron, qualitative treatment of n-p and p-p scattering at low energies; Elementary particle.

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**PHY3822: OPTICS AND LASER PHYSICS**

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**Module Title:** OPTICS AND LASER PHYSICS  
**Code:** PHY3822  
**NQF Level:** 8  
**Contact Hours:** 2 Lectures per week for 14 weeks, Practical Time: 7 sessions (21 hours)  
**Credits:** 8  
**Module Assessment:** Continuous [50%], Minimum 1 test and 1 assignment  
Exam [50%], 1 x 2-hour paper

**Pre-requisites:** PHY3631: Waves and Optics and PHY3711: Electrodynamics

**Module Description (contents):** This module will give opportunity to students to have mastery on various phenomenon based on the wave nature of light and that light is a transverse wave. The main contents of this course will be: Interference: Division of amplitude, Division of wavefronts, Thin films, Interferometers, Multiple reflections and Refractions; Diffraction: Fresnel's diffraction, Fraunhofer 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<sub>2</sub> laser and CO<sub>2</sub> laser; Applications.

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**PHY3842: ASTROPHYSICS**

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

**Pre-requisites:** PHY3732: Modern Physics II

**Module description (content):** Origins; parallax, magnitudes & luminosity; stellar spectra; classification and the H-R (Herzprung-Russel) diagram; stellar equilibrium: equations of state, hydrostatic equilibrium, radiation pressure; virial theorem; stellar timescales; Energy production mechanisms and Radiative Transport: P-P chain, CNO-cycle, triple- $\alpha$  process, other processes; shell burning; nucleosynthesis; Radiative transport; convective envelopes and convective cores; Stellar and planetary formation; Stellar Evolution: mass-luminosity relations; main sequence; stellar clusters; low mass, solar/intermediate mass and high mass stars; Stellar "graveyards": degenerate matter; white dwarfs; type Ia & II supernovae; neutron stars; pulsars and pulsar nebulae; SNRs; Stellar black holes; Pulsars, accreting binaries and AGNs; Practical astronomy: time; calendars; conversions; spherical geometry; coordinates & coordinate transformations; angular separation; rising & setting; compensations: precession, nutation, aberration, atmospheric refraction, barycentric motion;

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**PHY3862: ADVANCED POTENTIAL FIELDS**

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**Module Title:** ADVANCED POTENTIAL FIELDS  
**Code:** PHY3862  
**NQF Level:** 8  
**National Professional:** None  
**Contact Hours:** 2 Lectures per week for 14 weeks, Practical Time: 7 sessions (21 hours)  
**Credits:** 8  
**Module assessment:** Continuous assessment (50%, Minimum 2 tests and 2 or more practical assignments) Examination (50% 1 x 3-hour paper)

**Pre-requisites:** PHY3711: Electrodynamics

**Module description:** The following topics will be covered; Potential field theory: 2D and 3D gravitational and magnetic potentials, equipotential surfaces, forces of attraction – 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).

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**PHY3829: ELECTRONICS II**

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**Module Title:** ELECTRONICS II

**Code:** PHY3829

**NQF Level:** 8

**Contact hours:** 2 Lectures/Week for 14 weeks: 7 Practical /Tutorial ssessions (21 hours)

**Credits:** 8

**Module Assessment:** Continuous: 50%, Examination: 50% (1 x 2 hour exam)

**Pre-requisites:** PHY3702: Electronics I

**Module description:** This course is to give students an insight into the analysis and design of electronic circuits. The detailed course content is as follows:

Diodes and diode applications, diode testing, zener diodes and applications; Design of single stage CE amplifier, feedback, multistage amplifiers; Special electronic devices, optoelectronic devices, photoconductive cells, photodiodes, phototransistors, solar cells, light emitting diodes (LED), optocouplers, liquid-crystal displays (LCDs); BJT & FET differential pair, Ideal op-amp, inverting op-amp, non-inverting op-amp, frequency response, stability, gain-bandwidth, slew rate, offset currents and voltages, specifications, op-amp applications; Power BJT, power dissipation, power rating, thermal calculations, derating factor, heat sink, amplifiers classes and efficiency (class A, B, C), push-pull amplifier principle, push-pull drivers, harmonic distortion and feedback, distortions in push-pull amplifiers, class AB operation, biasing CAD design of analogue circuits.

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**I.1.3 PHYSICS DEPARTMENT: COURSE EQUIVALENTS**

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| <b>CURRENT COURSE</b> | <b>EQUIVALENT NEW COURSE</b> |
|-----------------------|------------------------------|
| PHC3101               | *PHY3501 or PHY3511          |
| PHC3112               | *PHY3512 or PHY3512          |
| PHC3192               | (To be offered again)        |
| PHC2102               | PHY3402                      |
| PHC3211               | PHY3511                      |
| PHC3201               | PHY3631                      |
| PHC3291               | (To be offered again)        |
| PHC3212               | PHY3512                      |
| PHC3202               | PHY3602                      |
| PHC3292               | (To be offered again)        |
| PHC3311               | PHY3611                      |
| PHC3331               | PHY3702                      |
| PHC3391               | (To be offered again)        |
| PHC3312               | PHY3712                      |
| PHC3332               | PHY3711                      |
| PHC3392               | (To be offered again)        |
| PHC3411               | PHY3811                      |
| PHC3431               | PHY3831                      |
| PHC3491               | (To be offered again)        |
| PHC3412               | PHY3812                      |
| PHC3492               | (To be offered again)        |
| PHC3402               | PHY3802 and PHY3822          |
| PHC3422               | PHY3842 and PHY3862          |

- For Life Sciences students only.

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## **J. DEPARTMENT OF STATISTICS**

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### **J.1 DIPLOMA PROGRAMMES**

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#### **J.1.1. REGULATION PERTAINING TO DIPLOMA STUDIES IN THE FACULTY**

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##### **QUALIFICATION: DIPLOMA IN APPLIED STATISTICS (11DSST)**

##### **INTRODUCTION**

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#### **J.1.2. 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)

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#### **J.1.3. DURATION OF STUDY**

The Diploma in Applied Statistics is to be offered on both full time and part-time basis. It cannot be completed in less than two (2) years for full-time students and cannot be completed in less than 3 years for part-time students. The maximum period of study for full-time and part-time students is 3 and 4 years, respectively.

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#### **J.1.4. MODE OF DELIVERY**

The Diploma in Applied Statistics will be offered in the evening. This is to allow full-time working candidates to attend lectures in the evening. The programme comprises of a total credit of 256 and it is at Namibian Qualification Framework (NQF) level 5. The year 1 modules are at NQF level 4 whereas the year 2 modules are at NQF level 5.

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#### **J.1.5. 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.

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#### **J.1.6. MINIMUM REQUIREMENTS FOR RE-ADMISSION**

To be readmitted to the Diploma programme, a student must have passed the minimum number of modules required as indicated below:

- 4 modules (equivalent to 64 credits) by the end of the first year; 2 of these modules (equivalent to 32 credits) must be non-core.
  
- 12 modules (equivalent of 192 credits) by the end of the second year

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#### **J.1.7. ADVANCEMENT AND PROGRESSION RULES**

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

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#### **J.1.8. MAXIMUM NUMBER OF MODULES PER YEAR**

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

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#### **J.1.9. ARTICULATION ROUTE**

After successful completion of the Diploma in Applied Statistics, students may be exempted from first year Statistics/and or Population Studies modules as follows:

A student joining the Bachelor of Science (Honours) degree in Statistics or Bachelor of Science Population Studies (Honours) after completing the Diploma in Applied Statistics from the University of Namibia or any equivalent qualification may be exempted from certain year 1 modules of the degree program on a case by case basis.

| <b>Module passed</b>         | <b>Exemption</b>                    |
|------------------------------|-------------------------------------|
| SSTD2511 Statistical Methods | STS3531 Descriptive Statistics      |
| SSTD2531 Probability         | STS3532 Introduction to Probability |



**QUALIFICATION: DIPLOMA IN APPLIED STATISTICS**

**YEAR 1**

| Semester | Module Title                      | Code    | Pre-requisite      |
|----------|-----------------------------------|---------|--------------------|
| 1        | English for General Communication | LEG2410 | Entry requirements |
| 1        | Computer Literacy                 | CLC3509 | Entry requirements |
| 1        | Basics of Statistics              | STD2431 | Entry requirements |
| 1        | The Statistical System            | STD2411 | Entry requirements |
| 1        | Contemporary Social Issues        | CSI3529 | Entry requirements |

| Semester | Module Title                      | Code    | Pre-requisite      |
|----------|-----------------------------------|---------|--------------------|
| 2        | English for General Communication | LEG2410 | Entry requirements |
| 2        | Index Numbers and Time series     | STD2412 |                    |
| 2        | Introduction to Mathematics       | STD2432 | Entry requirements |
| 2        | Sampling concepts in Survey work  | STD2452 | Entry requirements |

**YEAR 2**

| Semester | Module Title                       | Code    | Pre-requisite |
|----------|------------------------------------|---------|---------------|
| 1        | Basic Data Processing              | STD2551 | STD2452       |
| 1        | Probability                        | STD2531 | STD2432       |
| 1        | Statistical Methods and Techniques | STD2511 | STD2431       |
| 1        | Basic Micro Economics              | EMI2571 |               |

| Semester | Module Title                      | Code    | Pre-requisite |
|----------|-----------------------------------|---------|---------------|
| 2        | English for Academic Purposes     | LCE3519 |               |
| 2        | Statistical Modeling              | STD2532 | STD2432       |
| 2        | Basic Demography and Epidemiology | STD2512 | STD2411       |
| 2        | Basic Macro Economics             | EMA2572 |               |

**J.2. DIPLOMA IN APPLIED STATISTICS: MODULE AND CURRICULUM DESCRIPTION**

**FIRST YEAR MODULES**

**LEG2410 ENGLISH FOR GENERAL COMMUNICATION**

**4L/Week**

**Module title:** English for General Communication  
**Code:** LEG2410  
**NQF Level:** 4  
**Contact hours:** 4 hours per week for 28 weeks  
**Credits:** 32  
**Module Assessment:** Continuous assessment (60%):4 reading tests, 4 writing tests, 2 oral presentations and 1 literature worksheet. 1x3 hour examination paper (40%):  
**Pre-requisites:** None  
**Module description:** This module attempts to assist students to improve their general English proficiency. The main goal of this module is to develop the reading, writing, listening, speaking and study skills of students in order for them to perform tasks in an academic environment and beyond.

**CLC3509 COMPUTER LITERACY**

**2L/Week**

**Module title:** Computer Literacy  
**Code:** CLC 3509  
**NQF level:** 5  
**Contact hours:** 1 lecture theory and 1 lecture practical per week for 14 weeks  
**Credits:** 8  
**Module assessment:** Continuous Assessment 100% 2 Practical Tests 50% and 2 Theory Tests 50%  
**Prerequisites:** None  
**Module description:** The aim of this module is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment. The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

| <b>STD241 THE STATISTICAL SYSTEM</b>       |  | <b>4L/Week</b> |
|--|--|----------------|
| <b>Module Title:</b>                       | <b>The Statistical System</b>  |                |
| <b>Code:</b>                               | <b>STD2411</b>   |                |
| <b>NQF Level:</b>                          | <b>4</b>   |                |
| <b>Contact Hours:</b>                      | <b>4 lectures per week/14 weeks</b>  |                |
| <b>Credits:</b>                            | <b>16</b>  |                |
| <b>Module Assessment:</b>                  | <b>Continuous assessment (at least two tests and one assignments) 40%;<br/>1 x 3 hours Examination 60%</b>   |                |
| <b>Pre-requisite:</b>                      | <b>None</b>  |                |
| <b>Module description:</b>                 | 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.   |                |
| <b>STD 2431 BASICS OF STATISTICS</b>       |  | <b>4L/Week</b> |
| <b>Module Title:</b>                       | <b>BASICS OF STATISTICS</b>  |                |
| <b>Code:</b>                               | <b>STD 2431</b>  |                |
| <b>NQF Level:</b>                          | <b>4</b>   |                |
| <b>Contact Hours:</b>                      | <b>4 Lectures per week for 14 weeks</b>  |                |
| <b>Number of Credits:</b>                  | <b>16</b>  |                |
| <b>Module Assessment:</b>                  | <b>Continuous assessment (at least two tests and one assignments) 40%;<br/>1 x 3 hours Examination 60%</b>   |                |
| <b>Prerequisites:</b>                      | <b>None</b>  |                |
| <b>Module Description:</b>                 | Definition: Statistics; descriptive, inferential. Variables: qualitative versus quantitative. Data types: primary versus secondary, categorical versus discrete, continuous. Sources of data: Population versus sample. Reasons for sampling. Sampling techniques: probability versus non- probability sampling- advantages and disadvantages of each. Simple Random Sampling, Stratified Random Sampling, Systematic Sampling, cluster Sampling, Uses of random numbers. Convenience Sampling Purposive Sampling, Judgemental Sampling, Snowball Sampling. Types of measurements: nominal, ordinal, interval, ratio scales. Presentation of data: tabular forms; frequency tables, cross-tabulations (two- variable), graphical methods; histograms, pie charts, bar charts, frequency polygons, stem- and- leaf plots, box- and- whiskers plot, ogives. Measures of Central Tendency: $\Sigma$ notation, $\Pi$ notation, mean, median, mode, quartiles, percentiles. Measures of Dispersion: variance, standard deviation, range, inter- quartile range, skewness, Kurtosis. Identifying outliers. Uses of scientific calculators for statistical manipulation limited to calculation of mean, standard deviation, random number generation. |                |
| <b>CSI 3429 CONTEMPORARY SOCIAL ISSUES</b> |  | <b>4L/Week</b> |
| <b>Module Title:</b>                       | <b>Contemporary Social Issues</b>  |                |
| <b>Code:</b>                               | <b>CSI 3529</b>  |                |
| <b>NQF:</b>                                | <b>5</b>   |                |
| <b>Contact Hours:</b>                      | <b>2 periods per week for 14 weeks</b>   |                |
| <b>Credits:</b>                            | <b>8</b>   |                |
| <b>Module Assessment:</b>                  | <b>Continuous assessment (50%): test or assignment<br/>1x 2 hours examination paper (50%):</b>   |                |
| <b>Prerequisite:</b>                       | <b>None</b>  |                |
| <b>Module Description:</b>                 | The module raises awareness on the need for a personal, national and global ethics. The main objectives of the course is to help students reflect on the social moral issues; to discover themselves in a learner-centered, contextual, religious and life related setting. It also stimulates students for critical thinking and help them to appreciate their values, standards and attitudes. Furthermore it orientates students with regards to the epidemiology of HIV/AIDS; the prevalence of the disease on Namibia, Africa and Internationally. It also informs students on the psycho social and environmental factors that contribute to the spread of the disease, the impact of HIV/AIDS on their individual lives, family and communities at large. The unit further seeks to enhance HIV/AIDS preventive skills among students by means of paradigm shift and behavior change and also to impart general introductory knowledge on gender, to make students aware, as well as sensitize them towards gender issues and how they affect our society, Sub-Region and continent at large.   |                |
| <b>STD2432 INTRODUCTION TO MATHEMATICS</b> |  | <b>4L/Week</b> |
| <b>Module Title:</b>                       | <b>INTRODUCTION TO MATHEMATICS</b>   |                |
| <b>Code:</b>                               | <b>STD2432</b>   |                |
| <b>NQF Level:</b>                          | <b>4</b>   |                |
| <b>Contact Hours:</b>                      | <b>4 lectures per week/14 weeks,</b>   |                |
| <b>Credits:</b>                            | <b>16</b>  |                |
| <b>Module Assessment:</b>                  | <b>Continuous assessment (at least two tests and two assignments) 40%; 1x3 hours Examination 60%</b>   |                |
| <b>Pre-requisite:</b>                      | <b>Grade 12 Mathematics</b>  |                |
| <b>Module description:</b>                 | Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement; Matrices: addition, multiplication, scalar multiplication and transpose (for up to 3x3 dimension), determinant and inverse (with emphasis on 2x2), Derivatives: definition, rules of differentiation; the definite integral. Understand the difference between sequences and series and between finite and infinite series, and appreciate the idea of a limit. Solve basic problems involving Arithmetic and Geometric Progressions. Compute both simple and compound interests, apply the concept to discounting in studying Economics. Use the Binomial Series Expansion to any power. Indices and logarithms.  |                |

| <b>STD2452 SAMPLING CONCEPTS IN SURVEY WORK</b> |   | <b>4L/Week</b> |
|---|---|----------------|
| <b>Module Title:</b>                            | <b>SAMPLING CONCEPTS IN SURVEY WORK</b>   |                |
| <b>Code:</b>                                    | <b>STD2452</b>  |                |
| <b>NQF Level:</b>                               | 4   |                |
| <b>Contact Hours:</b>                           | 4 lectures per week/14 weeks,   |                |
| <b>Credits:</b>                                 | 16  |                |
| <b>Module Assessment:</b>                       | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; 1 x 3 hours Examination <b>60%</b>  |                |
| <b>Pre- requisite:</b>                          | None  |                |
| <b>Module description:</b>                      | Identifying data needs. Importance of examining the literature to determine existing data sources, their appropriateness and their reliability. Using knowledge concerning the target population. Samples, target population, study population, sampling frames, sampling units. Developing objectives; Designing a sampling CHEme; Designing and testing a questionnaire; Data entry and data cleaning; Producing statistical summaries that relate to the objectives of the study; Presenting results What is meant by "representativeness"? The importance of getting results that are generalisable. What is meant by simple random sampling and stratified random sampling. How to draw such samples. Benefits and limitations. Probability versus non-probability sampling methods. A brief overview of quota sampling, purposive sampling, systematic sampling, cluster sampling and multi-stage sampling. Developing a sampling strategy for a given problem. Identifying information needs. Discussing alternative sampling CHEmes as presented by different groups. Estimating a population mean, a population proportion. Distinguishing between "with" and "without" replacement sampling. Computing measures of precision. How to take a stratified random sample. Advantages of stratification. Sample sizes using proportional allocation or Neyman's allocation. Deriving estimates for a population mean, total and proportion. Formulae for determining the sample size based on simple random sampling for estimating a population mean or population proportion. Difficulties associated with use of formulae. Recognizing broad issues that enter into sample size determinations. Key considerations needed to make decisions about sample sizes. Cluster and multi-stage sampling. Probability proportional to size (PPS) sampling. Self-weighting designs. Brief introduction to the role of design effects. Brief overview of different types of non-sampling errors. Discussion of how non-sampling errors can be minimized. Role of sampling weights in estimation. Calculation of weights for simple scenarios. |                |

| <b>STD2412 INDEX NUMBERS AND TIME SERIES</b> |   | <b>4L/Week</b> |
|--|---|----------------|
| <b>Module Title:</b>                         | <b>INDEX NUMBERS AND TIME SERIES</b>  |                |
| <b>Code:</b>                                 | <b>STD2412</b>  |                |
| <b>NQF Level:</b>                            | 4   |                |
| <b>Contact Hours:</b>                        | 4 lectures per week/14 weeks,   |                |
| <b>Credits:</b>                              | 16  |                |
| <b>Module Assessment:</b>                    | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; 1x3 hour Examination <b>60%</b>   |                |
| <b>Pre- requisite:</b>                       | Grade 12 Mathematics  |                |
| <b>Module description:</b>                   | Introduction to index numbers; Basic theory of index number, consumer price indices, errors in index numbers, rebasing techniques, introduction to National Accounts, GDP statistics by activity, GDP by expenditure, National Income and the balance of payment, measuring GDP. Introduction to time series; Trends in time series; decomposing a time series; forecasting and review. |                |

## SECOND YEAR MODULES

| <b>STD2531 PROBABILITY</b> |   | <b>4L/Week</b> |
|----------------------------|---|----------------|
| <b>Module Title:</b>       | <b>PROBABILITY</b>  |                |
| <b>Code:</b>               | <b>STD2531</b>  |                |
| <b>NQF Level:</b>          | 5   |                |
| <b>Contact Hours:</b>      | 4 lectures per week/14 weeks,   |                |
| <b>Credits:</b>            | 16  |                |
| <b>Module Assessment:</b>  | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; 1x3 hour Examination <b>60%</b>   |                |
| <b>Pre- requisite:</b>     | SSTD2432  |                |
| <b>Module description:</b> | Introduction to probability and life tables ideas; Laws of probability; Conditional probability and independence; probability distributions: the binomial distribution, the Poisson distribution, the normal distribution; using probability ideas in life tables; basic life table computations. |                |

| <b>STD2511 STATISTICAL METHODS AND TECHNIQUES</b> |  | <b>4L/Week</b> |
|---|--|----------------|
| <b>Module Title:</b>                              | <b>STATISTICAL METHODS AND TECHNIQUES</b>  |                |
| <b>Code:</b>                                      | <b>STD2511</b>   |                |
| <b>NQF Level:</b>                                 | 5  |                |
| <b>Contact Hours:</b>                             | 4 lectures per week/14 weeks,  |                |
| <b>Module Assessment:</b>                         | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; 1X3 hour Examination <b>60%</b>  |                |
| <b>Pre- requisite:</b>                            | SSTD2431   |                |
| <b>Module description:</b>                        | Analysis of Variance: One way and two-ways; Linear models and estimation by least squares: an introduction; measures of association between variables; Hypothesis testing: Test of significance for means; proportions and variance: in small and large samples (dependent and independent samples); Chi-square tests; Calculating Type II Error probabilities and finding the sample size for the Z test; relationships between hypothesis testing procedure and confidence intervals; Significance levels and p-values as ways of reporting results of a statistical test; |                |

|  |  |                |
|--|--|----------------|
| <b>EMI2571 BASIC MICROECONOMICS</b>              |  | <b>4L/Week</b> |
| <b>Module Title:</b>                             | <b>BASIC MICROECONOMICS</b>  |                |
| <b>Code:</b>                                     | <b>EMI2571</b>   |                |
| <b>NQF Level:</b>                                | 5  |                |
| <b>Contact Hours:</b>                            | 4 lectures per week/14 weeks,  |                |
| <b>Credits:</b>                                  | 16   |                |
| <b>Module Assessment:</b>                        | Continuous assessment (at least two tests and two assignments) 40%; 1x3 hour Examination <b>60%</b>  |                |
| <b>Pre- requisite:</b>                           | None   |                |
| <b>Module description:</b>                       | This module is aimed at introducing students to key concepts used in microeconomics and facilitates a basic understanding of the economic phenomena. The module is designed to help students understand that society's economic choices often involve tradeoffs between efficiency and equity and serves as preparation for students for further study of the discipline with the economics field. The module content includes: an introduction to microeconomics, demand and supply, market structures, factor markets and introduction to international trade.   |                |
| <b>LEA3519 ENGLISH FOR ACADEMIC PURPOSES</b>     |  | <b>4L/Week</b> |
| <b>Module title:</b>                             | <b>ENGLISH FOR ACADEMIC PURPOSES</b>   |                |
| <b>Code:</b>                                     | <b>LEA3519</b>   |                |
| <b>NQF level:</b>                                | 5  |                |
| <b>Contact hours:</b>                            | 4 periods per week for 14 weeks  |                |
| <b>Credits:</b>                                  | 16   |                |
| <b>Module assessment:</b>                        | Continuous assessment ( <b>60%</b> ): 2 tests (reading and writing), 1 academic written essay, 1 oral presentation Examination (40%):1x3 hour examination paper  |                |
| <b>Prerequisites:</b>                            | LCE3519  |                |
| <b>Module description:</b>                       | This module develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.   |                |
| <b>STD2552 BASIC DATA PROCESSING</b>             |  | <b>4L/Week</b> |
| <b>Module Title:</b>                             | <b>BASIC DATA PROCESSING</b>   |                |
| <b>Code:</b>                                     | <b>STD 2552</b>  |                |
| <b>NQF Level:</b>                                | 5  |                |
| <b>Contact Hours:</b>                            | 2 theoretical lectures and 2 practical lectures per week   |                |
| <b>Number of Credits:</b>                        | 16   |                |
| <b>Module Assessment:</b>                        | Continuous Assessment (at least two tests and two assignments) <b>40%</b> , Examination <b>60%</b> . 1x3 hour practical and theoretical Examination  |                |
| <b>Prerequisites:</b>                            | STD2452  |                |
| <b>Module Description:</b>                       | Designing a questionnaire, coding, variable definition; transferring data from paper form to electronic files, uses and limitations of a spreadsheet for data entry; organising data in a spreadsheet; Exploratory data analysis for single variables; analysing numeric variables, producing and presenting good tables and graphs, Analysing categorical variables; managing the dataset; organising multiple response data; international standards and guidelines; efficient storage and management of electronic files; cross tabulation and testing for relationships and associations.  |                |
| <b>STD2512 BASIC DEMOGRAPHY AND EPIDEMIOLOGY</b> |  | <b>4L/Week</b> |
| <b>Module Title:</b>                             | <b>BASIC DEMOGRAPHY AND EPIDEMIOLOGY</b>   |                |
| <b>Code:</b>                                     | <b>STD2512</b>   |                |
| <b>NQF Level:</b>                                | 5  |                |
| <b>Contact Hours:</b>                            | 4 lectures per week/14 weeks,  |                |
| <b>Credits:</b>                                  | 16   |                |
| <b>Module Assessment:</b>                        | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; 1 x 3 hours Examination <b>60%</b>   |                |
| <b>Pre- requisite:</b>                           | STD2411  |                |
| <b>Module description:</b>                       | Meaning of demography. Data sources: census, vital registration and surveys. Nature of demographic data and usual need for very large samples. Data collection problems: frame, non-response and measurement errors. Uses and importance of demographic data. Difficult concepts for data collection and analysis e.g. household and family. Difficult data to elicit e.g. complete fertility histories. Meaning of epidemiology. Data sources, examples and discussion: routine data, cross-sectional surveys, longitudinal and sentinel site studies, research approaches. Introduction to "demographic shorthand" use of algebraic symbols. Absolute vs. relative numbers. Ratio, proportion and rate. Death rates introduced as being conceptually some of the simplest demographic rates. Age-specific death rates. Data sources. Mortality rates. Mention of some other types of rates. Attribute data & its importance in epidemiology. Point and period prevalence. Incidence and relationship to prevalence. Risk, risk factors, comparison of risks. Brief introduction to cohort and case-control studies and basic perceptions of risk therein. Confounding. Direct and indirect standardisation introduced and discussed in context of death rates. Brief mention of other, more general applications of this idea. Age-grouping conventions. Age-misreporting. Disaggregation and its data demands. Reporting detailed data. Introduction to age-period-cohort issues. Construction of a simple life table |                |

| STD2532 STATISTICAL MODELLING |  | 4L/Week |
|-------------------------------|--|---------|
| <b>Module Title:</b>          | STATISTICAL MODELLING  |         |
| <b>Code:</b>                  | STD2532  |         |
| <b>NQF Level:</b>             | 5  |         |
| <b>Contact Hours:</b>         | 2 theoretical lectures and 2 practical lectures per week   |         |
| <b>Number of Credits:</b>     | 16   |         |
| <b>Module Assessment:</b>     | Continuous Assessment (at least two tests and two assignments) <b>40%</b> , 1x3 hour Examination <b>60%</b> .  |         |
| <b>Prerequisites:</b>         | STD2432  |         |
| <b>Module Description:</b>    | Simple Linear Regression; Inferences about the regression line; Correlation and the Coefficient of determination; Assumptions underlying regression analysis; Multiple linear regression; Choosing the best model; Predictions from the regression model; analysis of variance for comparing means; analysis of variance with two categorical factors; comparing regressions |         |

| EMA2572 BASIC MACROECONOMICS |  | 4L/Week |
|------------------------------|--|---------|
| <b>Module Title:</b>         | BASIC MACROECONOMICS   |         |
| <b>Code:</b>                 | EMA2572  |         |
| <b>NQF Level:</b>            | 5  |         |
| <b>Contact Hours:</b>        | 4 lectures per week/14 weeks,  |         |
| <b>Credits:</b>              | 16   |         |
| <b>Module Assessment:</b>    | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; 1x3 hour Examination <b>60%</b>  |         |
| <b>Pre-requisite:</b>        | None   |         |
| <b>Module description:</b>   | This module introduces basic concepts and tools used in macroeconomic analysis: the theory, measurement, and determination of national income; business cycles; the multiplier; fiscal policy; budget deficits; and the national debt; aggregate supply and aggregate demand; money, banking, and monetary policy, exchange rates and balance of payments accounts; and stabilization policy for unemployment and inflation. |         |

### J.3 BACHELOR OF SCIENCE HONOURS MAJORS AND MINORS, CURRICULUM AND PREREQUISITES

**QUALIFICATION:** B.Sc. (Honours) Statistics Major and Computer Science Minor (11BSTC)

Students opting for a major in **Statistics** (with Computer Science minor) must take all of the following modules:

#### YEAR 1

| SEMESTER                      | MODULE  | CODE    | PRE-/COREQUISITES             |
|-------------------------------|---|---------|-------------------------------|
| 1                             | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1                             | Descriptive Statistics                          | STS3531 | C in Gr. 12 Mathematics       |
| 1                             | Computer Literacy                               | CLC3509 | None                          |
| 1                             | Basic Mathematics                               | MAT3511 | C in Gr. 12 Mathematics       |
| 1                             | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | C in Gr. 12 Mathematics       |
| <b>Computer Science Minor</b> |   |         |                               |
| 1                             | Programming Fundamentals I                      | CMP3511 | Departmental Entry Test       |

| SEMESTER                      | MODULE                       | CODE     | PRE-/COREQUISITES                  |
|-------------------------------|------------------------------|----------|------------------------------------|
| 2                             | English for academic Purpose | LEA3519  |                                    |
| 2                             | Contemporary Social Issues   | CSI 3529 |                                    |
| 2                             | Precalculus                  | MAT3512  | C in Gr. 12 Mathematics            |
| 2                             | Introduction to Probability  | STS3532  | C in Gr. 12 Mathematics            |
| <b>Computer Science Minor</b> |                              |          |                                    |
| 3                             | Programming Fundamentals II  | CMP3512  | CMP3511 Programming Fundamentals I |

#### YEAR 2

| SEMESTER                      | MODULE                           | CODES   | PRE/CO-REQUISITES                  |
|-------------------------------|----------------------------------|---------|------------------------------------|
| 1                             | Probability Theory               | STS3611 | STS3532, MAT3512                   |
| 1                             | Statistical Estimation           | STS3631 | STS3532                            |
| 1                             | Calculus I                       | MAT3611 | None                               |
| 1                             | Sets and Numbers                 | MAT3601 | None                               |
| <b>Computer Science Minor</b> |                                  |         |                                    |
| 1                             | Introduction to Database Systems | CMP3611 | CMP3511 Programming Fundamentals I |

| SEMESTER                      | MODULE                                | CODES   | PRE/CO-REQUISITES                        |
|-------------------------------|---------------------------------------|---------|--|
| 2                             | Introduction to Statistical Computing | STS3612 | STS3531                                  |
| 2                             | Calculus II                           | MAT3612 | MAT3512                                  |
| 2                             | Statistical Inference                 | STS3632 | STS3532                                  |
| <b>Computer Science Minor</b> |                                       |         |  |
| 2                             | Advanced Databases                    | CMP3622 | CMP3611 Introduction to Database Systems |

**YEAR 3**

| SEMESTER                      | MODULE                      | CODES   | PRE/CO-REQUISITES                  |
|-------------------------------|-----------------------------|---------|------------------------------------|
| 1                             | Linear Models               | STS3711 | STS3611, STS3632                   |
| 1                             | Distribution Theory         | STS3721 | MAT3611, MAT3632, STS3611          |
| 1                             | Sampling Techniques         | STS3731 | STS3531                            |
| 1                             | Research and Survey Methods | STS3701 | None                               |
| <b>Computer Science Minor</b> |                             |         |                                    |
| 1                             | Artificial Intelligence     | CMP3771 | CMP3511 Programming Fundamentals I |

| SEMESTER                      | MODULE                                       | CODES   | PRE/CO-REQUISITES   |
|-------------------------------|--|---------|---|
| 2                             | Data processing                              | STS3732 | STS3632, STS3612  |
| 2                             | Experimental Design and Analysis of Variance | STS3752 | STS3636   |
| 2                             | Non-parametric and Categorical Statistics    | STS3712 | STS3632   |
| <b>Computer Science Minor</b> |  |         |   |
| 2                             | Database Programming                         | CMP3852 | CMP3511 Programming Fundamentals I;<br>CMP3622 Advanced Databases |

**YEAR 4**

| SEMESTER | MODULE                           | CODES   | PRE/CO-REQUISITES |
|----------|----------------------------------|---------|-------------------|
| 1        | Time Series Analysis             | STS3801 | STS3711           |
| 1        | Statistical Computer Programming | STS3811 | STS3732           |
| 1        | Research Project                 | STS3810 |                   |
| 1        | Decision Analysis                | STS3821 | STS3711           |
| 1        | Stochastic Processes             | STS3831 | STS3721           |

| SEMESTER | MODULE                              | CODES   | PRE/CO-REQUISITES |
|----------|-------------------------------------|---------|-------------------|
| 2        | Multivariate Distribution Theory    | STS3812 | STS3721           |
| 2        | Research Project                    | STS3810 |                   |
| 2        | Forecasting Methods and Application | STS3852 |                   |
| 2        | Statistical Quality Control         | STS3832 | STS3721           |

**QUALIFICATION: B.Sc. (Honours) Statistics Major and Population Studies Minor (11BSTP)**

Students opting for a major in **Statistics** (with Population Studies minor) must take all of the following modules:

**YEAR 1**

| SEMESTER                         | MODULE  | CODES   | PRE/CO-REQUISITES             |
|----------------------------------|---|---------|-------------------------------|
| 1                                | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1                                | Descriptive Statistics                          | STS3531 | C in Gr. 12 Mathematics       |
| 1                                | Computer Literacy                               | CLC3509 | None                          |
| 1                                | Basic Mathematics                               | MAT3511 | C in Gr. 12 Mathematics       |
| 1                                | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | C in Gr. 12 Mathematics       |
| <b>Population Studies Minor:</b> |   |         |                               |
| 1                                | Foundation of Sociology                         | SOG3511 |                               |

| SEMESTER                         | MODULE                       | CODES   | PRE/CO-REQUISITES       |
|----------------------------------|------------------------------|---------|-------------------------|
| 2                                | English for academic Purpose | LEA3519 |                         |
| 2                                | Contemporary Social Issues   | CSI3529 |                         |
| 2                                | Precalculus                  | MAT3512 | C in Gr. 12 Mathematics |
| 2                                | Introduction to Probability  | STS3532 | C in Gr. 12 Mathematics |
| <b>Population Studies Minor:</b> |                              |         |                         |
| 2                                | Basics of Sociology          | SOG3532 |                         |

**YEAR 2**

| SEMESTER                        | MODULE   | CODES   | PRE/CO-REQUISITES |
|---------------------------------|--|---------|-------------------|
| 1                               | Probability Theory                                   | STS3611 | STS3532, MAT3512  |
| 1                               | Statistical Estimation                               | STS3631 | STS3532           |
| 1                               | Calculus I   | MAT3611 | None              |
| 1                               | Sets and Numbers                                     | MAT3601 | None              |
| <b>Population Studies Minor</b> |  |         |                   |
| 1                               | Official statistics and National Statistical systems | POP3631 | None              |

| SEMESTER                        | MODULE                                | CODES   | PRE/CO-REQUISITES |
|---------------------------------|---------------------------------------|---------|-------------------|
| 2                               | Introduction to Statistical Computing | STS3612 | STS3531           |
| 2                               | Calculus II                           | MAT3612 | MAT3512           |
| 2                               | Statistical Inference                 | STS3632 | STS3532           |
| <b>Population Studies Minor</b> |                                       |         |                   |
| 2                               | Social Demography                     | SOG3652 |                   |

### YEAR 3

| SEMESTER                        | MODULE                      | CODES   | PRE/CO-REQUISITES         |
|---------------------------------|-----------------------------|---------|---------------------------|
| 1                               | Linear Models               | STS3711 | STS3611, STS3632          |
| 1                               | Distribution Theory         | STS3721 | MAT3611, MAT3632, STS3611 |
| 1                               | Sampling Techniques         | STS3731 | STS3531                   |
| 1                               | Research and Survey Methods | STS3701 | None                      |
| <b>Population Studies Minor</b> |                             |         |                           |
| 1                               | Demographic Methods I       | POP3711 |                           |

| SEMESTER                        | MODULE                                       | CODES   | PRE/CO-REQUISITES |
|---------------------------------|--|---------|-------------------|
| 2                               | Data processing                              | STS3732 | STS3632, STS3612  |
| 2                               | Experimental Design and Analysis of Variance | STS3752 | STS3636           |
| 2                               | Non-parametric and Categorical Statistics    | STS3712 | STS3632           |
| <b>Population Studies Minor</b> |  |         |                   |
| 2                               | Demographic Methods II                       | POP3732 | POP3711, POP3611  |

### YEAR 4

| SEMESTER | MODULE                           | CODES   | PRE/CO-REQUISITES |
|----------|----------------------------------|---------|-------------------|
| 1        | Time Series Analysis             | STS3801 | STS3711           |
| 1        | Statistical Computer Programming | STS3811 | STS3732           |
| 1        | Research Project                 | STS3810 |                   |
| 1        | Decision Analysis                | STS3821 | STS3711           |
| 1        | Stochastic Processes             | STS3831 | STS3721           |

| SEMESTER | MODULE                              | CODES   | PRE/CO-REQUISITES |
|----------|-------------------------------------|---------|-------------------|
| 2        | Multivariate Distribution Theory    | STS3812 | STS3721           |
| 2        | Research Project                    | STS3810 |                   |
| 2        | Forecasting Methods and Application | STS3852 |                   |
| 2        | Statistical Quality Control         | STS3832 | STS3721           |

### QUALIFICATION: B.Sc. (Honours) Statistics Major and Mathematics Minor (11BSTM)

Students opting for a major in **Statistics** (with Mathematics minor) must take all of the following modules:

### YEAR 1

| SEMESTER                 | MODULE  | CODES   | PRE/CO-REQUISITES             |
|--------------------------|---|---------|-------------------------------|
| 1                        | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1                        | Descriptive Statistics                          | STS3531 | C in Gr. 12 Mathematics       |
| 1                        | Computer Literacy                               | CLC3509 | None                          |
| 1                        | Basic Mathematics                               | MAT3511 | C in Gr. 12 Mathematics       |
| 1                        | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | C in Gr. 12 Mathematics       |
| <b>Mathematics Minor</b> |   |         |                               |
| 1                        | Programming Fundamentals I                      | CMP3511 | Departmental Entry Test       |

| SEMESTER                 | MODULE                       | CODES    | PRE/CO-REQUISITES                  |
|--------------------------|------------------------------|----------|------------------------------------|
| 2                        | English for academic Purpose | LEA3519  |                                    |
| 2                        | Contemporary Social Issues   | CSI 3529 |                                    |
| 2                        | Precalculus                  | MAT3512  | C in Gr. 12 Mathematics            |
| 2                        | Introduction to Probability  | STS3532  | C in Gr. 12 Mathematics            |
| <b>Mathematics Minor</b> |                              |          |                                    |
| 2                        | Programming Fundamentals II  | CMP3512  | CMP3511 Programming Fundamentals I |

### YEAR 2

| SEMESTER                 | MODULE                                | CODES   | PRE/CO-REQUISITES                                      |
|--------------------------|---------------------------------------|---------|--|
| 1                        | Probability Theory                    | STS3611 | STS3532, MAT3512                                       |
| 1                        | Statistical Estimation                | STS3631 | STS3532  |
| 1                        | Calculus I                            | MAT3611 | [MAT3511 and MAT 3512]<br>or<br>[MAT3531 and MAT3512]  |
| 1                        | Sets and Numbers                      | MAT3601 | any two following modules: MAT3511<br>MAT3531, MAT3512 |
| <b>Mathematics Minor</b> |                                       |         |  |
| 1                        | Numerical Methods                     | MAT3621 |  |
| SEMESTER                 | MODULE                                | CODES   | PRE/CO-REQUISITES                                      |
| 2                        | Introduction to Statistical Computing | STS3612 | STS3531  |
| 2                        | Calculus II                           | MAT3612 | [MAT3511 and MAT 3512]<br>or<br>[MAT3531 and MAT3512]  |
| 2                        | Statistical Inference                 | STS3632 | STS3532  |
| <b>Mathematics Minor</b> |                                       |         |  |
| 2                        | Elementary Linear Algebra             | MAT3652 | Any two following modules: MAT3511<br>MAT3531, MAT3512 |

### YEAR 3

| SEMESTER                 | MODULE                      | CODES   | PRE/CO-REQUISITES         |
|--------------------------|-----------------------------|---------|---------------------------|
| 1                        | Linear Models               | STS3711 | STS3611, STS3632          |
| 1                        | Distribution Theory         | STS3721 | MAT3611, MAT3632, STS3611 |
| 1                        | Sampling Techniques         | STS3731 | STS3531                   |
| 1                        | Research and Survey Methods | STS3701 | None                      |
| <b>Mathematics Minor</b> |                             |         |                           |
| 1                        | Linear Algebra I            | MAT3711 | MAT3601<br>MAT3652        |

| SEMESTER                 | MODULE                                       | CODES   | PRE/CO-REQUISITES  |
|--------------------------|--|---------|--------------------|
| 2                        | Data processing                              | STS3732 | STS3632, STS3612   |
| 2                        | Experimental Design and Analysis of Variance | STS3752 | STS3636            |
| 2                        | Non-parametric and Categorical Statistics    | STS3712 | STS3632            |
| <b>Mathematics Minor</b> |  |         |                    |
| 2                        | Linear Algebra II                            | MAT3712 | MAT3601<br>MAT3652 |

### YEAR 4

| SEMESTER | MODULE                           | CODES   | PRE/CO-REQUISITES |
|----------|----------------------------------|---------|-------------------|
| 1        | Time Series Analysis             | STS3801 | STS3711           |
| 1        | Statistical Computer Programming | STS3811 | STS3732           |
| 1        | Research Project                 | STS3810 |                   |
| 1        | Decision Analysis                | STS3821 | STS3711           |
| 1        | Stochastic Processes             | STS3831 | STS3721           |

| SEMESTER | MODULE                              | CODES   | PRE/CO-REQUISITES |
|----------|-------------------------------------|---------|-------------------|
| 2        | Multivariate Distribution Theory    | STS3812 | STS3721           |
| 2        | Research Project                    | STS3810 |                   |
| 2        | Forecasting Methods and Application | STS3852 |                   |
| 2        | Statistical Quality Control         | STS3832 | STS3721           |



**QUALIFICATION: B.Sc. (Honours) Statistics Major and Economics Minor (11BSTE)**

Students opting for a major in **Statistics** (with Economics minor) must take all of the following modules:

**YEAR 1**

| SEMESTER               | MODULE  | CODES    | PRE/CO-REQUISITES             |
|------------------------|---|----------|-------------------------------|
| 1                      | English Communication & Study Skills            | LCE3519  | University entry requirements |
| 1                      | Descriptive Statistics                          | STS3531  | C in Gr. 12 Mathematics       |
| 1                      | Computer Literacy                               | CLC3509  |                               |
| 1                      | Basic Mathematics                               | MAT3511  | C in Gr. 12 Mathematics       |
| 1                      | Analytic Geometry, Complex Numbers and Matrices | MAT3531  | C in Gr. 12 Mathematics       |
| <b>Economics Minor</b> |   |          |                               |
| 1                      | Basic Microeconomics                            | EMI3571  |                               |
| SEMESTER               | MODULE  | CODES    | PRE/CO-REQUISITES             |
| 2                      | English for academic Purpose                    | LEA3519  |                               |
| 2                      | Contemporary Social Issues                      | CSI 3529 |                               |
| 2                      | Precalculus                                     | MAT3512  | C in Gr. 12 Mathematics       |
| 2                      | Introduction to Probability                     | STS3532  | C in Gr. 12 Mathematics       |
| <b>Economics Minor</b> |   |          |                               |
| 2                      | Basic Macroeconomics                            | EMA3572  |                               |

**YEAR 2**

| SEMESTER               | MODULE                                | CODES   | PRE/CO-REQUISITES |
|------------------------|---------------------------------------|---------|-------------------|
| 1                      | Probability Theory                    | STS3611 | STS3532, MAT3512  |
| 1                      | Statistical Estimation                | STS3631 | STS3532           |
| 1                      | Calculus I                            | MAT3611 | None              |
| 1                      | Sets and Numbers                      | MAT3601 | None              |
| <b>Economics Minor</b> |                                       |         |                   |
| 1                      | Intermediate Microeconomics I         | EMI3671 |                   |
| SEMESTER               | MODULE                                | CODES   | PRE/CO-REQUISITES |
| 2                      | Introduction to Statistical Computing | STS3612 | STS3531           |
| 2                      | Calculus II                           | MAT3612 | MAT3512           |
| 2                      | Statistical Inference                 | STS3632 | STS3532           |
| <b>Economics Minor</b> |                                       |         |                   |
| 2                      | Intermediate Microeconomics II        | EMI3672 |                   |

**YEAR 3**

| SEMESTER               | MODULE                                       | CODES   | PRE/CO-REQUISITES         |
|------------------------|--|---------|---------------------------|
| 1                      | Linear Models                                | STS3711 | STS3611, STS3632          |
| 1                      | Distribution Theory                          | STS3721 | MAT3611, MAT3632, STS3611 |
| 1                      | Sampling Techniques                          | STS3731 | STS3531                   |
| 1                      | Research and Survey Methods                  | STS3701 | None                      |
| <b>Economics Minor</b> |  |         |                           |
| 1                      | Econometrics I                               | ETM3771 |                           |
| SEMESTER               | MODULE                                       | CODES   | PRE/CO-REQUISITES         |
| 2                      | Data processing                              | STS3732 | STS3632, STS3612          |
| 2                      | Experimental Design and Analysis of Variance | STS3752 | STS3636                   |
| 2                      | Non-parametric and Categorical Statistics    | STS3712 | STS3632                   |
| <b>Economics Minor</b> |  |         |                           |
| 2                      | Econometrics II                              | ETM3772 |                           |

**YEAR 4**

| SEMESTER | MODULE                           | CODES   | PRE/CO-REQUISITES |
|----------|----------------------------------|---------|-------------------|
| 1        | Time Series Analysis             | STS3801 | STS3711           |
| 1        | Statistical Computer Programming | STS3811 | STS3732           |
| 1        | Research Project                 | STS3810 |                   |
| 1        | Decision Analysis                | STS3821 | STS3711           |
| 1        | Stochastic Processes             | STS3831 | STS3721           |

| SEMESTER | MODULE                              | CODES   | PRE/CO-REQUISITES |
|----------|-------------------------------------|---------|-------------------|
| 2        | Multivariate Distribution Theory    | STS3812 | STS3721           |
| 2        | Research Project                    | STS3810 |                   |
| 2        | Forecasting Methods and Application | STS3852 |                   |
| 2        | Statistical Quality Control         | STS3832 | STS3721           |

\*\*NB: For students to be considered as having fulfilled requirements for a minor in **Statistics**, they are required to take the following courses:

STS3531: Descriptive Statistics,  
 STS3532: Introduction to Probability,  
 MAT3512: Precalculus  
 STS3611: Probability Theory,  
 STS3632: Statistical Inference  
 STS3731: Sampling Techniques,  
 STS3712: Non- parametric and Categorical Data Analysis.

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### J.3.1. B.SC.STATISTICS: MODULE AND CURRICULUM DESCRIPTIONS

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#### FIRST YEAR MODULES

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#### STS531 DESCRIPTIVE STATISTICS

4L/ Week

|                            |  |
|----------------------------|--|
| <b>Module Title:</b>       | <b>DESCRIPTIVE STATISTICS</b>  |
| <b>Code:</b>               | <b>STS3531</b>   |
| <b>NQF Level:</b>          | 5  |
| <b>Contact Hours:</b>      | 4 lectures per week/14 weeks, 1 hour tutorial per week/14 weeks  |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | Continuous assessment (at least two tests and two assignment) <b>40%</b> ; examination <b>60%</b> (1x3 hour examination paper).  |
| <b>Pre- requisite:</b>     | C Grade 12 Mathematics   |
| <b>Module description:</b> | Collection and Presentation of Data; Data Sources: primary versus secondary. Data types: categorical versus discrete and continuous numerical data. Types of measurements: nominal, ordinal, interval, ratio scales. Measures of Central Tendency: mean, mode, median. Measures of dispersion: Skewness and Kurtosis, quartiles, standard deviation, variance, range, inter- quartile range. Presentation of data: tabular forms, frequency tables, cross – tabulations (two variable), graphical methods, histograms, pie charts, bar charts, frequency polygons, stem and leaf plots, box and whiskers plot, identifying outliers; ogives. |

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#### STS3532 INTRODUCTION TO PROBABILITY

4L/ Week

|                            |  |
|----------------------------|--|
| <b>Module Title:</b>       | <b>INTRODUCTION TO PROBABILITY</b>   |
| <b>Code:</b>               | <b>STS3532</b>   |
| <b>NQF Level:</b>          | 5  |
| <b>Contact hours:</b>      | 4 lectures per week / 14 weeks, 1 hour tutorial per week   |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; examination <b>60%</b> (1x3 hour examination paper).   |
| <b>Pre-requisite:</b>      | C Grade 12 Mathematics   |
| <b>Module description:</b> | Counting techniques: permutation and combination, Set theory; relative frequency and probability, properties, Identification of events, Addition rule, mutually exclusive events, conditional probability, calculation of total probability, Bayes Theorem and independence; Random experiments and Sample space; The axioms of probability; random variables, expectations, random vectors, functions of random variables; and probability density in discrete and continuous case; Bernoulli trials, Binomial; Poisson, Geometric; Uniform and Normal; Binomial and Normal tables. |

#### SECOND YEAR MODULES

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#### STS3611 PROBABILITY THEORY

|                            |  |
|----------------------------|--|
| <b>Module Title:</b>       | <b>PROBABILITY THEORY</b>  |
| <b>Code:</b>               | <b>STS3611</b>   |
| <b>NQF Level:</b>          | 6  |
| <b>Contact hours:</b>      | 4 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks  |
| <b>Credits:</b>            | 16   |
| <b>Module Assessment:</b>  | Continuous assessment (at least two tests and two assignments) <b>40%</b> ; examination <b>60%</b> (1x3 hour examination paper).   |
| <b>Pre-requisite:</b>      | STS3532: Introduction to Probability; MAT3512: Precalculus   |
| <b>Module description:</b> | Convergence in probability, Law of large number, Sums and Products, convergence of distribution, Central Limit Theorem, Negative Binomial, Hypergeometric, Exponential ; Normal Approximation to Binomial and Poisson. Bivariate and multivariate probability distributions; Marginal and Conditional probability distributions; Independent random variables; Expected value of a function of random variables; Covariance of two random variables; the expected value and variance of linear functions of random variables. Mathematical expectations. |

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**STS3631 STATISTICAL ESTIMATION**

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**Module Title:** STATISTICAL ESTIMATION  
**Code:** STS3631  
**NQF Level:** 6  
**Contact hours:** 4 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous assessment (at least two tests and two assignments) **40%**; examination **60%** (1x3 hour examination paper).  
**Pre-requisite:** STS3532: Introduction to Probability  
**Module description:** Sample statistics and sampling distributions: Sampling distributions related to the Normal distribution; the Central Limit Theorem. Estimation of parameters: the bias and mean square error of point estimators; Some common unbiased point estimator; Confidence intervals; Properties of point estimators and Methods of Estimation: relative efficiency; consistency; sufficiency; the Rao-Blackwell theorem and Minimum Variance Unbiased Estimators; the Method of Moments; the Method of maximum Likelihood.

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**STS3612 INTRODUCTION TO STATISTICAL COMPUTING**

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**Module Title:** INTRODUCTION TO STATISTICAL COMPUTING  
**Code:** STS3612  
**NQF Level:** 6  
**Contact hours:** 4 lab- based lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination 60% - 3 hour Laboratory based  
**Pre-requisite:** STS3531: Descriptive Statistics  
**Module description:** Introduction to a statistical package (SPSS, Excel for analysis; Minitab, Statistica); Data acquisition and management; Create datasets, variable definition, variable labels, data entry, data cleaning, selecting cases, split files, Descriptive statistics; Graphical representation-editing, cross tabulation, Import/copying files, tables from excel, SPSS to word, estimation and hypothesis testing using a statistical package.

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**STS3632 STATISTICAL INFERENCE**

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**Module Title:** STATISTICAL INFERENCE  
**Code:** STS3632  
**NQF Level:** 6  
**Contact hours:** 4 lectures per week / 14 weeks, 1 hour tutorial per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper)  
**Pre-requisite:** STS3532: Introduction to Probability  
**Module description:** Hypothesis testing: Test of significance for means; proportions and variance: in small and large samples (dependent and independent samples); Chi-square tests; Calculating Type II Error probabilities and finding the sample size for the Z test; relationships between hypothesis testing procedure and confidence intervals; Significance levels and p-values as ways of reporting results of a statistical test; Testing hypotheses concerning variances; power of tests and the Neyman-Pearson Lemma; Likelihood Ratio Tests. Linear models and estimation by least squares: an introduction; measures of association between variables

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**THIRD YEAR MODULES**

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**STS3711 LINEAR MODELS**

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**Module Title:** LINEAR MODELS  
**Code:** STS3711  
**NQF Level:** 7  
**Contact hours:** 4 lectures per week / 14 weeks, 3 hour practical per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) 40%; Examination **60%**  
**Pre-requisite:** STS3611: Probability Theory; STS3632 Statistical Inference  
**Module description:** This module is expected to introduce students to linear models, and their application in predicting future occurrences based on models built from available information. Linear models and estimation; fitting a simple linear model; multiple regression; statistical inference of linear models; polynomial and nonlinear regression; residual analysis; multicollinearity and its effects; Diagnostics and remedial measures; model building – stepwise procedure

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**STS3721 DISTRIBUTION THEORY**

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**Module Title:** DISTRIBUTION THEORY  
**Code:** STS 3721  
**NQF Level:** 7  
**Contact hours:** 2 lectures per week / 14 weeks, 1 hour tutorial per week  
**Credits:** 8  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%**  
**Pre-requisite:** MATS3611 Calculus I; MATS3632 Calculus II; STS3611: Probability Theory  
**Module description:** Moments of Binomial, Poisson, Uniform, Normal, Geometric, Hypergeometric and Exponential distributions; Bivariate Normal, Gamma, Beta, Chi- square, F and t distributions. moment generating functions; Finding the Probability distribution of a Function of random variables: sums, products and quotients: The Method of Distribution functions, the method of Transformation, the Method of moment generating functions; Order Statistics and their functions.

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**STS3731 SAMPLING TECHNIQUES**

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**Module Title:** SAMPLING TECHNIQUES  
**Code:** STS3731  
**NQF Level:** 7  
**Contact hours:** 4 lectures per week / 14 weeks, 1 hour tutorial per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1 hour examination paper)  
**Pre-requisite:** STS3531: Descriptive Statistics

**Module description:** The overall aim of this module is to equip the student with the planning of data collection process, estimation of required sample size and estimation of population mean, total, proportion as well as variance. Data collection methods: probability and non-probability methods. Response and non-response errors. Estimation of population mean, population total, population proportion and population variance. Sample size allocation in: simple random sampling (with and without replacement), stratified random sampling, systematic sampling, cluster sampling (two-stage), quota sampling, judgemental sampling, and snowball sampling. Calculation of sampling and Non-sampling errors. Confidence interval. Weighting.

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**STS3701 RESEARCH AND SURVEY METHODS**

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**Module Title:** RESEARCH AND SURVEY METHODS  
**Code:** STS 3701  
**NQF Level:** 7  
**Contact hours:** 2 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks  
**Credits:** 8  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper).  
**Pre-requisite:** None

**Module description:** Design and use of questionnaires (formulating research problem, research questions, research hypotheses), methods of collecting data, errors in surveys, ethical issues, pilot studies and revising questionnaire, types of research (desk studies, types of surveys): advantages and disadvantages, report writing, dealing with non-response, coding, scientific language, sampling frame.

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**STS3732 DATA PROCESSING**

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**Module Title:** DATA PROCESSING  
**Code:** STS3732  
**NQF Level:** 7  
**Contact hours:** 4 Lab- based lectures per week / 14 weeks; 3 hour practical per week/14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour Laboratory Based – examination).  
**Pre-requisite:** STS3632 Statistical Inference; STS3612: Introduction to Statistical Computing

**Module description:** Applications of inferences concerning means and proportions to data – Parametric tests: t- test, Chi-Square Goodness of Fit and Independence tests, ANOVA tests and Post- hoc tests. Testing for Assumptions: Kolmogorov-Smirnov test for Normality, Levene's tests for Equality and Homogeneity of Variance. Nonparametric tests: Binomial test, Sign Test, Wilcoxon Signed- Ranks test, Mann- Whitney test, Kruskal – Wallis test, Friedman's test, Spearman Rank Correlation test. Application of Simple Linear Regression (modelling) to data. Mini project.

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**STS3712 NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS**

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**Module Title:** NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS  
**Code:** STS3712  
**NQF Level:** 7  
**Contact hours:** 4 lectures per week / 14 weeks, 1 hour tutorial per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper)  
**Pre-requisite:** STS 3632: Statistical Inference

**Module description:** Goodness of fit tests; Chi- square test, Kolmogorov – Smirnov test. Nonparametric statistics, nonparametric tests: Median tests, Sign test, Wilcoxon Signed Rank test, Mann – Whitney U test, Kruskal – Wallis H test, Friedman's test, Spearman Rank Correlation test. Contingency tables; inferences for two way contingency tables; Chi- square test of Independence. Dummy variables, models for binary response variable: logistic regression and log linear models.

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**STS3752 EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE**

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**Module Title:** EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE  
**Code:** STS3752  
**NQF Level:** 7  
**Contact hours:** 4 lectures per week / 14 weeks, 3 hour practical per week/14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper).  
**Pre-requisite:** STS3632: Statistical Inference; Co- requisite – STS3711 Linear Models  
**Module description:** Students who do this module will be equipped sufficiently with the basic understanding of how to design researches and analyse the data collected. Experiments; Experimental design; one-way ANOVA; Two-way ANOVA; Latin and Greco-Latin squares design; Multiple comparison; Factorial design. Analysis involving incomplete tables and missing values; estimation of missing values; multiple comparison methods.

**FOURTH YEAR MODULES**

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**STS3852 FORECASTING METHODS AND APPLICATIONS**

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**Module Title:** FORECASTING METHODS AND APPLICATIONS  
**Code:** STS3852  
**NQF Level:** 8  
**Contact hours:** 4 lectures per week / 14 weeks, 1 hour tutorial per week/14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper).  
**Co- requisite:** STS3801: Time Series Analysis  
**Module description:** The Forecasting Context; Basic Forecasting Tools; Time Series Decomposition; Exponential Smoothing Methods; Simple Regression Multiple Regression; The Box-Jenkins Methodology for ARIMA Models; Advanced Forecasting Models; Regression with ARIMA Errors; Dynamic Regression Models; Intervention Analysis; State Space Models; Neural Networks; Forecasting the Long-term; Mega trends; Analogies; Scenarios; Judgmental Forecasting and Adjustments; Accuracy of Judgmental Forecasts; Judgmental Biases and their Limitations; Combining Statistical and Judgmental Forecasts; Using Forecasting Methods in Practice; Implementing Forecasting: uses, advantages, and Limitations

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**STS3812 MULTIVARIATE DISTRIBUTION THEORY**

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**Module Title:** MULTIVARIATE DISTRIBUTION THEORY  
**Code:** STS3812  
**NQF Level:** 8  
**Contact hours:** 4 lectures per week / 14 weeks, 1 hour tutorial per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper)  
**Pre-requisite:** STS3721: Distribution Theory  
**Module description:** The multivariate normal distribution: definition, moment generating function, conditional distributions. Estimation of the mean vector; covariance matrix and distribution of the estimates. The Hotellings T<sup>2</sup> Distribution; Chi-square distribution. Inference about the mean vectors: one or two sample cases. Test of independence.

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**STS3832 STATISTICAL QUALITY CONTROL**

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**Module Title:** STATISTICAL QUALITY CONTROL  
**Code:** STS3832  
**NQF Level:** 8  
**Contact hours:** 4 lectures per week / 14 weeks, 3 hour practical per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour examination paper).  
**Pre-requisite:** STS3732: Data Processing  
**Module description:** Sampling inspection: OC curve average run length, process curve and method of choosing sample plans. Mood's theorem. Control charts: simple control charts for variables, properties of charts, economic designs of charts, charts for variables and qualitative data. CUSUM charts: economic design control charts and use of monogram to design interval CEMes.

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**STS3811 STATISTICAL COMPUTER PROGRAMMING AND SIMULATION**

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**Module Title:** STATISTICAL COMPUTER PROGRAMMING AND SIMULATION  
**Code:** STS3811  
**NQF Level:** 8  
**Contact hours:** 4 laboratory- based lectures per week / 14 weeks, 3 hour practical per week/14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x3 hour lab- based examination).  
**Pre-requisite:** STS3732: Data Processing

**Module description:** Introduction to programming (in C/C++/etc.): Algorithms, simple data types, assignment, conditionals, iteration, functions and procedures, complex data types, array processing. Statistics: Introduction to statistical package programmes; SPSS syntax/MS Excel scripts/etc., generation of random numbers, simulations of probability distributions; normal, binomial, etc. Data analysis; elementary distribution theory: binomial and normal distributions; random sampling; population parameters and sample statistics; estimation, confidence intervals and hypothesis testing based on the binomial and normal distributions.

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**STS3801 TIME SERIES ANALYSIS**

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**Module Title:** TIME SERIES ANALYSIS  
**Code:** STS3801  
**NQF Level:** 8  
**Contact hours:** 2 Lectures per week/14 weeks, 3 hour practical every other week  
**Credits:** 8  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) 40%; Examination **60%** (1x2 hour examination paper)  
**Pre-requisite:** STS 3711: Linear Models

**Module description:** Components of a Time Series; Smoothing techniques; Trend Analysis; Time Series Analysis: Multiplicative Models and Additive Models; Measuring the Cyclical Effect; Measuring the Seasonal Effect.

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**STS3821 DECISION ANALYSIS**

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**Module Title:** DECISION ANALYSIS  
**Code:** STS3821  
**NQF Level:** 8  
**Contact hours:** 2 Lectures per week/14 weeks, 1 hour tutorial per week  
**Credits:** 8  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%** (1x2 hour examination paper)  
**Pre-requisite:** STS3711: Linear Models

**Module description:** Types of decision problems. Decision-making under uncertainty; Basic concepts; ways of expressing outcomes: Payoffs and opportunity losses. Characterizing the uncertainty in decision problems. Solving decision problems using the expected payoff criterion and the expected utility criterion. Classifying decision makers by their utility functions. Revising state of nature probabilities: Bayes' rule. Solving decision problems using posterior probabilities.

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**STS3831 STOCHASTIC PROCESSES**

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**Module Title:** STOCHASTIC PROCESSES  
**Code:** STS3831  
**NQF Level:** 8  
**Contact hours:** 4 Lectures per week/14 weeks, 1 hour tutorial per week  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) 40%; Examination **60%** (1x2 hour examination paper)  
**Pre-requisite:** STS3721: Distribution Theory

**Module description:** **Conditional Probability and conditional expectations; Elements of Stochastic Processes:** Definition, Stationarity, finite –dimensional distributions, versions and modification, **Markov Chains in discrete time and Markov Chains in continuous time:** The basic limit theorem of Markov chains and applications, Classification of states, Limiting probabilities, Branching processes; **The Poisson Processes:** Counting process, Compounding stochastic processes. **Queuing processes; Gaussian distribution:** for variables, vectors and processes; **Brownian motion and Branching Processes:** Definition, Gaussian construction, independence of increments Geometric Brownian motion, Brownian Bridge and Ornstein-Uhlenbeck process.

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**STS3810**

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**Module title:** RESEARCH PROJECT  
**Code:** STS3810  
**NQA level:** 8  
**Contact hours:** 2 contact hours per week  
**Credits:** 32

**Module assessment:** 100% Project report 70% Oral presentation 30%

**Pre-requisite:** At least 75% of third year modules must have been passed

**Module description:** A piece of work on a selected topic showing the applications of relevant statistical tools and embodied in a project report. The project is expected to run throughout the two semesters. Students are expected to work under the supervision of a member of academic staff. The internal and external examiners will examine the student's project report at the end of the second semester. A student may be expected to do an oral on the project.

## SERVICE MODULES OFFERED

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### STS3522 INTRODUCTION TO STATISTICS

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**Module Title:** INTRODUCTION TO STATISTICS  
**Code:** STS3522  
**NQF Level:** 5  
**Contact Hours:** 2 Lectures per Week + 1 hour tutorial per week for 14 weeks  
**Credits:** 8  
**Module Assessment:** Continuous assessment (at least two tests and two assignments) 40%, Examination 60% (1x2 Hour examination paper)  
**Prerequisites:** C in NSSC Mathematics  
**Module Description:** Definition: Statistics; descriptive, inferential. Variables: qualitative versus quantitative. Data types: primary versus secondary, categorical versus discrete, continuous. Sources of data. Population versus sample. Types of measurements: nominal, ordinal, interval, ratio scales. Presentation of data: tabular forms and graphical methods: histograms, pie charts, bar charts, frequency polygons, ogives, stem- and- leaf plots, box- and-whiskers plots. Measures of Central Tendency:  $\Sigma$  notation, mean, median, mode, quartiles, percentiles. Measures of Dispersion: variance, standard deviation, range, inters- quartile range, skewness and kurtosis. Identification of outliers. Uses of scientific calculators for statistical manipulation limited to calculation of mean, standard deviation.

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### STS3621 STATISTICS FOR LIFE SCIENCES I

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**Module Title:** STATISTICS FOR LIFE SCIENCES I  
**Code:** STS3621  
**NQF Level:** 6  
**Contact Hours:** 2 Lectures per Week + 1 hour tutorial per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%**. (1x2 hour Examination paper).  
**Prerequisites:** STS 3422: Introduction to Statistics  
**Module Description:** Tests of Hypotheses: one sample and two sample cases for dependent and independent samples; Confidence Intervals. Linear regression and correlation. Test of Significance of regression and Correlation coefficients; Predictions using regression models.

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### STS3622 STATISTICS FOR LIFE SCIENCES II

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**Module Title:** STATISTICS FOR LIFE SCIENCES II  
**Code:** STS3622  
**NQF Level:** 6  
**Contact Hours:** 2 lectures per week/14 weeks, 1 hour tutorial per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) 40%, Examination **60%**. (1x2 hour Examination paper)  
**Prerequisites:** STS3522: Introduction to Statistics  
**Module Description:** Design of Biological Experiments: Choice of factors, sampling units, Analysis of variance: One- and two-way. Selecting samples, replications. Nonparametric tests: Sign test, Mann- Whitney U- test, Wilcoxon- Signed Ranks test, Spearman rank correlation test, Kruskal – Wallis H – test, Friedman's test; Use of Chi- square test for independence and goodness of fit. Tests for normality should be included Shannon-Wiener index?

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### STS3691 STATISTICS FOR ENGINEERS

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**Module Title:** STATISTICS FOR ENGINEERS  
**Code:** STS3691  
**NQF Level:** 6  
**Contact Hours:** 4 Lectures per week/14 weeks, 2 hours practical per week for 14 weeks  
**Credits:** 16  
**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%** (1x3 hour examination paper).  
**Prerequisite:** STS 3422: Introduction to Statistics  
**Module Description:** Probability: Theory (Random experiments, Random events), Conditional Probability, Mathematical Expectation and Decision making; Probability Distributions and Densities: Binomial, Geometric, Hypergeometric, Poisson, Normal, Uniform, Gamma, Beta, Weibull; Sampling Distributions: Mean, Variance; Inferences concerning Mean, Variance and Proportions: Point and Interval Estimations, Parametric tests, Nonparametric tests; Linear Regression and Correlation: Simple and Multiple Linear Regression, Correlation; Analysis of Variance: Completely Randomized and Randomized Block Designs, Multiple Comparisons; Applications to Quality Assurance: Control Charts for Measurements and for Attributes, Tolerance Limits, OC Curves, Acceptance Sampling; Applications to Reliability and Life Testing: Reliability, Failure-time distributions, Exponential Model in Reliability and in Life Testing, Weibull Model in Life Testing.

## J.4 B.Sc. POPULATION STUDIES (HONOURS) MAJORS AND MINORS, CURRICULUM & PREREQUISITES

**QUALIFICATION:** B.Sc. Population Studies (Honours) **Population Studies** Major and Geography Minor (11BPGE)

Students opting for a major in **Population Studies** (with Geography) minor must take all of the following modules:

### YEAR 1

| SEMESTER | MODULE  | CODES    | PRE/CO-REQUISITES       |
|----------|---|----------|-------------------------|
| 1        | English Communication and Study Skills          | LCE3519  | C in Gr.12 English      |
| 1        | Computer Literacy                               | CLC 3509 | None                    |
| 1        | Basic Mathematics                               | MAT3511  | C in Gr.12 Mathematics  |
| 1        | Fundamentals of Physical Geography              | GHE3511  |                         |
| 1        | Descriptive statistics                          | STS3531  | C in Gr.12 Mathematics  |
| 1        | Analytic Geometry, Complex Numbers and Matrices | MAT3531  | C in Gr. 12 Mathematics |

| SEMESTER | MODULE                          | CODES    | PRE/CO-REQUISITES      |
|----------|---------------------------------|----------|------------------------|
| 2        | English for academic Purpose    | LEA3519  |                        |
| 2        | Contemporary Social Issues      | UCS13529 | None                   |
| 2        | Precalculus                     | MAT3512  | C in Gr.12 Mathematics |
| 2        | Fundamentals of Human Geography | GHE3532  |                        |
| 2        | Introduction to Probability     | STS3532  | C in Gr.12 Mathematics |

### YEAR 2

| SEMESTER | MODULE   | CODES   | PRE/CO-REQUISITES                                      |
|----------|--|---------|--|
| 1        | Settlement Geography                                 | GHE3641 |  |
| 1        | Climatology  | GHE3621 |  |
| 1        | Economic Geography                                   | GHE3661 |  |
| 1        | Geomorphology  | GHE3601 |  |
| 1        | Community Health                                     | NCH3630 | None   |
| 1        | Sets and Numbers                                     | MAT3601 | any two following modules: MAT3511<br>MAT3531, MAT3512 |
| 1        | Introduction to Demography                           | POP3611 | None   |
| 1        | Official Statistics and National Statistical Systems | POP3631 | None   |

| SEMESTER | MODULE                                | CODES   | PRE/CO-REQUISITES |
|----------|---------------------------------------|---------|-------------------|
| 2        | Introduction to Statistical Computing | STS3612 | STS3531           |
| 2        | Social Demography                     | SOG3652 |                   |
| 2        | Community Health                      | NCH3630 |                   |
| 2        | Statistical Inference                 | STS3632 | STS3532           |
| 2        | Biogeography                          | GHE3642 |                   |

### YEAR 3

| SEMESTER | MODULE                             | CODES    | PRE/CO-REQUISITES |
|----------|------------------------------------|----------|-------------------|
| 1        | Health Service Planning            | NHM3711  |                   |
| 1        | Fundamentals of Data processing    | POP3731  | STS3612           |
| 1        | Sampling Techniques                | STS3731  | STS3531           |
| 1        | Demographic Methods I              | POP3711  |                   |
| 1        | Geographic Analysis and Techniques | HGIS3711 |                   |

| SEMESTER | MODULE                         | CODES    | PRE/CO-REQUISITES   |
|----------|--------------------------------|----------|---------------------|
| 2        | Health service Management      | NHM3712  |                     |
| 2        | Geographic Information Systems | HGIS3732 |                     |
| 2        | Demographic Methods II         | POP3732  | Co-POP3711, POP3611 |
| 2        | Regional Geography             | GHE3752  |                     |

### YEAR 4

| SEMESTER | MODULE                                  | CODES   | PRE/CO-REQUISITES |
|----------|---|---------|-------------------|
| 1        | Epidemiological Methods                 | POP3811 |                   |
| 1        | Health Communication                    | ISA3862 |                   |
| 1        | Research Project                        | POP3810 |                   |
| 1        | Environmental Management and Governance | GSP3800 |                   |
| 1        | Spatial Planning                        | GSP3820 |                   |
| 1        | Remote Sensing                          | GHR3801 |                   |



| SEMESTER | MODULE                                  | CODES   | PRE/CO-REQUISITES |
|----------|---|---------|-------------------|
| 2        | Population Migration                    | POP3832 |                   |
| 2        | Population Projections                  | POP3822 |                   |
| 2        | Research Project                        | POP3810 |                   |
| 2        | Environmental Management and Governance | GSP3800 |                   |
| 2        | Spatial Planning                        | GSP3820 |                   |
| 2        | Applied Spatial Analysis                | GHR3822 |                   |

**QUALIFICATION:** B.Sc. Population Studies (Honours) **Population Studies** Major and Statistics Minor (11BPST)

Students opting for a major in **Population Studies** (with Statistics minor) must take all of the following modules:

#### YEAR 1

| SEMESTER | MODULE  | CODES   | PRE/CO-REQUISITES             |
|----------|---|---------|-------------------------------|
| 1        | English Communication & Study Skills            | LCE3519 | University entry requirements |
| 1        | Descriptive Statistics                          | STS3531 | C in Gr. 12 Mathematics       |
| 1        | Computer Literacy                               | CLC3509 | None                          |
| 1        | Basic Mathematics                               | MAT3511 | C in Gr. 12 Mathematics       |
| 1        | Analytic Geometry, Complex Numbers and Matrices | MAT3531 | C in Gr. 12 Mathematics       |
| 1        | Foundation of Sociology                         | SOG3511 |                               |

| SEMESTER | MODULE                       | CODES     | PRE/CO-REQUISITES       |
|----------|------------------------------|-----------|-------------------------|
| 2        | English for academic Purpose | LEA3519   |                         |
| 2        | Contemporary Social Issues   | UCSI 3529 |                         |
| 2        | Precalculus                  | MAT3512   | C in Gr. 12 Mathematics |
| 2        | Introduction to Probability  | STS3532   | C in Gr. 12 Mathematics |
| 2        | Basics of Sociology          | SOG3532   |                         |

#### YEAR 2

| SEMESTER | MODULE   | CODES   | PRE/CO-REQUISITES |
|----------|--|---------|-------------------|
| 1        | Probability Theory                                   | STS3611 | STS3532, MAT3512  |
| 1        | Statistical Estimation                               | STS3631 | STS3532           |
| 1        | Community Health                                     | NCH3630 | None              |
| 1        | Introduction to Demography                           | POP3611 | None              |
| 1        | Sets and Numbers                                     | MAT3601 |                   |
| 1        | Official Statistics and National Statistical Systems | POP3631 | None              |

| SEMESTER | MODULE                                | CODES   | PRE/CO-REQUISITES |
|----------|---------------------------------------|---------|-------------------|
| 2        | Introduction to Statistical Computing | STS3612 | STS3531           |
| 2        | Social Demography                     | SOG3652 |                   |
| 2        | Community Health                      | NCH3630 |                   |
| 2        | Statistical Inference                 | STS3632 | STS3532           |

#### YEAR 3

| SEMESTER | MODULE                          | CODES   | PRE/CO-REQUISITES |
|----------|---------------------------------|---------|-------------------|
| 1        | Health Service Planning         | NHM3711 |                   |
| 1        | Fundamentals of Data processing | POP3731 | STS3612           |
| 1        | Sampling Techniques             | STS3731 | STS3531           |
| 1        | Demographic Methods I           | POP3711 |                   |
| 1        | Research and Survey Methods     | STS3701 |                   |

| SEMESTER | MODULE                                    | CODES   | PRE/CO-REQUISITES    |
|----------|---|---------|----------------------|
| 2        | Health service Management                 | NHM3712 |                      |
| 2        | Social Research Methods                   | SOG3732 |                      |
| 2        | Demographic Methods II                    | POP3732 | Co- POP3711, POP3611 |
| 2        | Non-parametric and Categorical Statistics | STS3712 | STS3632              |

**YEAR 4**

| SEMESTER | MODULE                                 | CODES   | PRE/CO-REQUISITES |
|----------|--|---------|-------------------|
| 1        | Epidemiological Methods                | POP3811 |                   |
| 1        | Health Communication                   | ISA3862 |                   |
| 1        | Research Project                       | POP3810 |                   |
| 1        | Advanced Sociology of Namibian Society | SOS3840 |                   |
| 1        | Sociology of Gender and Sexuality      | SOS3860 |                   |
| 1        | Sociology of Health                    | SOZ3820 |                   |

| SEMESTER | MODULE                                 | CODES   | PRE/CO-REQUISITES |
|----------|--|---------|-------------------|
| 2        | Population Migration                   | POP3832 |                   |
| 2        | Population Projections                 | POP3822 |                   |
| 2        | Research Project                       | POP3810 |                   |
| 2        | Advanced Sociology of Namibian Society | SOS3840 |                   |
| 2        | Sociology of Gender and Sexuality      | SOS3860 |                   |
| 2        | Sociology of Health                    | SOG3880 |                   |

**QUALIFICATION:** B.Sc. Population Studies (Honours) **Population Studies** Major and Sociology Minor (11BPSO)

Students opting for a major in **Population Studies** (with Sociology minor) must take all of the following modules:

**YEAR 1**

| SEMESTER | MODULE  | CODES    | PRE/CO-REQUISITES      |
|----------|---|----------|------------------------|
| 1        | English Communication and Study Skills          | LCE3519  | C in Gr.12 English     |
| 1        | Computer Literacy                               | CLC 3509 | None                   |
| 1        | Basic Mathematics                               | MAT3511  | C in Gr.12 Mathematics |
| 1        | Foundation of Sociology                         | SOG3511  |                        |
| 1        | Descriptive statistics                          | STS3531  | C in Gr.12 Mathematics |
| 1        | Analytic Geometry, Complex Numbers and Matrices | MAT3531  | C in Gr.12 Mathematics |

| SEMESTER | MODULE                       | CODES     | PRE/CO-REQUISITES      |
|----------|------------------------------|-----------|------------------------|
| 2        | English for academic Purpose | LEA3519   |                        |
| 2        | Contemporary Social Issues   | UCSI 3529 | None                   |
| 2        | Precalculus                  | MAT3512   | C in Gr.12 Mathematics |
| 2        | Basics of Sociology          | SOG3532   |                        |
| 2        | Introduction to Probability  | STS3532   | C in Gr.12 Mathematics |

**YEAR 2**

| SEMESTER | MODULE   | CODES   | PRE/CO-REQUISITES                                    |
|----------|--|---------|--|
| 1        | Social problems: learning to conceptualize and implement social research | SOG3671 |  |
| 1        | Community Health   | NCH3630 | None   |
| 1        | Sets and Numbers   | MAT3601 | any two following modules: MAT3511, MAT3531, MAT3512 |
| 1        | Introduction to Demography   | POP3611 | None   |
| 1        | Official Statistics and National Statistical Systems                     | POP3631 | None   |

| SEMESTER | MODULE                                | CODES   | PRE/CO-REQUISITES |
|----------|---------------------------------------|---------|-------------------|
| 2        | Introduction to Statistical Computing | STS3612 | STS3531           |
| 2        | Social Demography                     | SOG3652 |                   |
| 2        | Community Health                      | NCH3630 |                   |
| 2        | Statistical Inference                 | STS3632 | STS3532           |
| 2        | Classical sociological Theory         | SOG3612 |                   |

**YEAR 3**

| SEMESTER | MODULE                          | CODES   | PRE/CO-REQUISITES |
|----------|---------------------------------|---------|-------------------|
| 1        | Health Service Planning         | NHM3711 |                   |
| 1        | Fundamentals of Data processing | POP3731 | STS3612           |
| 1        | Sampling Techniques             | STS3731 | STS3531           |
| 1        | Demographic Methods I           | POP3711 |                   |
| 1        | Research and Survey Methods     | STS3701 |                   |

| SEMESTER | MODULE                        | CODES   | PRE/CO-REQUISITES    |
|----------|-------------------------------|---------|----------------------|
| 2        | Health service Management     | NHM3712 |                      |
| 2        | Social Research Methods       | SOG3732 |                      |
| 2        | Demographic Methods II        | POP3732 | Co- POP3711, POP3611 |
| 2        | Sociology of Namibian society | SOG3772 |                      |

**YEAR 4**

| SEMESTER | MODULE                                 | CODES    | PRE/CO-REQUISITES |
|----------|--|----------|-------------------|
| 1        | Epidemiological Methods                | POP3811  |                   |
| 1        | Health Communication                   | HISA3832 |                   |
| 1        | Research Project                       | POP3810  |                   |
| 1        | Advanced Sociology of Namibian Society | SOS3840  |                   |
| 1        | Sociology of Gender and Sexuality      | SOS3860  |                   |
| 1        | Sociology of Health                    | SOZ3820  |                   |

| SEMESTER | MODULE                                 | CODES   | PRE/CO-REQUISITES |
|----------|--|---------|-------------------|
| 2        | Population Migration                   | POP3832 |                   |
| 2        | Population Projections                 | POP3822 |                   |
| 2        | Research Project                       | POP3810 |                   |
| 2        | Advanced Sociology of Namibian Society | SOS3840 |                   |
| 2        | Sociology of Gender and Sexuality      | SOS3860 |                   |
| 2        | Sociology of Health                    | SOZ3820 |                   |

**J.4.1. B.SC. POPULATION STUDIES MODULE AND CURRICULUM DESCRIPTIONS****FIRST YEAR MODULES****SOG3511: FOUNDATIONS OF SOCIOLOGY****Module Title:** FOUNDATIONS OF SOCIOLOGY**Code:** SOG3511**NQF level:** 5**Contact hours:** 4 lectures per week / 14 weeks**Credits:** 16**Module assessment:** Continuous assessment 60%, consisting of 1 written assignment, minimum of two tests, examination 40%.**Prerequisites:** None

**Module description:** The course serves as a guide to the foundations of the discipline. While introducing the student to the basic concepts, theories, fields and applications of international sociology, it focuses on Namibian society. Sociology is shown with its different faces – its history of origins, the classical and contemporary interpretations of social action, social structure and social change. As well, the course reflects on the principal social institutions, such as family, state, economy, education and religion. It emphasizes the analysis and the impact of social inequality, such as class, race, and gender.

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**SOG3532: BASICS OF SOCIOLOGY: PARADIGMS AND METHODS****(4L/Week)**

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**Module title:** BASICS OF SOCIOLOGY: PARADIGMS AND METHODS**Code:** SOG3532**NQF level:** 5**Contact hours:** 4 lectures per week / 14 weeks**Credits:** 16**Module assessment:** Continuous assessment **60%**, consisting of 1 written assignment, minimum of two tests, examination **40%**

Module description: The introductory course emphasizes the link between the theoretical body of sociology and its methodological implementation. It acquaints the student with the basic paradigms of the discipline. At the same time, it familiarizes the student with the basic knowledge and instruments of social research. With this first out of four methodological courses, the new sociology curriculum intends to strengthen the student's research abilities. Such faculties are increasingly on request on the Namibian labour market, reflecting the broad developmental efforts of post-independence Namibian society. Themes covered: sociological sub-disciplines; main paradigms: functionalism, interactionism, marxism; post-structuralism; race, class, gender and ethnicity; social institutions: family, education and media. Social research: sources of knowledge; criteria for judging good research; purpose of social research, research goals; types of social research; key concepts; research ethics; instruments: measurement, sampling; sources of data; the research process; research proposal.

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**GHE3511: FUNDAMENTALS OF PHYSICAL GEOGRAPHY**

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**Module title:** FUNDAMENTALS OF PHYSICAL GEOGRAPHY**Code:** GHE3511**NQF Level:** 5**Contact hours:** 4 lectures / week for 14 weeks**Credits:** 16**Module assessment:** Continuous assessment **60%** (minimum 03 assessments, practical work). Examination **40%** (01 x 03 hours paper)**Prerequisite:** University, Faculty and Department Rules and Regulations apply

Module description (content): Students acquaint themselves with the essential foundations of Physical Geography, including common links to auxiliary disciplines and fields of study. The module presents structures, functions, processes and distributional patterns inherent in phenomena of 'natural' environments, relating to climate, geomorphology, hydrology, soils and vegetation. The content focuses on the interrelationship of geo-ecosystems, including the human factor. With particular reference to Namibian conditions, the module offers fundamental applications of concepts inherent in the functioning of the atmo-, litho-, sphere, hydro- and biosphere.

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**GHE3532 FUNDAMENTALS OF HUMAN GEOGRAPHY**

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**Module title:** FUNDAMENTALS OF HUMAN GEOGRAPHY**Code:** GHE3532**NQF Level:** 5**Contact hours:** 4 periods / week for 14 weeks**Credits:** 16**Module assessment:** Continuous assessment 60 % (minimum 03 assessments, practical work). Examination 40 % (1 x 3 hours paper)**Prerequisite:** University, Faculty and Department Rules and Regulations apply

**Module description (content):** Students acquaint themselves with foundations and concepts of Human Geography, including the subject's links to auxiliary disciplines. The module presents structures, functions, processes and distributional patterns inherent in phenomena of human environments. The content focuses on demographic features of population, rural and urban settlements and economic activities including tourism, land-use and infrastructure, regional diversity / similarity as well as politico-geographical perspectives relating to spatial development. Local to international references cover Namibia, the African continent and selected regions of the world. The module structure implies practical exercises / assignments, aiming at fostering application of knowledge, reflective thinking and practical skills.

**SECOND YEAR MODULES**

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**POP3611 INTRODUCTION TO DEMOGRAPHY**

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**Module Title:** INTRODUCTION TO DEMOGRAPHY**Code:** POP3611**NQA level:** 6**Contact hours:** 4 lectures per week / 14 weeks**Credits:** 16**Module Assessment:** Continuous assessment **40%** (at least two tests and two assignments); Examination 60%**Pre-requisite:** none

**Module description:** Nature and scope of Demography; The development of population theories: Malthusian and Neo-Malthusian theories, Socialist and Marxist views, Neo-Marxian views, demographic transition theory. Population size and composition, Population change; Components of population change; Key concepts in fertility; Sources of data for fertility analysis; Levels, trends and differentials of fertility; Major macro level fertility theories and models; Transition; responses; Micro level perspectives of fertility; economic, psychological; socio-cultural. Recent changes in fertility patterns in developing countries; Fertility policies and programmes. Key concepts in mortality; Sources of data for mortality analysis; Levels and trends of mortality; Differentials and Determinants; Recent changes in mortality levels and patterns in developing countries; Mortality policies and programmes in developing countries; Emerging and re-emerging diseases and their effects on mortality patterns. Population trends (Namibian context); Population Conferences; Impact of HIV.

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**POP3631 OFFICIAL STATISTICS AND NATIONAL STATISTICAL SYSTEMS**

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|                           |   |
|---------------------------|---|
| <b>Module Title:</b>      | <b>OFFICIAL STATISTICS AND NATIONAL STATISTICAL SYSTEMS</b>                                       |
| <b>Code:</b>              | <b>POP3631</b>  |
| <b>NQA level:</b>         | 6   |
| <b>Contact hours:</b>     | 4 lectures per week / 14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> (at least two tests and two assignments); Examination <b>60%</b> |
| <b>Pre-requisite:</b>     | None  |

**Module description:** Purpose and scope of official statistics, structure and work of the National Statistical System, Organization, methods and practices of data collection and dissemination. Social Statistics: Define educational levels, purpose, principles and procedures with respect to education statistical data collection, Understand and appreciate data requirement for educational development purposes, Understand and appreciate various rate and ratios required for analysis of statistics on teacher and pupils, Understand definition and scope of health related statistical issues, Understand statistics on medical facilities and uses of hospital records, Comprehend basic ideas of epidemiological issues and indicators of health, Understand and define scope of housing statistics, Understand the importance of statistics related to: definition of a dwelling unit, housing condition, housing needs requirements. Understand labour and employment statistics: Explain how the following statistics are defined and calculated: labour force, economically active and inactive population, employment rates etc.; Understand the importance of statistics on wages, labour income, social security, underemployment etc. System of national accounts (SNA): Explain the importance of compiling national accounts; Explain the uses of national accounts in socio-economic planning. Trade statistics; migration statistics; (understand statistics from various line ministries), civil registration statistics, economic statistics.

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**SOG3671 SOCIAL PROBLEMS- LEARNING TO CONCEPTUALIZE AND IMPLEMENT**

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|                           |   |
|---------------------------|---|
| <b>Module title:</b>      | <b>SOCIAL PROBLEMS- LEARNING TO CONCEPTUALIZE AND IMPLEMENT</b>   |
| <b>Code:</b>              | <b>SOG3671</b>  |
| <b>NQF Level:</b>         | 6   |
| <b>Contact Hours:</b>     | 4 Lectures per week/14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module Assessment:</b> | Continuous assessment <b>60%</b> , consisting of 2 written assignments, 1 presentation and a minimum of 2 tests. Examination <b>40%</b> . |
| <b>Prerequisites:</b>     | None  |

**Module Description:** The course mostly utilizes lecture and tutorial format. It resumes the methodological training introduced into the sociology curriculum with the 1st year module "Basics of Sociology". It familiarizes the student with the use of social problems (class, poverty and inequality, gender inequality, crime and violence, alcohol and substance abuse; HIV/AIDS and other health issues; environmental problems etc.). At lower intermediate level, the course is the second in a sequence of three modules aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation. Practical acquaintance with the field, however, will be reserved for a further course at upper intermediate level, in the following years of studies.

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**SOG3612 CLASSICAL SOCIOLOGICAL THEORY**

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|---------------------------|--|
| <b>Module title:</b>      | <b>CLASSICAL SOCIOLOGICAL THEORY</b>   |
| <b>Code:</b>              | <b>SOG3612</b>   |
| <b>NQF level:</b>         | 6  |
| <b>Contact hours:</b>     | 4 lectures per week / 14 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment <b>60%</b> , consisting of 2 written assignments, minimum 1 test; examination <b>40%</b> |
| <b>Prerequisites:</b>     | None   |

**Module description:** This module will survey and analyse the main classical sociological theories and their philosophical predecessors (1750-1950) that are central to the emergence and development of the sociological tradition. Enlightenment philosophy will be examined (Rousseau, Adam Smith); also German idealism (Hegel and Kant) and British socialist thought and utilitarianism (Owen, Bentham). The influence of these on the emergence of classical sociology will be explained. Extensive analysis of the major founders of sociology such as Comte, Marx, Durkheim and Weber will be at the heart of this module discussing themes such as religion, rise of modern society, class and social division, methods of social analysis. In addition students will study: Spencer, Morgan and Darwinian social evolution; Mauss on social order and social construction of the person; Toennies on community; Simmel and Lukacs on industrial culture; Schuetz and Husserl on the life-world; Mead's symbolic interactionism; Adorno and the Frankfurt School; Parsons and structural functionalism.

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**SOG3652 SOCIAL DEMOGRAPHY**

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| <b>Module title:</b>       | <b>SOCIAL DEMOGRAPHY</b>   |
| <b>Code:</b>               | <b>SOG3652</b>   |
| <b>NQF Level:</b>          | 6  |
| <b>Contact hours:</b>      | 4 lectures per week / 14 weeks   |
| <b>Total credits:</b>      | 16   |
| <b>Module assessment:</b>  | Students' work will be assessed through continuous assessment ( <b>60%</b> ) and an examination paper of three hours duration ( <b>40%</b> ). Continuous assessment grades is based on a minimum of two (2) in-class tests and one (1) individual assignment of approximately 5 pages (plus a reference list). Test and assignment dates will be discussed and agreed upon in class. Periodically, class will be divided into groups for the purpose of discussing questions provided by the lecturer. Students are graded upon their participation & presentation in groups. The final examination will evaluate factual information and understanding. |
| <b>Prerequisites:</b>      | None   |
| <b>Module description:</b> | Demography, the science of human population, deals with changes and differences in the size and structure of human populations. Demography is concerned with virtually everything that influences, or can be influenced by, population size, distribution, processes, structure or characteristics. This module pays particular attention to population concepts, population dynamics (processes), theories, causes and demographic data and their usage. The emphasis of the module is on substantive rather than technical issues.   |

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**STS3632 STATISTICAL INFERENCE**

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|----------------------------|---|
| <b>Module Title:</b>       | <b>STATISTICAL INFERENCE</b>  |
| <b>Code:</b>               | <b>STS3632</b>  |
| <b>NQF Level:</b>          | 6   |
| <b>Contact hours:</b>      | 4 lectures per week / 14 weeks, 1 hour tutorial per week  |
| <b>Credits:</b>            | 16  |
| <b>Module Assessment:</b>  | Continuous Assessment (at least two tests and two assignments) <b>40%</b> ; Examination <b>60%</b>  |
| <b>Pre-requisite:</b>      | STS3532: Introduction to Probability  |
| <b>Module description:</b> | 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 |

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**GHE3611 CLIMATOLOGY**

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|--------------------------------------|--|
| <b>Module title:</b>                 | <b>CLIMATOLOGY</b>   |
| <b>Code:</b>                         | <b>GHE3621</b>   |
| <b>NQF Level:</b>                    | 6  |
| <b>Contact hours:</b>                | 2 lectures / week for 14 weeks   |
| <b>Credits:</b>                      | 8  |
| <b>Module assessment:</b>            | Continuous assessment <b>60%</b> (minimum 03 assessments, practical work).<br>Examination <b>40%</b> (01 x 03 hours paper)   |
| <b>Prerequisite:</b>                 | University, Faculty and Department Rules and Regulations apply   |
| <b>Module description (content):</b> | The module investigates components, patterns, processes and functioning relating to phenomena of climatology such as air temperature; atmospheric moisture and precipitation; and on atmospheric pressure, motion and circulation. |

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**GHE3601 GEOMORPHOLOGY**

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|--------------------------------------|---|
| <b>Module title:</b>                 | <b>GEOMORPHOLOGY</b>  |
| <b>Code:</b>                         | <b>GHE3601</b>  |
| <b>NQF Level:</b>                    | 6   |
| <b>Contact hours:</b>                | 2 lectures / week for 14 weeks  |
| <b>Credits:</b>                      | 8   |
| <b>Module assessment:</b>            | Continuous assessment <b>60%</b> (minimum 03 assessments, practical work).<br>Examination <b>40%</b> (01 x 03 hours paper)  |
| <b>Prerequisite:</b>                 | University, Faculty and Department Rules and Regulations apply  |
| <b>Module description (content):</b> | The content focuses on processes such as weathering and mass wasting; and the creation of structural terrestrial, marine and aeolic landforms. Landscapes from Namibia and southern Africa exemplify the relevant types of landforms. |

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**GHE3641 SETTLEMENT GEOGRAPHY**

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**Module title:** SETTLEMENT GEOGRAPHY  
**Code:** GHE3641  
**NQF Level:** 6  
**Contact hours:** 2 lectures / week for 14 weeks  
**Credits:** 8  
**Module assessment:** Continuous assessment **60%** (minimum 03 assessments, practical work).  
Examination 40% (01 x 03 hours paper)

**Prerequisite:** University, Faculty and Department Rules and Regulations apply

**Module description (content):** The module builds students' in depth comprehension and skills in fields of Settlement Geography including tourism settlement(s). The content familiarises students with structures, patterns, processes, trends and developments relating to urbanisation, settlement development and planning. Regional examples collected from Namibia and internationally present varying spatial scales and timeframes. The content demonstrates the application of recognised models and theories in the analysis of settlements. Case studies strengthen the reflective comprehension of distinct phenomena and problem formations emerging from human settlement over time.

**Practicals:** Closely related to the content taught in Settlement Geography, exercises in Practical 2 aim at nurturing the reflective ability of students through knowledge and application skills.

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**GHE3661 ECONOMIC GEOGRAPHY**

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**Module title:** ECONOMIC GEOGRAPHY  
**Code:** GHE3661  
**NQF Level:** 6  
**Contact hours:** 2 lectures / week for 14 weeks  
**Credits:** 8  
**Module assessment:** Continuous assessment **60%** (minimum 03 assessments, practical work).  
Examination **40%** (01 x 03 hours paper)

**Prerequisite:** University, Faculty and Department Rules and Regulations apply

**Module description (content):** The content builds students' in depth comprehension and skills in fields of Economic Geography, including economic aspects of tourism. The content familiarises students with structures, patterns, processes, trends and developments relating to economic growth and development. Regional examples collected from Namibia and internationally, present varying spatial scales and timeframes. The content demonstrates the application of recognised models and theories in the analysis of geographic economic development in main sectors of the Namibian economy. Case studies strengthen the reflective comprehension of distinct phenomena and problem formations emerging from economic endeavour.

**Practicals:** Closely related to the content taught in Climatology, exercises in Practical 2 aim to develop the reflective ability of students through knowledge and application skills.

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**GHE3642 BIOGEOGRAPHY**

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**Module title:** BIOGEOGRAPHY  
**Code:** GHE3642  
**NQF Level:** 6  
**Contact hours:** 2 lectures / week for 14 weeks  
**Credits:** 8  
**Module assessment:** Continuous assessment **60%** (minimum 03 assessments, practical work). Examination **40%** (1 x 2 hours paper)

**Prerequisite:** University, Faculty and Department Rules and Regulations apply

**Module description (content):** This module introduces students to the components, functions, processes, patterns and phenomena of Biogeography. Biogeography includes a broad range of topics including evolution, ecology, history of biogeography, biogeographical system, population ecology, distribution of single species and communities, dispersal and extinction, continental biogeography, conservation biogeography and biodiversity.

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**NCH3630 COMMUNITY HEALTH NURSING SCIENCE I**

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**Module title:** COMMUNITY HEALTH NURSING SCIENCE  
**Code:** NCH3630  
**NQF Level:** 6  
**Contact hours:** 2 periods per week x 28 weeks  
**Credits:** 32  
**Prerequisite:** None  
**Module assessment:** Continuous assessment 50%: A minimum of four tests/assignments Examination 50%: 1 x 2hr paper

**Module Description:** This module aims and introduce knowledge and appropriate skills to students to improve the quality of health status of the individual, family and community in Namibia. Module Requirement and Expectations Compulsory attendance - 80%: active class participation : make appointments with lecturer for tutorials.

### THIRD YEAR MODULES

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#### POP3711 DEMOGRAPHIC METHODS I

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**Module title:** DEMOGRAPHIC METHODS I

**Code:** POP3711

**NQA level:** 7

**Contact hours:** 4 lectures per week / 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **40%** (at least two tests and two assignments); Examination **60%**

**Pre-requisite:** None

**Module description:** Sources and types of demographic data. Uses and limitations of demographic data: Population census, sample surveys, vital registration, population register, non-traditional sources (parish register, administrative records), international sources, availability of population data in sub-Saharan Africa. Evaluation of demographic data; Errors in demographic data and techniques of detecting these errors; Data adjustment techniques. Techniques of estimating population size and composition, some basic demographic methods: the balancing equation, rates and ratios: dependency ratio: age and economic dependency ratios and their implications. Population composition: analysis of sex structure, analysis of age structure, age-sex pyramid. Estimation and measurements of basic demographic parameters: fertility, mortality and migration.

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#### POP3732 DEMOGRAPHIC METHODS II

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**Module title:** DEMOGRAPHIC METHODS II

**Code:** POP3732

**NQA level:** 7

**Contact hours:** 4 lectures per week / 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment 40% (at least two tests and two assignments); Examination **60%**

**Pre-requisite:** none

**Module description:** Direct and indirect methods of estimation of fertility and mortality. Measurements of Mortality: CDR, ASDR, (q-type and m-type mortality rates), the Lexis chart; Standardization (standardized death rate, standardized mortality ratio), Infant mortality rate. Frameworks and models for mortality analysis, Measurements of fertility: CBR, ASFR, standardization applied to fertility rates, TFR, Period and Cohort analysis of fertility; Parity progression, The determinants of fertility, Frameworks and models for fertility analysis, The Life table: the theory of the life table, abridged life tables, multiple decrement life tables, Population growth: fertility and population growth, Geometric and exponential growth, the annual rate of growth and the net reproductive rate.

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#### POP3731 FUNDAMENTALS OF DATA PROCESSING

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**Module title:** FUNDAMENTALS OF DATA PROCESSING

**Code:** POP3731

**NQA level:** 7

**Contact hours:** 4 lectures per week / 14 weeks; 3 hours practical per week

**Credits:** 16

**Module assessment:** Continuous assessment **40%**; Examination **60%**

**Pre-requisite:** STS 3612 Introduction to Statistical Computing

**Module description:** Introduce students to parametric and non-parametric tests. Introduction to regression analysis: Linear regression and Correlation; Explaining the relationship between variables using a Scatter plot; Fitting a simple linear regression model and test of hypothesis for regression coefficient; Testing the association between variables using the correlation analysis. Introducing multiple linear regression analysis: model selection techniques: forward, backward, stepwise; categorical variables in regression; Generalized Linear models: parameter estimation, interpretation; Logistic regression analysis: parameter estimation; interpretation of odds ratio; estimated probabilities.

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#### NHM3711 HEALTH SERVICE PLANNING

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**Module title:** HEALTH SERVICE PLANNING

**Code:** NHM3711

**NQF level:** 7

**Contact hours:** 4 periods per week × 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment 50% (minimum 2 tests; 1 assignment). Examination 50% (1 × 2 hour examination paper)

**Module description:** This module aims at introducing students to aspects of health service planning which will enable them to develop health service programmes for the socio-economic development of communities

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#### NHM3712 HEALTH SERVICE MANAGEMENT

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**Module title:** HEALTH SERVICE MANAGEMENT

**Code:** NHM3712

**NQF level:** 7

**Contact hours:** 4 periods per week × 14 weeks

**Credits:** 16

**Prerequisites:** None

**Module assessment:** Continuous assessment 50% (minimum 2 tests; 1 assignment). Examination 50% (1 × 2 hour examination paper)

**Module description:** This module aims at introducing students to aspects of health service management that will enable them to plan, implement and evaluate health service programmes, as well as human resources management.



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**SOG3732 SOCIAL RESEARCH METHODS**

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**Module Title:** SOCIAL RESEARCH METHODS

**Code:** SOG3732

**NQF level:** 7

**Contact hours:** 4 lectures per week / 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **60%**, consisting of 2 written assignments, 1 presentation, and a minimum of 2 tests. Examination equals **40%**.

**Prerequisites:** None

**Module description:** The course mostly utilizes lecture and tutorial format. It examines the different methodological and theoretical debates that underpin different research traditions. Topics include measurement, reliability and validity, index and scale construction, sampling, methods of data collection, data analysis. At upper intermediate level, the course is the third in a sequence of modules aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation.

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**STS3701 RESEARCH AND SURVEY METHODS**

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**Module Title:** RESEARCH AND SURVEY METHODS

**Code:** STS3701

**NQF Level:** 7

**Contact hours:** 2 lectures per week / 14 weeks

**Credits:** 8

**Module Assessment:** Continuous Assessment (at least two tests and two assignments) **40%**; Examination **60%**

**Pre-requisite:** None

**Module description:** Design and use of questionnaires (formulating research problem, research questions, research hypotheses), methods of collecting data, errors in surveys, ethical issues, pilot studies and revising questionnaire, types of research (desk studies, types of surveys): advantages and disadvantages, report writing, dealing with non-response, coding, scientific language, sampling frame.

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**SOG3772 SOCIOLOGY OF NAMIBIAN SOCIETY**

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**Module title:** SOCIOLOGY OF NAMIBIAN SOCIETY

**Code:** SOG3772

**NQF level:** 7

**Contact hours:** 4 lectures per week / 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment **60%**, consisting of 2 assignments and minimum 1 test, examination **40%**

**Prerequisites:** None

**Module description:** Modern Namibian society will be examined using a cultural sociology approach. This will distinguish the course from the 4th year double module 'Advanced sociology of Namibian society'. It explores how Namibia and its socio-cultural structures and processes were historically shaped: prior to colonialism; during German and South African colonialism; currently in independent Namibia. Discourse and identity theory (Foucault, Giddens, Hall etc.) will structure the historical and modern analysis in the following topics: ethnic and national identity past and present; colonial and capitalist work culture (with emphasis on contract labour and migration); identity imposition and the state of the San peoples; sexual cultures in Namibia & HIV; the impact of the new mass media; youth cultures; tourism and culture; poverty and deprivation; consumption, class and the new materialism in modern Namibia; religious culture and Namibian society.

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**GIS3711 GEOGRAPHICAL ANALYSIS AND TECHNIQUES**

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**Module title:** GEOGRAPHICAL ANALYSIS AND TECHNIQUES

**Code:** GIS3711

**NQF Level:** 7

**Contact hours:** 4 periods /week for 14 weeks

**Credits:** 16

**Module assessment:** Continuous assessment 60 % (minimum 02 tests, 03 assignments; practical work). Examination 40 % (01 x 03 hours paper)

**Prerequisite:** University, Faculty and Department Rules and Regulations apply

**Module description (content):** The module offers application-orientated insights into scientific methods and techniques, comprising the formulation of hypotheses and assumptions; collection and compilation of data; research design and management; field survey and reconnaissance; as well as the formulation of findings. Exposure to map production; fundamental geodesy; map and aerial photography analysis and interpretation complements this module, enhancing essential skills in geographic analysis techniques. The content familiarises students with the nature of statistical methods applied to quantitative geographic problem analysis, together with the employ of techniques in collecting and analysing qualitative data. Relevant computer-assisted GIS software supports practical components of the module work, seeking to ensure that all participants share a working knowledge of spreadsheet capabilities.

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## GIS3732 GEOGRAPHICAL INFORMATION SYSTEMS

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|---------------------------|---|
| <b>Module title:</b>      | <b>GEOGRAPHICAL INFORMATION SYSTEMS</b>   |
| <b>Code:</b>              | <b>GIS3732</b>  |
| <b>NQF Level:</b>         | 7   |
| <b>Contact hours:</b>     | 4 periods / week for 14 weeks   |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment 60 % (minimum 02 tests, 03 assignments, practical work). Examination 40 % (01 x 03 hours paper) |

**Prerequisites:** University, Faculty and Department Rules and Regulations apply

**Module description (content):** The module introduces students to computer-assisted spatial data processing; development, implementation and functions of geographic information systems; data models and structures; as well as analytical procedures. The content focuses on foundations of mapping, database management and information science, including concepts that are essential to any GIS package. Project work based on the application of GIS to a variety of environmental problem formations complement skill-orientated exercises, offered in the Laboratory for Spatial Analysis, DGHES. Hands-on experiences provide students with advanced skills. They should enable students to master software packages such as ArcView 3.x, ArcInfo 8.x, and IDRISI/ILWIS in order to facilitate the creating of maps of geographical locations and their attributes; the performing of spatial analyses using spatial and attributed data; and the display of results in the form of maps and tables.

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## GHE3752 REGIONAL GEOGRAPHY

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**Module title:** Regional Geography

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|-----------------------|------------------------------|
| <b>Code:</b>          | <b>GHE3752</b>               |
| <b>NQF Level:</b>     | 7                            |
| <b>Contact hours:</b> | 4 Lectures per week/14 weeks |
| <b>Credits:</b>       | 16                           |

**Module Assessment :** Continuous assessment **60%** : Examination **40%** (1 x 3 hour examination paper)

**Prerequisite:** None

**Content:** The module familiarises students with concepts of and approaches to Regional Geography and furthers students' comprehension of the complexity of the system "region", comprising regional structures and functions (politico-economic, socio-cultural). It reflects data in distinct regions, emphasising the interaction of local and external factors, forces and processes over distance and time in Namibia, Africa and other continents. The module incorporates aspects of regional disparity and explains regional development against the background of different paradigms and concepts of regional development.

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## SOG3732 SOCIAL RESEARCH METHODS

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|---------------------------|---|
| <b>Module Title:</b>      | <b>SOCIAL RESEARCH METHODS</b>  |
| <b>Code:</b>              | <b>SOG3732</b>  |
| <b>NQF level:</b>         | 7   |
| <b>Contact hours:</b>     | 4 lectures per week / 14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment <b>60%</b> , consisting of 2 written assignments, 1 presentation, and a minimum of 2 tests. Examination equals <b>40%</b> . |

**Prerequisites:** None

**Module description:** The course mostly utilizes lecture and tutorial format. It examines the different methodological and theoretical debates that underpin different research traditions. Topics include measurement, reliability and validity, index and scale construction, sampling, methods of data collection, data analysis. At upper intermediate level, the course is the third in a sequence of modules aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation.

## FOURTH YEAR MODULES

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### POP3811 EPIDEMIOLOGICAL METHODS

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|---------------------------|---|
| <b>Module title:</b>      | <b>EPIDEMIOLOGICAL METHODS</b>  |
| <b>Code:</b>              | <b>POP3811</b>  |
| <b>NQA level:</b>         | 8   |
| <b>Contact hours:</b>     | 4 lectures per week / 14 weeks  |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> (at least two tests and two assignments); Examination <b>60%</b> |
| <b>Pre-requisite:</b>     | None  |

**Module description:** Epidemiological study design; Clinical trials; Case control: Incidence and Prevalence; Design and analysis of Cohort (prospective) studies: advantages and disadvantages. Advantages and disadvantages of cross-sectional studies Matched Case control design and analyses using McNemar's test, reasons for matching: advantages and disadvantages relative to unmatched studies; Measures of Association and impact: Relative risk and odds ratio: estimation of Odds ratio from 2 X 2 tables; Bias: Selection and information bias; effects of the various forms of bias on estimation. Confounding and effect modification: its determination and control.

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### POP 3822 POPULATION PROJECTIONS

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|---------------------------|--|
| <b>Module title:</b>      | <b>POPULATION PROJECTIONS</b>  |
| <b>Code:</b>              | <b>POP 3822</b>  |
| <b>NQA level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week / 14 weeks;  |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> (at least two tests and one assignment); Examination <b>60%</b> |
| <b>Pre-requisite:</b>     | None   |

**Module description:** Introducing population projection; the need for population forecast; Basic methods of population projection and applications; the mathematical method; the limitations of the mathematical method. The component method of population projection: the principles of the method, the details of the method; the use of broader age groups, data requirements. Population projections in the Namibian context.

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### POP3832 POPULATION MIGRATION

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|---------------------------|---|
| <b>Module title:</b>      | <b>POPULATION MIGRATION</b>                               |
| <b>Code:</b>              | <b>POP3832</b>  |
| <b>NQA level:</b>         | 8   |
| <b>Contact hours:</b>     | 4 lectures per week / 14 weeks                            |
| <b>Credits:</b>           | 16  |
| <b>Module assessment:</b> | Continuous assessment <b>40%</b> ; Examination <b>60%</b> |
| <b>Pre-requisite:</b>     | None  |

**Module description:** Definition and terminologies in migration studies. International migration. Sources of data, quality of statistics. Evaluation and estimation of international migration. Intercensal component method. Intercensal cohort – component method. Net migration, gross migration (migration turnover) and migration ratios. Migration rates: crude immigration rate. Crude emigration rate. Crude net migration rate. Crude gross migration rate. Contribution of migration to population change. Graphic techniques of analysis (population turnover). Life-time migration. Migration streams and counter streams. Return migration. Longitudinal migration. Bases of migration rates. Sources of migration statistics. Measurement of mobility. National 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's push and pull theory. Lee's Intervening Obstacles theory. Other theories. Contribution of migration to urbanization. Other consequences of migration at the place of origin and at the place of destination. Internal migration (Namibian context)

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### ISA3862 HEALTH COMMUNICATION

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|---------------------------|--|
| <b>Module title:</b>      | <b>HEALTH COMMUNICATION</b>  |
| <b>Code:</b>              | <b>ISA3862</b>   |
| <b>NQA level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week / 14 weeks   |
| <b>Credits:</b>           | 8  |
| <b>Module assessment:</b> | Continuous assessment <b>60%</b> ; Examination (minimum of 1 test and 2 assignments).<br>Examination <b>40%</b> (1x3 hour paper) |
| <b>Pre-requisite:</b>     | None   |

**Module description (content):** Health communication is one of the most effective methods of preventing the further spread of the HIV/AIDS pandemic in society, in the absence of a cure or vaccination. Health communication uses a variety of strategic communication approaches and tools to achieve behaviour change among groups which are at risk of contracting HIV/AIDS. The course familiarizes students with health communication concepts and theories, the steps of planning a health communication project, methods of identifying risk factors in the health behaviour of communities, target audience analysis. The course also focuses on research methods to collect data from a target audience for communication programmes, behaviour and attitude change, planning communication projects, health message design, liaison with media and selecting communication channels and evaluating health communication interventions.

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**SOS3840 ADVANCED SOCIOLOGY OF NAMIBIAN SOCIETY**

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|---------------------------|--|
| <b>Module Title:</b>      | <b>ADVANCED SOCIOLOGY OF NAMIBIAN SOCIETY</b>  |
| <b>Code:</b>              | <b>SOS3840</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week / 28 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Continuous assessment <b>60%</b> , consisting of 2 written assignments, 2 oral presentations, and a minimum of two tests; examination <b>40%</b> . |
| <b>Prerequisites:</b>     | None   |

**Module description:** The course is presented in seminar format. It embarks on the analysis of contemporary Namibian society in its varied cultural, economic, political, historical, social, and social structural aspects. The analysis is based on the comprehensive sighting of current research, thus emphasizing the research orientation of the curriculum at final year level. The course applies sociological perspectives learned in the previous course of the curriculum. Main topical areas of the debate: land issue; labour migration; labour market and unemployment; industrial relations; societal development and Vision 2030; globalization and neo-liberalism; youth; poverty; family; gender; sexual cultures; education; media; religion; traditionalism; social structural change and post-colonial class structure; pre-colonial social formations in Namibia; colonialism, apartheid and liberation.

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**SOS3860 SOCIOLOGY OF GENDER AND SEXUALITY**

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|---------------------------|--|
| <b>Module title:</b>      | <b>SOCIOLOGY OF GENDER AND SEXUALITY</b>   |
| <b>Code:</b>              | <b>SOS3860</b>   |
| <b>NQF level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week / 28 weeks   |
| <b>Total credits:</b>     | 16   |
| <b>Module assessment:</b> | Students' work will be assessed through continuous assessment ( <b>60%</b> ) and one written final examination ( <b>40%</b> ). For continuous assessment; students are required to submit a minimum of two (2) individual essays. Essays should reflect the critical analysis of the gender system based on theoretical knowledge acquired in the course, literature reviewed and analysis of own life experiences. Students are also expected to do three (3) group presentations of published articles. Additionally, students will be required to participate in monthly seminars. Seminar materials will be assigned on a monthly basis and students are expected to have read the materials in advance of the seminar. The final examination will evaluate the student's understanding of the proceedings in class and her / his theoretical ability. |
| <b>Prerequisites:</b>     | None   |

**Module description:** To detect that the social world is largely organised around the gender divide is perhaps one of the most difficult tasks in our current social and political climate. The fact that no two individuals experience the gender system in exactly the same way does not diminish its powerful impact on most individuals. Gender definitely structures shared experiences among categories of people (race, ethnicity, social class) and also their sexual cultures. That is the reason why gender issues have been mainstreamed into the syllabi of the first three years of the B.A. sociology curriculum. This final year course aims at an in-depth analysis of the way in which femininity and masculinity are constructed by both industrialized and developing societies. Testing sociological theories of structuralist orientation and of agency, the course will exemplify both approaches: the ways in which societies socialize individuals into gendered identities and roles, and the ways in which individuals appropriate and re-construct them. The second main focus of the course will be to put to the test gender theories within the social and cultural distinctiveness of Namibian society. Topics include: sociological schools in the conceptualization of gender, i.e. origins of biological sex, origins and strands of feminism; feminist analysis of Namibian society, women's movement in Namibia; sexuality, i.e. components of sexual identity, sexual identities, sexual cultures, sexual rights, friendship and intimate relationship; reproductive health, i.e. gender and HIV/AIDS, safe motherhood, contraception, abortion; men and masculinity, i.e. concepts of masculinity, construction of masculinities in Namibian society, masculinity and gender-based violence; gender policies and developmental organizations in Namibia, i.e. Women in Development (WID), Women and development (WAD), Gender and Development (GAD), policy approaches of state and civil society; gender and economy, i.e. poverty, empowerment, labour market and work place, gender division of labour, job and salary discrimination; gender and culture, i.e. education, media, cultural traditions and commodified culture; gender and social structure, i.e. gender stratification, gender and class; gender and politics, i.e. women and power, women in politics, the legal framework for the promotion of gender equity.

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**SOZ3880 SOCIOLOGY OF HEALTH**

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|---------------------------|--|
| <b>Module title:</b>      | <b>SOCIOLOGY OF HEALTH</b>   |
| <b>Code:</b>              | <b>SOZ3880</b>   |
| <b>NQF Level:</b>         | 8  |
| <b>Contact hours:</b>     | 2 lectures per week / 28 weeks   |
| <b>Credits:</b>           | 16   |
| <b>Module assessment:</b> | Students' work will be assessed through continuous assessment ( <b>60%</b> ) and one written final examination ( <b>40%</b> ). For continuous assessment, students are required to submit a minimum of two (2) individual essays. Essays should reflect the critical analysis of health and illness behaviour. |
| <b>Prerequisites:</b>     | None   |

**Module description:** This module examines the social contexts of physical and mental health and illness. The module gives prominence to the debates, contrasting models and perspectives that characterise the field of sociology of health. Topics include concepts and theoretical frameworks for sociological understandings of health and illness; the individual (self), society and illness; social organisation and political economy of the health care system; the development of health professions, health professionals and the health work force; stratification, inequality and power in health care delivery organisations; health care and bureaucracy; health care and social change; comparative analyses of alternatives to the

dominant paradigms of health, illness and healing; ethical issues in health care and contemporary issues in the study of health and illness.

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#### **GSP3800 CONCEPTS OF ENVIRONMENTAL MANAGEMENT**

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**Module title:** CONCEPTS OF ENVIRONMENTAL MANAGEMENT  
**Code:** GSP3800  
**NQF Level:** 8  
**Contact hours:** 2 lectures / week for 28 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment: **60%** (minimum 04 assessments; research assignments). Examination: **40%** (1 x 3 hours paper)  
**Prerequisites:** Successful completion of all minor modules of the 1st, 2nd and 3rd year level  
**Module description (content):** This module advances students' comprehension of the interdependent functioning whole of the geo-system, biological and human system (geo-ecosystem) through a strong focus on environmental resources and selected environmental problem formations. The content demonstrates the need for conservation and environmental management. Discussions examine academic perspectives and build intellectual skills required in evaluation procedures such as Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). Practice-orientated assignments apply principles of Integrated Environmental Management (IEM). The module fosters the internalisation of environmental obligations, environmental auditing and environmental ethics needed for sustainable societies.

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#### **GSP3820 SPATIAL PLANNING**

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**Module title:** SPATIAL PLANNING  
**Code:** GSP3820  
**NQF Level:** 8  
**Contact hours:** 2 lectures / week for 28 weeks  
**Credits:** 16  
**Module assessment:** Continuous assessment: **60%** (minimum 04 assessments; research assignments). Examination: **40%** (1 x 3 hours paper)  
**Prerequisite:** Successful completion of all modules of the 1st, 2nd and 3rd year level  
**Module description (content):** This module explores the relationship between social structures and their distribution within the territory of state. It is assumed that the triangular relationship between society, economy and territory reflected in the consumption of land reflects a rather created than incidental allocation in space. Governments, through their public services, usually regulate the triangular, interdependent and interlocked system of society, economy and land consumption at local, regional and national level. The content exposes students to the application of their geographical knowledge and understanding to structured and scaled processes of territorial planning. The module focuses institutional agents of public sector planning and assesses their contribution to the allocation of local and regional resources such as land in order to organising the sector and spatial development of state territory.

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#### **GHR3801 REMOTE SENSING**

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**Module Title:** REMOTE SENSING  
**Code:** GHR3801  
**NQF Level:** 8  
**Contact Hours:** 2 periods / week for 14 weeks  
**Credits:** 8  
**Module Assessment:** Continuous Assessment **60%** (Minimum 02 tests, 07 Lab assignments). Examination **40 %** (1 x 3 hours Examination paper)  
**Prerequisite:** Successful completion of all minor modules of the 1st, 2nd and third year level  
**Module Description (Content):** This module focuses on the physical principles of remote sensing data acquisition and handling, optical and digital image processing techniques, and environmental and scientific applications of remote sensing data from local to global scales. Specifically, the module deals with the following topics: Physical principles of the visible, infrared and microwave section of the electromagnetic spectrum; Remote sensing platforms and sensors; Data acquisition, storage and processing; Image processing and analysis; Remote sensing applications in geosciences. The module is delivered through a mixture of lectures, tutorials and practicals using remotely sensed data, and practice in digital image processing techniques to provide relevant information for addressing geoscientific issues at a range of temporal and spatial scales.

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#### **GHR3822 APPLIED SPATIAL ANALYSIS**

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**Module Title:** APPLIED SPATIAL ANALYSIS  
**Code:** GHR3822  
**NQF Level:** 8  
**Contact Hours:** 2 periods / week for 14 weeks  
**Credits:** 8  
**Module Assessment:** Research report **100%**  
**Prerequisite:** HGHR 3811  
**Module Description (Content):** This module allows students to deepen their previously acquired skills in geostatistic (HGIS 3711), GIS (HGIS 3732) and / or Remote Sensing (HGHR 3411) by applying them in a wide range of areas such as environmental impact assessment, water resources management, environmental modelling, and terrain analysis. It is designed to develop students' applied vocational and professional skills relevant to work or research. The content is essentially pegged to the module HGHE 3410: Research Project, in which geostatistic, GIS and or Remote Sensing could be employed as a major tool.

**POP3810**

**Module title:** RESEARCH PROJECT  
**Code:** POP3810  
**NQA level:** 8  
**Contact hours:** 2 contact hours per week  
**Credits:** 32

**Module assessment: 100%** Project report 70% Oral presentation 30%

**Pre-requisite:** At least 75% of third year modules must have been passed

**Module description:** In this course students will undertake independent and practical research on a selected demographic topic which will be presented as a research report. Students will be expected to apply demographic and statistical methods and follow all phases of research process. The project is expected to run throughout the two semesters. Students are expected to work under the supervision of a member of academic staff. The internal and external examiners will examine the student's project report at the end of the second semester. A student may be expected to do an oral on the project.

**J.1.2 STATISTICS DEPARTMENT: COURSE EQUIVALENTS**

| OLD     |                                    | NEW (STARTED 2008) |  |
|---------|------------------------------------|--------------------|--|
| STS3101 | Statistics 1A                      | STS3522            | Introduction to Statistics                           |
| STS3101 | Statistics 1A                      | STS3531            | Descriptive Statistics                               |
| none    |                                    | STS3532            | Introduction to Probability                          |
|         |                                    |                    |  |
| STS3211 | Probability                        | STS3611            | Probability Theory                                   |
| STS3201 | Inference I                        | STS3631            | Statistical Estimation                               |
| none    |                                    | STS3612            | Introduction to Statistical Computing                |
| STS3212 | Inference II                       | STS3632            | Statistical Inference                                |
|         |                                    |                    |  |
| STS3402 | Regression Analysis                | STS3711            | Linear Models  |
| STS3312 | Distribution Theory                | STS3721            | Distribution Theory                                  |
| STS3331 | Sampling Theory and Survey Methods | STS3731            | Sampling Techniques                                  |
| STS3331 | Sampling Theory and Survey Methods | STS3701            | Research and Survey Methods                          |
| STS3311 | Data Processing                    | STS3732            | Data Processing                                      |
| STS3411 | Design and Analysis of Experiments | STS3752            | Experimental Design and Analysis of Variance         |
| none    |                                    | STS3712            | Non- parametric and Categorical Statistics           |
|         |                                    |                    |  |
| none    |                                    | STS3801            | Time Series Analysis                                 |
| none    |                                    | STS3811            | Statistical Computer Programming                     |
| STS3400 | Projects                           | STS3810            | Research Project                                     |
| none    |                                    | STS3821            | Decision Analysis                                    |
| none    |                                    | STS3831            | Stochastic Processes                                 |
| STS3401 | Multivariate Analysis              | STS3812            | Multivariate Distribution Theory                     |
| none    |                                    | STS3852            | Forecasting Methods and Applications                 |
| STS3412 | Statistical Quality Control        | STS3832            | Statistical Quality Control                          |
|         |                                    |                    |  |
| none    |                                    | POP3611            | Introduction to Demography                           |
| none    |                                    | POP3631            | Official Statistics and National Statistical Systems |
|         |                                    |                    |  |
| STS3391 | Fundamentals of Data Processing    | POP3731            | Fundamentals of Data Processing                      |
| STS3332 | Demography                         | POP3711            | Demographic Methods I                                |
| none    |                                    | POP3732            | Demographic Methods II                               |
|         |                                    |                    |  |
| none    |                                    | POP3811            | Epidemiological Methods                              |
| STS3400 | Research Projects                  | POP3810            | Research Projects                                    |
| STS3432 | Population Migration               | POP3832            | Population Migration                                 |
| none    |                                    | POP3822            | Population Projections                               |
|         |                                    |                    |  |

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**SECTION II: OLD CURRICULUM STUDENTS WILL REGISTER FOR EQUIVALENCE MODULES IN 2012.THE DETAILS OF OLD CURRICULUM MODULES SEE 2009 PROSPECTUS AND 2010 PROSPECTUS**

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**M. PART-TIME COURSE/DISTANCE EDUCATION**

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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.

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**N. GENERAL INFORMATION**

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All general information as well as the general examination dates and the dates for registration appear in the General Information and Regulations Prospectus.