

CORRESPONDENCE

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VISION & MISSION STATEMENT

Vision

A university leading in engaged scholarship

Mission

The University of Venda produces graduates that are locally relevant and globally competitive

THE CALENDAR IS OBTAINABLE IN THE FOLLOWING SEPARATE PARTS:

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	University Senate	
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SCHOOL OF MATHEMATICAL AND NATURAL SCIENCES

ADMINISTRATIVE STAFF MEMBERS:

Dean	: N Potgieter, BSc (RAU), MSc, PhD (UP)
Deputy Dean	: MP Tshisikhawe, BSc (Hons), MSc (Univen), PhD (UP), PGDipHE (Rhodes)
Executive Secretary	: MB Mantshimuli (BBA)
Typist/Clerk	: Vacant
School Administrator	: LD Dongola, BA (Hons) (Univen)

VUWANI SCIENCE RESEARCH CENTRE:

Coordinator	: NE Maluta, BSc (Hons) (Unin), MSc (Univen), PhD (Bath, (UK)
Lab Technicians	: SM Mathebe Bsc (Hons) (Univen)

NRF SARCHI CHAIR:

Coordinator	: SH Foord, PhD (UP)
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RESEARCH PROFESSOR:

Research Professor	: PO Bessong, PhD (Univen), Postdoc (Virginia, USA)
Research Assistant	: LG Mavhandu-Ramarumo, PhD (Univen)

ACADEMIC STAFF MEMBERS:

(Heads of Departments are indicated by means of an asterisk*)

Biochemistry Department

Professors	: *A Shonhai, BSc (Hons) (NUST), PhD (Rhodes)
Senior Lecturer	: NE Madala, PhD (UJ)
	: A Burger, BSc (Hons) (UP), MSc, PhD (Rhodes)
Lecturers	: SC. Tshidino, BSc; BSc Hons (UNIVEN); MSc; PhD (NMU); PGDHET (UFH)
	: L Mathomu MSc (Unisa)
Junior Lecturers	: A Burger, BSc (Hons) (UP), MSc, PhD (Rhodes)
Lab Technicians	: DC Mmboyi, BSc (Hons) (Univen)
	: C Ndou, BSc (Hons) (Univen)

Botany Department

Associate Professors	: *MP Tshisikhawe, BSc (Hons), MSc (Univen), PhD (UP), (Rhodes)
Senior Lecturers	: MH Ligavha-Mbelengwa, BSc (Hons), BEd (Univen), MSc (UCT) UED, SABUFSEP (North Carolina A&T State, USA)
	: LI Ramovha, BSc (Unin), BSc (Hons) (Univen), MSc (UP), HED (Postgrad) (Unisa) PhD (UP)
	: NA Masevhe, BA, BSc (Hons), UED, MSc (Univen), PhD (UP)
Lecturers	: RT Tshivhandekano, B.Sc (Univen), BSc (Hons), MSc (UCT), M.Env.Man (PU for CHE)
	: N Swelankomo BSc (Hons) (Unitra), MSc (US)
Lab Technicians	: MP Legodi, BSc (Hons) (Unin), MSc (UL)

Computer Science and Information Systems Department

Senior Lecturers	: Vacant
Lecturers	: G Dzawo, BSc, MSc (NUST, Zimbabwe); PG Dip (CHE) (RU)
	: *N Soganile, BSc (Cuba), MSc (NUST, Zimbabwe), PG Dip (CHE) (RU)
	: B Moyo, BSc (Cuba), MSc (NUST, Zimbabwe)

Chemistry Department

Associate Professors	: IDI Ramaite, BSc (Hons) (Univen), PhD (Rhodes), PrChem SA : Prof M Kabanda, Associate prof, PhD, MSc all from Univen
Senior Lecturers	: *SS Mnyakeni-Moleele, BSc (Hons), PhD (WITS), PrChem SA : MA Legodi, BSc (UCT), BSc (Hons) (Unin), PhD (UP), PrChem SA : LC Murulana, BSc (Univen), BSc (Hons), MSc, PhD (North West), PrChem SA : E Batisai, BSc (Hons), MSc, PhD (SU) : N Tavengwa PhD (WITS), PrChem SA
Lecturers	: LR Puka, BSc, BSc (Hons) (VISTA), MSc (RAU) : TE Ramurafhi, MSc (Medunsa)
Senior Lab Technicians	: FB Mutshaeni, BSc Hons (Univen) PrChem SA
Lab Technicians	: NR Maseko, BSc (Wits), BSc (Hons) (Univen)
NMR Operators	: P Pandelani, BSc (Hons)(Unin)

Mathematics and Applied Mathematics Department

Professors	: S Shateyi, BSc (Hons), MSc, DPhil (UZ) : W Garira, BSc (UZ), MSc (UK), PhD (London)
Senior Lecturers	: *S Moyo, MSc (PFUR-USSR), PhD (Brunel, UK) : JC Ndogmo, PhD (Montreal, Canada), DEA (Louis Pasteur OF Strasbourg University, France)
Lecturers	: MA Luruli, BSc (Georgia Statey, USA), MSc (Clar Atlanta), (USA) : FS Netshapala, BSc (Ed), BSc (Hons) (Univen), MSc (UP) : RM Mukhodobwane, BA (Hons) (Univen), HED, BEd (Unisa), MSc (Univen) : D Mathebula, BSc (Hons) (Univen), MSc (US), PhD (Univen) : M Mohlala, BSc (Hons) (KZN), MSc, DPhil (Howar University) : AD Maphiri, BA, BSc, MSc, PGDE, (Univen) : A Manthada, BSc (Hons), PGDE, MSc (Univen) : IR Makgatho, BSc (Hons)(Unisa), Business and Administration (Hons)(Stellenbosch), MSc, HED (Limpopo) : VT Makhoshi BSc, (Hons), UED, MSc (Univen) : K Muzhinji, Dip.Ed. (UZ), BSc. Ed (Hons), (Bindura University of Science Education, Zimbabwe), MSc (TU Kaiserslautern, Germany), MSc (Johannes Kepler, Austria), PhD (Univen)
Junior Lecturers	: TL Kubjana, MSc (UWC) : N Mukwevho BSc Hons, MSc (Univen) : N Ndou, BSc, BSc (Hons), MSc (Univen)

Microbiology Department

Professors	: N Potgieter, BSc (RAU), MSc, PhD (UP)
Associate Professors	: A Samie, BSc (Hons), MSc (Yaoundé, Cameroon), PhD (Univen) : *AN Traore, DEUG B, Licence, Maitrise (UJF, Grenoble, France); MSc (RAU), PhD (UJ)
Senior Lecturers	: ME Musie, BSc (Wits), BSc (Hons), MSc, PhD (Univen)
Lecturers	: J Kabue-Ngandu, MSC (SU), PhD (Univen) : MT Sigidi BSc (Hons) (UKZN), MSc, PhD (Univen)
Lab Technicians	: M Magwalivha, BSc (Hons) (Univen), MSc (UP)

Physics Department

Professors	: Vacant
Senior Lecturers	: JK Kirui, BSc (Hons) (NairobI), MSc (British Columbia), PhD (Wits) : *NE Maluta, BSc (Hons) (Unin), MSc (Univen), PhD (Bath University), (UK) : D Tinarwo, Lic. Ed (Phy) (Jose' Varona, Cuba) BSc (Hons), MSc (Zimbabwe), PhD.Ing (Germany)

Lecturers	: L Jhamba, BSc (Hons), BEd, MSc, MScEd (Zimbabwe) PhD (Wits)
	: F Nemangwele, BSc (Univen), BSc (Hons), MSc (UWC), PhD (Univen)
	: TS Mulaudzi, BSc.Ed, BSc (Hons), MSc, PhD (Univen)
	: L Phuthu
Senior Lab Technicians	: TS Ravhengani, MSc (Univen)
Lab Technicians	: TT Khedzi, BSc Hons (Univen)
	: S Mathebe BSc (Hons) (Univen)

Science Foundation Department

Professors	: *S Shateyi, BSc (Hons) (NUST), MSc, DPhil (Zimbabwe)
Lecturers	: RS Pearce, MSc (UWC)
	: GM Mokganya, MSc (Univen)
	: O Matsilele, BSc (Hons) (Univen)
	: VM Nekhubvi, BSc (Hons), MSc (Univen)
Junior lecturer	: I Zitha

Statistics Department

Professors	: Vacant
Associate Professors	: Vacant
Senior Lecturers	: KA Kyei, BSc (Hons), PGD (Ghana), DD, MD, (UCL, Louvain-La-Neuve, Belgium), PhD (UP)
	: C Sigauke, BEd, MSc (Zimbabwe), PhD (UFS)
	: *A Bere, BSc (Hons), MSc (Zimbabwe), PhD (UWC)
Lecturers	: TB Mulaudzi, BSc (Hons) (UNIN), MSc (Univen)
	: TH Tshisikhawe, BSc (Hons), MSc (Univen)

Zoology Department

Professors	: Y Moodley PhD (UCT)
	: SH Foord, PhD (UP)
Associate Professors	: *IEJ Barnhoorn PhD (UJ), Postdoc (UP)
Senior Lecturers	: LH Swanepoel, PhD (UP)
Lecturers	: CS Schoeman, MSc (US), PhD (Univen)
	: GJ Madonsela, MSc (UDW)
	: H Roux, MSc (UJ)
	: HE Munzhelele, MSc (Univen)
	: S Hugo, PhD (UP)
Chief Lab Technician	: K Magwede, BA, UED, MSc (Univen), PhD (UJ)
Lab Technicians	: MG Phaphana, BA, UED (Univen)

SECTION 2:

QUALIFICATIONS OFFERED WITHIN THE SCHOOL OF MATHEMATICAL AND NATURAL SCIENCES

Qualification name	Total years for qualification (n)	Total Credits	NQF level
Diploma in Fresh Water Technology	3	360	6
Extended Bachelor of Science degree	4	360	7
Bachelor of Science degree	3	360	7
Bachelor of Honours	1	120	8
Masters	2	180	9
PhD	3	360	10

SECTION 3:

OVERVIEW OF POSSIBLE CAREER OPPORTUNITIES IN LINE WITH QUALIFICATIONS OFFERED BY THE SCHOOL

Biochemistry Department

Biochemist, Lecturer, Researcher, Quality Controller, Medical Biochemist, Biochemical technologist, Biotechnologist

Botany Department

Plant Ecologist, Plant Physiologist, Plant Ecophysiological, Plant Systematist, Ethnobotanist Lecturer, Botanist, Researcher, Environmental Consultant, Pre- medicine, Taxonomist, Nature Conservationist

Chemistry Department

Quality Control Chemist, Lecturer, Analytical Chemist, Industrial Research Chemist, Sales Representative, Forensic Chemist, Food Chemist, Patent Agent

Computer Science and Information System Department

Software applications developer, Computer systems analyst, Computer systems engineer, Network System administrator, Database administrator, Business intelligence analyst, Web Developer, Computer programmer, Software quality assurance (QA) tester

Mathematics and Applied Mathematics Department

Researchers in various areas of application of mathematics, viz engineering, biometrics, biomathematics, Physics, financial institutions, insurance companies, Teachers/ Lecturer
Consultants, Computer Programmers, Data science specialists, Modellers of real life processes

Microbiology Department

Lecturer, Researcher, Pre-medicine, Quality Controller, Medical Microbiologist, Food Technologist, Virologist, Environmental Microbiologist, Biotechnologist

Physics Department

Physicist, Laboratory Physicist, Pre-medicine, Quality Controller, Astrophysicist, Plasma Physicist, Applied Physicist, Medical Physicist and Lecture

Statistics Department

Lecturer, Statistician, Business analyst, Data analyst,

Zoology Department

Environmental writer, Statistia, Biodiversity Manager, Conservation Ecologist and Scientist, Environmental Planner, Zoologist, Geneticist and Ecologist

IMPORTANT NOTICE TO ALL STUDENTS

Students who are registered for undergraduate and postgraduate degrees before 2020 must follow section 4 rules and regulations

1. Only Section 4 rules and regulations in this yearbook is important to students registered on old qualification codes and degrees. The onus rest upon the shoulders of the student to make sure he/she is registered for the correct modules and for the correct qualification codes according to the year of first registration.
2. You must use the yearbook which corresponds to the year you have first registered for a specific degree as the basis for the modules and module codes you are supposed to register for. Eg. If you are registered for the degree **BACHELOR OF SCIENCE IN CHEMISTRY AND BIOCHEMISTRY [code: BSCCHB] in 2018** – then only the rules and modules for this specific degree in 2018 is important to you and you cannot register for any other modules without permission from the Dean. You can also not register any new code modules
3. It is therefore important to make sure that you talk with the School administrator if your modules are not on the system when you register to finish your degree OR when you experience any other issue surrounding your registration.
4. Please only look at section 4 to finish your undergraduate degree – if you have any questions, contact the Dean or the School administrator
5. All Hons, Masters and Doctoral students who are still on old degree codes must finish their modules and degrees under the old qualification rules – please see the Dean and School administrator for any queries.

Students registered for the first time for any undergraduate or postgraduate degree in 2020 and 2021 must follow section 5 rules and regulations

1. Section 5 rules and regulations are important for all undergraduate and postgraduate students who first registered during 2020 for the extended BSc programme, the B.Sc degree, the BSc honours degree, MSc and PhD degrees. Please follow these rules carefully and make sure all new qualification codes, module codes, pre-requisites are followed as outlined and clearly explained.
2. All students registered for the Masters in eScience will be registered in this degree from 2020.
3. It is therefore important to make sure that you talk with the Dean and the School administrator if your modules are not on the system when you register OR when you experience any other issue surrounding your studies

SECTION 4:

THIS SECTION IS FOR ALL STUDENTS WHO ARE REGISTERED ON OLD QUALIFICATION/DEGREE CODES BEFORE 2020

4.1 ADMISSION REQUIREMENTS FOR THE SCIENCE FOUNDATION PROGRAMME

- (a) Candidates with a National Senior Certificate (NSC) stipulating admission to a bachelor's degree, and an achievement rating of **3** (40-49%) or better in matric English, Mathematics, Physical Science and any other related subject, as judged by responsible departments, may be admitted to the Science Foundation Programme.
- (b) Approved qualifications for which students will be registered in the Science Foundation programme:
 - BSc (Bachelor of Science)
 - BENVSC (Environmental Sciences)
 - BENVM (Environmental Sciences)
 - BSCAGR (Agriculture)

4.2 ADMISSION REQUIREMENTS FOR DIPLOMA IN FRESHWATER TECHNOLOGY (DIPFWT) (OFFERED IN THE ZOOLOGY DEPARTMENT):

- (a) A national Senior Certificate with a minimum of 30% in the language of learning coupled with an achievement rating of 3 (Moderate Achievement, 40 – 49%) or better in four of the recognized 20-credit NSC subjects and a 4 in either Biology, Agricultural Sciences, Physical Sciences or Geography.

4.3 ADMISSION REQUIREMENTS FOR BACHELOR OF SCIENCE DEGREE (BSc)

- (a) Students must follow one of the learning programmes listed under Bachelor of Science Learning Programmes.
- (b) Candidates wishing to enroll for a BSc degree must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects:
 - English
 - Mathematics
 - Physical Science
 - Any other related subject as judged by responsible departments
- (c) Candidates may be subjected to a selection procedure as determined by the school board.
- (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered.
- (e) Students from the Science Foundation Programme should have obtained 120 credits from the 12 modules registered for, which should include Physics, Chemistry and Mathematics modules.

4.4 ADMISSION REQUIREMENTS FOR BACHELORS OF SCIENCE HONOURS DEGREE (BSC HONS):

- (a) A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE.
- (b) Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval.

4.5 ADMISSION REQUIREMENTS FOR MASTERS OF SCIENCE DEGREE (MSC)

- (a) To be admitted to the programme a candidate must have obtained the Honours Bachelor's degree with 60% in the subject for which he/she wishes to enrol, or have had equivalent status conferred on him/her by SENATE.
- (b) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the School's Higher Degrees Committee.

4.6 ADMISSION REQUIREMENTS FOR DOCTORAL DEGREE (PHD)

- (a) To be admitted, candidates must have obtained a Master's degree or such other qualification as in the opinion of SENATE is of equivalent status, in the field where they wish to study, except if SENATE approves that it may be in another field, in which case they must satisfy SENATE as to their proficiency in the selected field.
- (b) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the School's Higher Degrees Committee.

4.7 RULES FOR PROGRESSION

4.7.1 SERVICE COURSES:

Students from other schools intending to register for modules in the School of Mathematical and Natural Sciences will only be permitted in accordance with a predetermined number of students for the relevant department and will only be permitted to register for modules for which they fulfil the pre-requisites of the modules.

4.7.2 MODULES FOR NON-DEGREE PURPOSES:

- (a) Students wishing to enrol for such modules must consult the appropriate Head of the Department and the Dean of the School.
- (b) A written application to this effect must be provided by the student and given to the Schools' Administrator who will confirm if the student qualifies for the additional modules. This will then be approved/not-approved by the Dean and send to RAC for final decision.

4.7.3 REGISTRATION AND CHANGE OF REGISTRATION:

- (a) Students will only be allowed to register or change registration for modules if a full academic record, which includes credits for each module, accompanies the registration form.
- (b) Students will only be allowed to register for a module if the Pre-requisites/s has/have been satisfied except otherwise waived by the Head of Department after consultation and approval by the Dean.
- (c) Candidates may be admitted as students in the School on the basis of relevant prior learning. Such candidates will be subjected to an evaluation programme by the School's Assessment and Recognition of Prior Learning (ARPL) committee. Final admission will only be granted by SENATE.

4.7.4 SCIENCE FOUNDATION:

- (a) The Science Foundation Programme will be for a one-year duration.
- (b) For a student to proceed to the 1st year of mainstream studies, he/she should have obtained at least 120 credits in the Science Foundation Programme.

- (c) A student who failed 3, 4 or 5 modules is allowed to repeat the failed modules once, of which failure to reach the minimum required 120 credits, the studies will be discontinued.
- (d) A student who failed to pass at least 6 modules will not be allowed neither to repeat the failed modules nor to continue with his/her studies.

4.7.5 DIPLOMA IN FRESHWATER TECHNOLOGY:

- (a) The minimum registration period for the Diploma in Freshwater Technology is three years.
- (b) To obtain the Diploma in Freshwater Technology from the School, students must have earned at least 360 credits including all core and fundamental modules in the relevant learning programme.
- (c) To complete a three-year learning programme, students are required to enrol for at least 120 credits per year.
- (d) For a student to progress to the third year level, a student must have passed **ALL** first and second year modules.
- (e) Assessment in the project based modules of the second and third year of the Diploma in Freshwater Technology (FWT 2601, FWT 2602, FWT 3601 and FWT 3602) will not include a formal exam but students will be assessed through project portfolios that have to be submitted for Assessment. In addition, the third year module Assessment will include the submission and Assessment of a report completed by the appointed supervisor of the institution where the candidate had completed an industrial placement that forms part of the Work Integrated Learning (WIL) component of the diploma.
- (f) Modules are offered as block teaching that consist of six teaching blocks of 9 days in each year of study. In addition, two block practical work will be included in the first year of study. The first block is in January prior to the start of graduate programme lectures.

4.7.6 BSc DEGREE:

- (a) For a student to be promoted to the next level, the following criteria must be met:
 - In order to register for second year level modules, a student must have passed 60% of first year level modules.
 - To register for third year level modules, all first year and second year modules must be passed, and
 - All modules at first, second and third years must be passed in order to register for the final fourth year level of a study programme
- (b) No curriculum change, whether within or from outside the School, will be recognized unless approved by SENATE.
- (c) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, subject to the approval of the Head of Department and the Dean.
- (d) Students can register **only** for modules for which **ALL** Pre-requisites have been satisfied.
- (e) Students retain credit for all modules passed
- (f) In order to qualify for a BSc degree in the School of Mathematical and Natural Sciences, students must obtain a minimum of half of their credits in a learning programme within this School.
- (g) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the Bachelor of Science Learning Programmes listed in this document. Departments may prescribe additional credits provided these do not exceed 32 credits. To complete a three-year learning programme, students are required to enrol for at least 120 credits per year, with the minimum number of credits at each level of study (NQF 5,6, and 7) being 72 credits at that level.
- (h) The minimum registration period for a BSc. degree is three years.

4.7.7 HONS DEGREE:

- (a) The general rules of the University will apply, **unless** otherwise specified for the School of Mathematical and Natural Sciences.
- (b) The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration.
- (c) **Project reports have to be handed in before the 30th of November of the academic year in order to graduate in May graduation.**
- (d) Except with the special permission of SENATE, the duration will not exceed TWO years
- (e) The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the school rules and unless he/she has been registered for one year at this University.

4.7.8 MSC DEGREE

- (a) The MSc degree is conferred on the basis of a dissertation and an examination, or a dissertation only, as determined by the Academic Board.
- (b) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination.
- (c) The general rules of the University will apply, **unless** otherwise specified for the School of Mathematical and Natural Sciences.
- (d) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress.
- (e) Students who wish to defer their studies at **any stage** must apply to the relevant department. If granted, such deferment will be for a maximum period of one year, after which a further application must be submitted. Deferment will, at most, be granted twice.
- (f) Unless otherwise decided by SENATE and subject to special provision in the school rules, the degree may be conferred if the candidate has been registered for a minimum of one academic year.

4.7.9 PhD DEGREE:

- (a) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the department and School's Higher Degrees Committee concerned for recommendation to the School of Postgraduate Studies and approval by SENATE. The Research proposal must be approved by the School's Higher Degrees Committee.
- (b) Unless otherwise decided by SENATE and subject to special provisions in the school:
 - The degree may be conferred only after the candidate has been registered for a period of at two years.
 - The maximum period of study is five years, subject to SENATE approval.
 - Extension may be granted only in exceptional cases and for only ONE year.
 - A student who desires an extension must submit a motivated application for consideration by SENATE.

4.8 COMPOSITION OF THE CURRICULUM FOR ALL OFFERED QUALIFICATIONS INCLUDING NQF LEVEL AND THE CREDITS FOR MODULES

4.8.1. SCIENCE FOUNDATION PROGRAMME MODULES

ONE YEAR DURATION	
Semester 1	Semester 2
FGS 1540 (12) Foundation Skills & Study Skills 1	FGS 1640 (12) Foundation Skills & Study Skills 1
FIT 1540 (12) Information Technology Fundamentals 1	FIT 1640 (12) Information Technology Fundamentals 1
FMT 1540 (12) Foundation Mathematics 1	FMT 1640 (12) Foundation Mathematics 1
FPH 1540 (12) Foundation Physics 1	FPH 1640 (12) Foundation Physics 1
FCH 1540 (12) Foundation Chemistry1	FCH 1640 (12) Foundation Chemistry1
FBI 1540 (12) Foundation Biology 1	FBI 1640 (12) Foundation Biology 1
Total credits = 72	Total credits = 72

4.8.2. DIPLOMA IN FRESHWATER TECHNOLOGY LEARNING PROGRAMME (DIPFWT) (OFFERED BY THE ZOOLOGY DEPARTMENT)

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF Level 7	
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
Core modules					
BIO 1543 (16) Diversity of Life for diploma students	BIO 1645 (16) Ecology, Adaptation and Evolution for diploma students	FWT 2531 (20) Basic Freshwater Ecology	FWT 2601 (30) Aquatic Habitat Delineation and Classification (Project)	FWT 3531 (20) Sampling Technology	FWT 3601 (30) Sampling in Freshwater Ecosystems (Project)
BIO 1544 (16) Cell Biology for diploma students	FWT 1641 (16) Introduction to Fluvial Geomorphology and the Physico-chemical Aspects of Water	FWT 2532 (20) Freshwater Biology	FWT 2602 (30) Collection and Identification of Freshwater Organisms (Project)	FWT 3532 (20) Introduction to Water Resource Management	FWT 3602 (30) Biomonitoring of Freshwater Ecosystems (Project)
FWT 1541 (16) Introductory biometry	FWT 1601 (28) An Introduction into Research Methodology and Project Planning and Project Management.	FWT 2533 (20) Identification of Freshwater Organisms		FWT 3533 (20) Biomonitoring Technology	
Fundamental modules					
HWR 1541 (8) Hydrology	COM 0601 (4) Computer Literacy				
Total credits = 120		Total credits = 120		Total credits = 120	

4.8.3. BACHELOR OF SCIENCE LEARNING PROGRAMMES

(A) BACHELOR OF SCIENCE IN BIOCHEMISTRY AND MICROBIOLOGY: BSCBCM

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry BIO 1541 (16) Tree of Life BIO 1542 (16) Cell Biology MAT 1543 (8) Mathematics for Life and Earth Sciences I STA 1549 (8) Basic Statistics COM 0510 OR COM 0610 (4) Computer Literacy ECS 1541 (10) English Communication Skills	CHE 1621 (8) Inorganic Chemistry I CHE 1622 (8) Organic Chemistry I STA 1649 (8) Basic Statistical Inference BIO 1643 (16) Ecology, Adaptation and Evolution ECS 1645 (10) English Communication Skills	BCM 2521 (10) Structural and Functional Biochemistry I BCM 2522 (10) Biochemical and Molecular Techniques MBY 2521 (10) Bacteriology MBY 2522 (10) Immunology ZOO 2541 (16) Animal Physiology	BCM 2621 (10) Structural and Functional Biochemistry II BCM 2622 (10) Metabolism MBY 2623 (10) Environmental Microbiology MBY 2624 (10) Virology	BCM 3521 (16) Protein Biochemistry BCM 3522 (16) Advanced Molecular Techniques MBY 3526 (14) Food Microbiology MBY 3527 (14) Industrial Microbiology	BCM 3621 (16) Enzymology and Enzyme Biotechnology BCM 3622 (16) Gene Expression, Protein Synthesis and Bioinformatics MBY 3628 (14) Mycology and Phycology MBY 3629 (14) Parasitology
Elective Modules - 8 credits:		Elective Modules – 16 credits:			
PHY 1525 (8) Physics for Natural Sciences	MAT 1643 (8) Mathematics for Life and Earth Sciences II PHY 1625 (8) Physics for Natural Sciences II	BIO 2542 (16) Population Ecology BOT 2544 (16) Plant Anatomy and Morphology CHE 2521 (10) Inorganic Chemistry II CHE 2521 (10) Organic Chemistry II	BOT 2645 (16) Plant Taxonomy and Reproductive Biology BOT 2649 (16) Ethnobotany I CHE 2620 (10) Analytical Chemistry CHE 2623 (10) Physical Chemistry ZOO 2648 (16) Animal Phylogeny		
Total credits = 136		Total credits = 112		Total credits = 120	

(B) BACHELOR OF SCIENCE IN BIOCHEMISTRY AND BIOLOGY: BSCBCB

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry BIO 1541 (16) Diversity of Life BIO 1542 (16) Cell Biology MAT 1543 (8) Mathematics for Life and Earth Sciences I ECS 1541 (10) English Communication Skills COM 0510 OR COM 0610 (4) Computer Literacy	CHE 1621 (8) Inorganic Chemistry I CHE 1622 (8) Organic Chemistry I ECS 1645 (10) English Communication Skills BIO 1643 (16) Ecology, Adaptation and Evolution	BCM 2521 (10) Structural and Functional Biochemistry I BCM 2522 (10) Biochemical and Molecular Techniques BOT 2544 (16) Plant Anatomy and Morphology ZOO 2541 (16) Animal Physiology ZOO 2544 (16) Principles of Genetics	BCM 2621 (10) Structural and Functional Biochemistry II BCM 2622 (10) Metabolism BOT 2645 (16) Plant Taxonomy and Reproductive Biology BOT 2649 (16) Ethnobotany ZOO 2648 (16) Animal Phylogeny	BCM 3521 (16) Protein Biochemistry BOT 3548 (10) Plant Systematics ZOO 3541 (20) Animal Ecophysiology	BCM 3621 (16) Enzyme and Enzyme Biotechnology BOT 3646 (10) Plant Physiology ZOO 3649 (20) Evolutionary Genetics
Elective Modules – 8 credits				Elective Modules – 16 credits	
PHY 1525 (8) Physics for Natural Sciences I STA 1549 (8) Basic Statistics	MAT 1643 (8) Mathematics for Life and Earth Sciences PHY 1625 (8) Physics for Natural Sciences II STA 1649 (8) Basic Statistical Inference			BCM 3522 (16) Advanced Molecular Techniques	BCM 3622 (16) Gene Expression, Protein Synthesis and Bioinformatics BOT 3641 (10) Ethnobotany II BOT 3647 (10) Plant Ecophysiology
Total credits = 120		Total credits = 126		Total credits = 104	

(C) BACHELOR OF SCIENCE IN MICROBIOLOGY AND BOTANY: BSCMB

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry BIO 1541 (16) Tree of Life BIO 1542 (16) Cell Biology MAT 1543 (8) Math for Life and Earth Sciences STA 1549 (8) Basic Statistics COM 0510 OR COM 0610 (4) Computer Literacy ECS 1541 (10) English Com Skills	CHE 1621 (8) Inorganic Chemistry 1 CHE 1622 (8) Organic Chemistry 1 STA 1649 (8) Basic Statistical Inference ECS 1645 (10) English Communication Skills I BIO 1643 (16) Ecology, Adaptation and Evolution	MBY 2521 (10) Bacteriology MBY 2522 (10) Immunology BOT 2544 (16) Plant Anatomy and Morphology BIO 2542 (16) Population Ecology	MBY 2623 (10) Environmental Microbiology MBY 2624 (10) Virology BOT 2645 (16) Plant Taxonomy and Reproductive Biology BOT 2649 (16) Ethnobotany I	MBY 3526 (14) Food Microbiology MBY 3527 (14) Industrial Microbiology BOT 3543 (10) Plant Ecology BOT 3548 (10) Plant Systematics	MBY 3628 (14) Mycology and Phycology MBY 3629 (14) Parasitology BOT 3641 (10) Ethnobotany II BOT 3646 (10) Plant Physiology BOT 3647 (10) Plant Ecophysiology
Elective Modules – 8 credits		Elective Modules - 14 credits			
PHY 1525 (8) Physics for Natural Sciences I	MAT 1643 (8) Mat for Biology, Earth and Life Sciences PHY 1625 (8) Physics for Nat Sciences II	CHE 2521 (10) Inorganic Chemistry CHE 2522 (10) Organic Chemistry	ZOO 2648 (16) Animal Phylogeny CHE 2620 (10) Analytical Chemistry CHE 2623 (10) Physical Chemistry		
Total credits = 136		Total credits = 118		Total credits = 106	

(D) BACHELOR OF SCIENCE IN BOTANY AND ZOOLOGY: BSCBZ

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
BIO 1541 (16) Tree of Life BIO 1542 (16) Cell biology CHE 1540 (12) General Chemistry MAT 1543 (8) Mat for Life and Earth Sciences I PHY 1525 (8) Physics for Natural Sciences I COM 0510 OR COM 0610 (4) Computer Literacy ECS 1541 (10) English Communication Skills STA 1549 (8) Basic Statistics	BIO 1643 (16) Ecology, Adaptation and Evolution PHY 1625 (8) Physics for Natural Sciences II ECS 1645 (10) English Communication Skills MAT 1643 (8) Mat for Life and Earth Sciences II STA 1649 (8) Basic Statistical Inference	BIO 2542 (16) Ecology BOT 2544 (16) Plant Anatomy and Morphology ZOO 2541 (16) Animal Physiology ZOO 2544 (16) Principles of Genetics	BIO 2646 (16) Conservation Biology I BOT 2645 (16) Plant Taxonomy and Reproductive Biology ZOO 2648 (16) Animal Phylogeny BOT 2649 (16) Ethnobotany I	BIO 3544 (16) Basic Freshwater Ecology BOT 3543 (10) Disturbance and Plant Ecology BOT 3548 (10) Plant Systematics ZOO 3541 (16) Animal Ecophysiology	BIO 3646 (16) Conservation Biology II BOT 3646 (10) Plant Physiology BOT 3647 (10) Plant Ecophysiology BOT 3641 (10) Ethnobotany II ZOO 3649 (20) Evolutionary Genetics
Total credits = 132		Total credits = 128		Total credits = 118	

(E) BACHELOR OF SCIENCE IN COMPUTER SCIENCES: BSCCSI

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
COM 1522 (8) Introduction to Computer Systems COM 1524 (8) Fundamentals of Computer Architecture COM 1721 (16) Object Oriented Programming MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundations I ECS 1541 (10) English Communication Skills	MAT1641 (8) Integral Calculus MAT1642 (8) Mathematics Foundation II COM1626 (8) Computer Technology ECS1645 (10) English Communication Skills	COM 2523 (10) Imperative Programming COM 2526 (10) Human-Computer Interaction COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals COM 2520 (10) Digital Design Techniques COM 2525 (10) Operating Systems COM 2701 (10) Computer Science Lab	COM 2624 (10) Algorithms and Data Structures COM 2626 (10) Data Communication and Computer Networks COM 2616 (10) Reasoning about programs COM 2628 (10) Contemporary Object-Oriented Concepts COM 2629 (10) Systems Analysis	COM 3520 (14) Software Engineering I COM 3521 (14) Distributed Operating Systems COM 3528 (14) Systems Design and Implementation	COM 3617 (14) Professional Issues in Computing and Information Technology COM 3621 (14) Advanced Algorithms COM 3629 (14) Database Design and Implementation COM 3620 (14) Software Engineering II COM 3626 (14) Artificial Intelligence COM 3627 (14) Evaluation of Information Systems
Elective Modules – 32 credits from:					
PHY 1521 (8) Mechanics PHY 1522 (8) Waves and Optics STA 1541 (8) Introduction to Statistics	PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism STA 1641 (8) Elementary Statistical Method I - Introductory Interference				
Total credits = 124		Total credits = 120		Total credits = 126	

(F) BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND MATHEMATICS: BSCCOM

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
COM 1522 (8) Introduction to Computer Systems COM 1524 (8) Fundamentals of Computer Architecture COM 1721 (16) Object Oriented Programming MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundation I STA 1542 (8) Introductory Probability ECS 1541 (10) English Communication Skills	MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundations II COM 1626 (8) Computer Technology ECS 1645 (10) English Communication Skills	COM 2523 (10) Imperative Programming COM 2529 (10) Database Fundamentals COM 2701 (10) Computer Science Lab MAT 2541 (10) Linear Algebra MAT 2542 (10) Multivariable Calculus MAT 2548 (10) Mathematical Modelling I	COM 2624 (10) Algorithms and Data Structures COM 2626 (10) Data Communication and Computer Networks MAT 2641 (10) Real Analysis I MAT 2642 (10) Differential Ordinary Equations I	MAT 3541 (14) Real Analysis II MAT 3542 (14) Group Theory	COM 3617 (14) Professional Issues in Computing and Information Technology COM 3621 (14) Advanced Algorithms COM 3629 (14) Database Design and Implementation MAT 3641 (14) Complex Analysis MAT 3643 (14) Graph Theory
Elective Modules – 32 credits:		Elective Modules - 20 credits		Elective Modules - 14 credits	
PHY 1521 (8) Mechanics PHY 1522 (8) Waves and Optics STA 1541 (8) Introduction to Statistics	MAT 1647 (8) Numerical Analysis I PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism STA 1641 (8) Elementary Statistical Method I – Introductory Interference	COM 2520 (10) Digital Design Techniques COM 2525 (10) Operating Systems COM 2526 (10) Human-Computer Interaction COM 2528 (10) Artificial Intelligence Fundamentals STA 2541 (10) Probability Theory	COM 2616 (10) Reasoning about programs COM 2628 (10) Contemporary Object-Oriented Concepts COM 2629 (10) Systems Analysis STA 2641 (10) Statistical Computing MAT 2647 (10) Numerical Analysis II	MAT 3547 (14) Partial Differential Equations COM 3521 (14) Distributed Operating Systems COM 3520 (14) Software Engineering I COM 3528 (14) Systems Design and Implementation	MAT 3642 (14) Rings and Fields MAT 3647 (14) Numerical Analysis III MAT 3648 (14) Mathematical Modelling II MAT 3649 (14) Geometry COM 3626 (14) Artificial Intelligence COM 3627 (14) Evaluation of Information Systems
Total credits = 132		Total credits = 120		Total credits = 112	

(G) BACHELOR OF SCIENCE IN MATHEMATICS AND APPLIED MATHEMATICS: BSCMAM

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematic Foundations I COM 1522 (8) Introduction to Computer Systems PHY 1521 (8) Mechanics STA 1542 (8) Introductory Probability COM 1721 (16) Object Oriented Programming ECS 1541 (10) English Communication Skills	MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundations II MAT 1646 (8) Mechanics I MAT 1647 (8) Numerical Analysis I ECS 1645 (10) English Communication Skills	MAT 2541 (10) Linear algebra MAT 2542 (10) Multivariable Calculus MAT 2548 (10) Mathematical Modelling I STA 2541 (10) Probability Theory	MAT 2641 (10) Real Analysis I MAT 2642 (10) Ordinary Differential Equations I MAT 2647 (10) Numerical Analysis II MAT 2648 (10) Vector Analysis STA 2641 (10) Statistical Computing	MAT 3541 (14) Real Analysis MAT 3547 (14) Partial Differential Equations MAT 3549 (14) Ordinary Differential Equations II	MAT 3641 (14) Complex Analysis MAT 3646 (14) Mechanics II MAT 3647 (14) Numerical Analysis III
Elective Modules – 16 credits:		Elective Modules - 30 credits:		Elective Modules - 42 credits	
COM 1524 (8) Fundamentals of Computer Systems PHY 1522 (8) Waves and Optics STA 1541 (8) Introduction to Statistics	PHY 1623 (8) Properties of Matter Thermal Physics PHY 1624 (8) Electricity and Magnetism STA 1641 (8) Elementary Statistical Methods I- Introductory Interference STA 1642 (8) Elementary Statistical Methods II – Correlation and Regression	COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals STA 2542 (10) Multiple Regression	COM 2616 (10) Reasoning about Programs COM 2624 (10) Algorithms and Data Structures COM 2629 (10) Systems Analysis STA 2642 (10) Sampling Techniques	STA 3541 (14) Statistical Interference MAT 3542 (14) Group Theory STA 3542 (14) Industrial Statistics	COM 3621 (14) Advanced Algorithms MAT 3642 (14) Rings and Fields MAT 3643 (14) Graph Theory MAT 3644 (14) Continuum Mechanics MAT 3648 (14) Mathematical Modelling II MAT 3649 (14) Geometry
Total credits = 124		Total credits = 120		Total credits = 126	

(H) BACHELOR OF SCIENCE IN FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS: BSCFMA

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundation I STA 1542 (8) Introductory Probability COM 1522 (8) Introduction to Computer Systems PHY 1521 (8) Mechanics COM 1721 (16) Object Oriented Programming ECS 1541 (10) English Communication Skills	MAT 1642 (8) Mathematics Foundations II MAT 1641 (8) Integral Calculus MAT 1646 (8) Mechanics I MAT 1647 (8) Numerical Analysis I ECS 1645 (10) English Communication Skills	MAT 2541 (10) Linear algebra MAT 2542 (10) Multivariable Calculus MAT 2548 (10) Mathematical Modelling I STA 2541 (10) Probability Distributions I	MAT 2641 (10) Real Analysis I MAT 2642 (10) Ordinary Differential Equations I MAT 2647 (10) Numerical Analysis II STA 2641 (10) Probability Distributions II	MAT 3541 (14) Real Analysis II MAT 3546 (14) Finance Mathematics MAT 3547 (14) Partial Differential Equations MAT 3549 (14) Ordinary Differential Equations II MAT 3556 (14) Statistical Finance Mathematics	MAT 3647 (14) Numerical Analysis III MAT 3656 (14) Advanced Finance Mathematics
Elective Modules – 16 credits		Elective Modules - 40 credits:		Elective Modules - 28 credits	
COM 1524 (8) Fundamentals of Computer Architecture ECO 1541 (12) Basic Economics STA 1541 (8) Introduction to Statistics	STA 1641 (8) Elementary Statistical Methods I ECO 1641 (12) Basic Macro-economics STA 1642 (8) Elementary Statistical Methods II – Correlation and Regression	COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals ECO 2541 (12) Intermediate Micro-economics STA 2542 (10) Multiple Regression	COM 2616 (10) Reasoning about Programs STA 2642 (10) Sampling Techniques ECO 2641 (12) Intermediate Macro-economics	STA 3541 (14) Statistical Inference	MAT 3641 (14) Complex Analysis MAT 3644 (14) Continuum Mechanics MAT 3648 (14) Mathematical Modelling II MAT 3649 (14) Geometry STA 3641 (14) Time Series Analysis
Total credits = 124		Total credits = 120		Total credits = 126	

(I) BACHELOR OF SCIENCE IN MATHEMATICS AND STATISTICS: BSCMST

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundations I COM 1721 (16) Object Oriented Programming PHY 1521 (8) Mechanics STA 1541 (8) Introduction to Statistics STA 1542 (8) Introductory Probability ECS 1541 (10) English Communication Skills	MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundations II STA 1641 (8) Elementary Statistical Method I – Introductory Interference STA 1642 (8) Elementary Statistical Methods II – Correlation and regression ECS 1645 (10) English Communication Skills	MAT 2541 (10) Linear algebra MAT 2542 (10) Multivariable Calculus STA 2541 (10) Probability Theory STA 2542 (10) Multiple Regression	MAT 2641 (10) Real Analysis I MAT 2642 (10) Ordinary Differential Equations I STA 2641 (10) Statistical Computing STA 2642 (10) Sampling Techniques	MAT 3541 (14) Real Analysis II STA 3541 (14) Introductory Inference	MAT 3641 (14) Complex Analysis STA 3642 (14) Experimental Design
Elective Modules – 16 credits:		Elective Modules - 40 credits:		Elective Modules – A total of 70 credits from either MAT or STA configured as: i) 28 credits from STA/42 credits from MAT or ii) 28 credits from MAT/42 credits from STA	
COM 1522 (8) Introduction to computer Systems COM 1524 (8) Fundamentals of computer Architecture PHY 1522 (8) Waves and Optics	MAT 1646 (8) Mechanics I MAT 1647 (8) Numerical Analysis I PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism	MAT 2548 (10) Mathematical Modelling I COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals	COM 2616 (10) Reasoning about Programs COM 2624 (10) Algorithms and Data Structures COM 2629 (10) Systems Analysis MAT 2647 (10) Numerical Analysis II MAT 2648 (10) Vector Analysis	STA 3542 (14) Industrial Statistics STA 3543 (14) Introduction to Research and Official Statistics MAT 3556 (14) Statistical Finance Mathematics MAT 3542 (14) Group Theory MAT 3546 (14) Finance Mathematics MAT 3547 (14) Partial Differential Equations	MAT 3648 (14) Mathematical Modelling II STA 3641 (14) Time Series Analysis STA 3643 (14) Multivariate Methods MAT 3656 (14) Advanced Financial Mathematics MAT 3647 (14) Numerical Analysis III
Total credits = 124		Total credits = 120		Total credits = 126	

(J) BACHELOR OF SCIENCE IN STATISTICS AND ECONOMICS: BSCSTE

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
ECO 1541 (12) Intermediate Microeconomics STA 1541 (8) Introduction to Statistics STA 1542 (8) Introductory Probability MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundations ECS 1541 (10) English Communication Skills	ECO 1641 (12) Basic Macro-economics STA 1641 (8) Elementary Statistical Method I – Introductory Interference STA 1642 (8) Elementary Statistical Methods II – Correlation and Regression MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundations II ECS 1645 (10) English Communication Skills	ECO 2541 (12) Intermediate Micro-economics STA 2541 (10) Probability Theory STA 2542 (10) Multiple Regression MAT 2541 (10) Linear Algebra MAT 2542 (10) Multivariable Calculus ECO 2543 (12) Environmental and Resource Economics	ECO 2641 (12) Intermediate Macro-economics STA 2641 (10) Statistical Computing STA 2642 (10) Sampling Techniques ECO 2642 (12) Applied Econometrics ECO 2645 (12) Financial Economics	ECO 3541 (12) International Trade and Finance ECO 3542 (12) Public Finance STA 3541 (14) Statistical Inference	ECO 3641 (12) The South African Economy ECO 3642 (12) The Economics of Africa STA 3642 (14) Experimental Design
Elective Modules – 24 credits				Elective Modules - 40 credits:	
COM 1522 (8) Intro to Computer Systems COM 1524 (8) Fundamentals of Computer Architecture COM 1721 (16) Object Oriented Programming	COM 1626 (8) Computer Technology			ECO 3544 (12) Industrial Economics Must take one of: STA 3542 (14) Industrial Statistics STA 3543 (14) Introduction to Research and Official Statistics	ECO 3643 (12) Money and Banking Must take one of: STA 3641 (14) Time Series Analysis STA 3643 (14) Multivariate Methods
Total credits = 132		Total credits = 120		Total credits = 116	

(K) BACHELOR OF SCIENCE IN MATHEMATICS AND PHYSICS: BSCMP

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
PHY 1521 (8) Mechanics PHY 1522 (8) Waves and Optics MAT 1541 (8) Differential Calculus CHE 1540 (16) General Chemistry MAT 1542 (8) Mathematics Foundations I COM 1721 (16) Object Oriented Programming ECS 1541 (10) English Communication Skills	PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundations II MAT 1647 (8) Numerical Analysis I ECS 1645 (10) English Communication Skills	PHY 2521 (10) Classical Mechanics PHY 2522 (10) Waves and Optics MAT 2541 (10) Linear Algebra MAT 2542 (10) Multivariable Calculus	PHY 2623 (10) Electrodynamics PHY 2624 (10) Modern Physics MAT 2641 (10) Complex Analysis MAT 2642 (10) Ordinary Differential Equations I MAT 2648 (10) Vector Analysis MAT 2647 (10) Numerical Analysis II	PHY 3521 (14) Atomic and Nuclear Physics PHY 3522 (14) Solid State Physics MAT 3541 (14) Real Analysis II MAT 3547 (14) Partial Differential Equations MAT 3549 (14) Ordinary Differential Equations II	PHY 3623 (14) Thermal and Statistical Physics PHY 3624 (14) Quantum Mechanics MAT 3641 (14) Complex Analysis
Elective Modules – 8 credits taken from:		Elective Modules – 20 credits taken from:		Elective Modules - 14 credits taken from:	
COM 1522 (8) Intro to Computer Systems COM 1524 (8) Fundamentals of Computer Architecture STA 1541 (8) Introduction to Statistics STA 1542 (8) Introductory Probability	STA 1641 (8) Elementary Statistical Methods I – Introductory Interference STA 1642 (8) Elementary Statistical Methods II – Correlation and Regression	MAT 2548 (10) Mathematical Modelling_I COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals STA 2541 (10) Probability Theory	CHE 2620 (10) Analytical Chemistry CHE 2623 (10) Physical Chemistry I STA 2641 (10) Statistical Computing		MAT 3644 (14) Continuum Mechanics MAT 3647 (14) Numerical Analysis III MAT 3648 (14) Mathematical Modelling II
Total credits = 122		Total credits = 120		Total credits = 126	

(L) BACHELOR OF SCIENCE IN PHYSICS AND CHEMISTRY: BSCPC

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry PHY 1521 (8) Mechanics PHY 1522 (8) Waves and Optics MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundation I ECS 1541 (10) English Communication Skills COM 0510 OR COM 0610 (4) Computer Literacy	CHE 1621 (8) Inorganic Chemistry I CHE 1622 (8) Organic Chemistry I PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundation II ECS 1645 (10) English Communication Skills	CHE 2521 (10) Inorganic Chemistry II CHE 2522 (10) Organic Chemistry II PHY 2521 (10) Classical Mechanics PHY 2522 (10) Waves and Optics MAT 2541 (10) Linear Algebra MAT 2542 (10) Multivariable Calculus	CHE 2620 (10) Analytical Chemistry CHE 2623 (10) Physical Chemistry I PHY 2623 (10) Electrodynamics PHY 2624 (10) Modern Physics	CHE 3523 (14) Physical Chemistry II PHY 3521 (14) Atomic and Nuclear Physics PHY 3522 (14) Solid State Physics CHE 3520 (14) Analytical Chemistry: Instrumental Techniques	CHE 3621 (14) Inorganic Chemistry III CHE 3622 (14) Organic Chemistry III PHY 3623 (14) Thermal and Statistical Physics PHY 3624 (14) Quantum Mechanics
Elective Modules – 16 credits taken from:		Elective Modules – 20 credits taken from:			
BIO 1541 (16) Diversity of Life BIO 1542 (16) Cell Biology I COM 1721 (16) Object Oriented Programming STA 1541 (8) Introduction to Statistics	BIO 1643 (16) Ecology, Adaptation and Evolution STA 1641 (8) Elementary Statistical Method I – Introductory Interference	COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals	COM 2629 (10) Systems Analysis MAT 2641 (10) Real Analysis I MAT 2642 (10) Ordinary Differential Equations I		
Total credits = 136		Total credits = 120		Total credits = 112	

(M) BACHELOR OF SCIENCE IN CHEMISTRY AND APPLIED CHEMISTRY: BSCCAC

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundations I PHY 1521 (8) Mechanics PHY 1522 (8) Waves and Optics ECS 1541 (10) English Communication Skills COM 0510 OR COM 0610 (4) Computer Literacy	CHE 1621 (8) Inorganic Chemistry I CHE 1622 (8) Organic Chemistry I MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundations II PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism ECS 1645 (10) English Communication Skills	CHE 2521 (10) Inorganic Chemistry II CHE 2522 (10) Organic Chemistry II CHE 2524 (10) Industrial Chemistry CHE 2525 (10) Applied Organic Chemistry PHY 2522 (10) Waves and Optics	CHE 2620 (10) Analytical Chemistry CHE 2623 (10) Physical Chemistry I CHE 2626 (10) Introductory Chemometrics CHE 2629 (10) Environmental Chemistry Fundamentals PHY 2624 (10) Relativity and Quantum Physics	CHE 3520 (14) Analytical Chemistry: Instrumental Techniques CHE 3523 (14) Physical Chemistry II CHE 3524 (14) Applied Chemical Analysis and Food Science CHE 3525 (14) Capita Selecta in Applied Chemistry	CHE 3621 (14) Inorganic Chemistry III CHE 3622 (14) Organic Chemistry III CHE 3626 (14) Process Technology CHE 3627 (14) Chemistry of Materials
Elective Modules – 16 credits		Elective Modules – 20 credits:			
BIO 1541 (16) Diversity of Life BIO 1542 (16) Cell Biology I COM 1721 (16) Object Oriented Programming STA 1541 (8) Introduction to Statistics COM 1524 (8) Fundamentals of Computer Architecture	BIO 1643 (16) Ecology, Adaptation and Evolution STA 1641 (8) Elementary Statistical Method I – Introductory Interference	COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals MAT 2541 (10) Linear Algebra MAT 2542 (10) Multivariable Calculus MBY 2521 (10) Bacteriology PHY2521 (10) Classical Mechanics	COM 2629 (10) Systems Analysis MAT 2641 (10) Real Analysis MAT 2642 (10) Ordinary Differential Equations PHY 2623 (10) Electrodynamics MBY 2623 (10) Environmental Microbiology		
Total credits = 136		Total credits = 120		Total credits = 112	

(N) BACHELOR OF SCIENCE IN CHEMISTRY AND MATHEMATICS: BSCCM

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundation I PHY 1521 (8) Mechanics PHY 1522 (8) Waves and Optics ECS1541 (10) English Communication Skills COM 0510 OR COM 0610 (4) Computer Literacy	CHE 1621 (8) Inorganic Chemistry I CHE 1622 (8) Organic Chemistry I MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundation II PHY 1623 (8) Properties of Matter, Thermal Physics PHY 1624 (8) Electricity and Magnetism ECS 1645 (10) English Communication Skills	CHE 2521 (10) Inorganic Chemistry II CHE 2522 (10) Organic Chemistry II MAT 2541 (10) Linear Algebra MAT 2542 (10) Multivariable Calculus	CHE 2620 (10) Analytical Chemistry CHE 2623 (10) Physical Chemistry I MAT 2641 (10) Real Analysis I MAT 2642 (10) Ordinary Differential Equations I	CHE 3520 (14) Analytical Chemistry: Instrumental Techniques CHE 3523 (14) Physical Chemistry II MAT 3541 (14) Real Analysis II MAT 3542 (14) Group Theory	CHE 3621 (14) Inorganic Chemistry III CHE 3622 (14) Organic Chemistry III MAT 3641 (14) Complex Analysis MAT 3648 (14) Mathematical Modelling II
Elective Modules – 16 credits:		Elective Modules – 40 credits		Elective Modules - 14 credits	
BIO 1541 (16) Diversity of Life BIO 1542 (16) Cell Biology I COM 1721 (16) Object Oriented Programming STA 1541 (8) Introduction to Statistics	STA 1641 (8) Elementary Statistical Method I – Introductory Interference MAT 1647 (8) Numerical Analysis I BIO 1643 (16) Ecology, Adaptation and Evolution	COM 2523 (10) Imperative Programming COM 2528 (10) Artificial Intelligence Fundamentals COM 2529 (10) Database Fundamentals PHY 2521 (10) Classical Mechanics PHY 2522 (10) Waves and Optics	COM 2616 (10) Reasoning about Programs COM 2629 (10) Systems Analysis PHY 2623 (10) Electrodynamics PHY 2624 (10) Modern Physics MAT 2647 (10) Numerical Analysis II	MAT 3547 (14) Partial Differential Equations	MAT 3642 (14) Rings and Fields MAT 3647 (14) Numerical Analysis III
Total credits = 126		Total credits = 120		Total credits = 126	

(O) BACHELOR OF SCIENCE IN CHEMISTRY AND BIOCHEMISTRY: BSCCHB

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
CHE 1540 (16) General Chemistry MAT 1541 (8) Differential Calculus MAT 1542 (8) Mathematics Foundation I BIO 1541 (16) Diversity of Life BIO 1542 (16) Cell Biology I PHY 1525 (8) Physics for Natural Sciences I ECS 1541 (10) English Communication Skills COM 0510 OR COM 0610 (4) Computer Literacy	CHE 1621 (8) Inorganic Chemistry I CHE 1622 (8) Organic Chemistry I MAT 1641 (8) Integral Calculus MAT 1642 (8) Mathematics Foundation II PHY 1625 (8) Physics for Natural Sciences II ECS 1645 (10) English Communication Skills	BCM 2521 (10) Structural and functional Biochemistry I BCM 2522 (10) Biochemical and Molecular Techniques CHE 2521 (10) Inorganic Chemistry II CHE 2522 (10) Organic Chemistry II MBY 2521 (10) Bacteriology MBY 2522 (10) Immunology	BCM 2621 (10) Structural and Functional Biochemistry II BCM 2622 (10) Metabolism CHE 2620 (10) Analytical Chemistry II CHE 2623 (10) Physical Chemistry I MBY 2623 (10) Environmental Microbiology MBY 2624 (10) Virology	CHE 3520 (14) Analytical Chemistry: Instrumental Techniques CHE 3523 (14) Physical Chemistry II BCM 3521 (16) Protein Biochemistry BCM 3522 (16) Advanced Molecular Techniques	CHE 3621 (14) Inorganic Chemistry III CHE 3622 (14) Organic Chemistry III BCM 3621 (16) Enzymology and Enzyme Biotechnology BCM 3622 (16) Gene Expression, Protein Synthesis and Bioinformatics
Total credits = 136		Total credits = 120		Total credits = 120	

4.9 POSTGRADUATE DEGREES:**4.9.1 BIOCHEMISTRY DEPARTMENT:****BSc HONS PROGRAMME:**

Pre-requisites: A BSc degree in Biochemistry. Prospective candidate must attain a minimum average mark of 60% from Biochemistry modules taken during the final year of the BSc degree. Prospective candidate will further be subjected to a final selection test which serves to assess their preparedness for the Honours course.

BCM 5701: Research Methods and Seminars

BCM 5523: Genomics, Proteomics and Bioinformatics

BCM 5525: Applied Biochemistry and Biotechnology

BCM 5622: Research Techniques

BCM 5623: Physiological Biochemistry and Cell Biology

BCM 5624: Protein Folding and Advanced Enzyme Kinetics

BCM 5700: Research Project and Report

MASTERS PROGRAMME

BCM 6000 *Pre-requisites: BSc (Hons) in Biochemistry or equivalent qualification.*

DOCTORAL PROGRAMME

BCM 7000 *Pre-requisites: MSc in Biochemistry or equivalent qualification.*

4.9.2 BOTANY DEPARTMENT:**BSc HONS PROGRAMME:**

Programme curricula: Each programme consists of six modules with a minimum total credit value of 120. In order to qualify for the BSc Honours degree a candidate must pass a minimum of **SIX** modules listed in the programme.

The core and optional modules offered in an academic year may vary depending on the staffing situation in the departments. Students are advised to consult the head of the department regarding the modules offered in a particular year.

BSc (Honours) in Botany (BSCHBT)	
BOT 5501 (16) Research Methodology BOT 5702 (42) Research Project	
Candidates must select a minimum of four modules from the following selection <u>which must include</u> two Botany (BOT) modules:	
BOT 5504 (16) Applied Plant Ecology	BOT 5505 (16) Applied Plant Ecophysiology
BOT 5606 (16) Plant Physiology	BOT 5608 (16) Plant Systematics
BIO 5510 (16) Freshwater Ecology	BIO 5511 (16) Conservation Biology
BOT 5612 (16) Applied Ethnobotany	BCM 5521 (15) Research Methods and Seminars
BCM 5622 (15) Research Techniques	MBY 5604 (15) The role of Microorganisms in Industrial Processes
MBY 5605 (15) The Role of Micro-organisms in the environment	ZOO 5607 (16) Molecular Ecology

MASTERS PROGRAMME

BIO 6000/BOT 6000: Research Project

Pre-requisites: Appropriate BSc (Honours) degree or SENATE conferred equivalent qualifications/ status.

DOCTORAL PROGRAMME

BIO 7000/BOT 7000: Research Project

Pre-requisites: Appropriate MSc degree or a SENATE conferred equivalent qualification/status.

4.9.3 CHEMISTRY DEPARTMENT:

BSc HONS PROGRAMME:

This programme is designed for students who intend to graduate as professional chemists. The module content offered in a particular year or semester may vary according to the availability of staff. This programme will consist of seven modules with the total credit value of 120

Students must accumulate all credits within 2 years of full-time study. **The learning programme consists of CHE 5530, CHE 5531, CHE 5532, CHE 5533 modules to be taken during the first semester and CHE 5630, CHE 5631, CHE 5632, CHE 5633 modules to be taken during the second semester, plus research project CHE 5700. A student who fails one module in the first semester may be allowed to replace the failed module by an additional, equivalent 2nd semester module in consultation with the HOD.**

CHE 5530: Analytical Chemistry

CHE 5531: Inorganic Chemistry

CHE 5532: Organic Chemistry

CHE 5533: Physical Chemistry

CHE 5538: Analytical and Inorganic Chemistry of Natural Products

CHE 5630: *Capita Selecta*: Analytical Chemistry

CHE 5631: *Capita Selecta*: Inorganic Chemistry

CHE 5632: *Capita Selecta*: Organic Chemistry

CHE 5633: *Capita Selecta*: Physical Chemistry

CHE 5638: Natural Products Chemistry

CHE 5700: Research project

MASTERS PROGRAMME

CHE 6000: Research project

Pre-requisite: Satisfactory completion of BSc (Hons) in Chemistry or an equivalent qualification.

DOCTORAL PROGRAMME

CHE 7000: Research project

Pre-requisite: Satisfactory completion of MSc in Chemistry or an equivalent qualification.

**4.9.4 COMPUTER SCIENCES DEPARTMENT:
BSc HONS PROGRAMME:**

Semester 1	Semester 2
COM 5531 (10) Introduction to Grid Computing	COM 5631 (10) Introduction to Wireless and Ad hoc Networking
COM 5532 (10) Software Engineering Methodology	COM 5632 (10) Forensic Computing
COM 5533 (10) Information Systems Security	COM 5633 (10) Compiler Principles
COM 5534 (10) Scientific Research Method	COM 5634 (10) Guided Reading
COM5535 (10) Guided Reading	
COM5700 (30) BSc Honours Research Project	
Total Credits = 120	

**4.9.5 MATHEMATICS AND APPLIED MATHEMATICS DEPARTMENT:
BSc HONS PROGRAMME:**

In order to be awarded the BSc Honours degree in Mathematics or Applied Mathematics, a candidate must have passed six prescribed modules and MAT 5700.

BSc Honours Packages

Package 1 (Applied Mathematics) - NQF level 8		Package 2 (Pure Mathematics) - NQF level 8		Package 3 (Pure Mathematics) – NQF level 8	
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2
MAT 5530 Numerical Solution of ODE MAT 5549 Partial differential Equations	MAT 5630 Numerical Solution for Partial Differential Equations	MAT 5534 Algebra I MAT 5537 Measure and Integration Theory	MAT 5632 General Topology MAT 5636 Algebra II	MAT 5538 Number Theory I MAT 5544 Combinatorics I	MAT 5650 Number Theory II MAT 5644 Combinatorics II
MAT 5701 Project		MAT 5701 Project		MAT 5701 Project	
Three of the following:		Two of the following:		Two of the following:	
MAT 5533 Calculus of Variations MAT 5540 Matrix Analysis MAT 5537 Measure and Integration Theory MAT 5541 Stochastic Differential Equations MAT 5543 Fluid Mechanics MAT 5532 Functional Analysis STA 5541 Advanced Probability Theory	MAT 5646 Topics in stability and Optimization MAT 5633 Integral Equations MAT 5641 Financial Mathematics STA 5644 Stochastic processes MAT 5653 Control Theory MAT 5643 Graph Theory	MAT 5540 Matrix Analysis MAT 5536 Complex Analysis MAT 5532 Functional Analysis MAT 5538 Number Theory I MAT 5533 Calculus Of Variations	MAT 5650 Number Theory II	MAT 5536 Complex Analysis MAT 5534 Algebra I MAT 5551 Theory of Computer Algebra MAT 5552 Partition Theory I MAT5540 Matrix Analysis	MAT 5643 Graph Theory MAT 5652 Partition Theory II
Total credits = 150		Total credits = 150		Total credits = 150	

MASTERS PROGRAMME:

MAT 6000: Research project

Pre-requisites: Appropriate BSc Honours degree in Mathematics or Applied Mathematics

In order to be awarded the MSc degree by research, in Mathematics or Applied Mathematics, a candidate must have completed satisfactorily the dissertation.

DOCTORAL PROGRAMME:

MAT 7000: Research Project

Pre-requisites: An appropriate MSc. Degree in Mathematics/Applied Mathematics or its equivalent.

4.9.6 **MICROBIOLOGY DEPARTMENT:**

BSc HONS PROGRAMME:

Prerequisites:

Candidates for the BSc (Honours) programme, should have completed the undergraduate programme with an average of 60% at the third year of the undergraduate programme. Candidates will undergo a selection interview.

MBY 5502: Advanced Immunological Concepts and Techniques

MBY 5503: The Role of Microorganisms in Disease

MBY 5604: The Role of Microorganisms in Industrial Processes

MBY 5605: The Role of Microorganisms in the Environment

MBY 5700: Research Project and Report

MBY 5701: Advanced Research Methodology and Seminars

MASTERS PROGRAMME:

MBY 6000: Research Project and Seminars

Pre-requisites: Appropriate BSc Honours degree

DOCTORAL PROGRAMME:

MBY 7000: Research Project and Seminars

Pre-requisites: Appropriate MSc degree.

4.9.7 **PHYSICS DEPARTMENT:**

BSc HONS PROGRAMME:

In order to qualify for the degree, a student must pass at least ***eight modules***. The core modules and optional modules offered in an academic year vary depending on the staffing situation in the department. Students are advised to consult the head of department about the modules offered in a particular year.

PHY 5521: Classical Mechanics (core)

PHY 5522: Quantum Mechanics I (core)

PHY 5523: Solid State Physics I (core)

PHY 5524: Renewable Energy

PHY 5525: Mathematical Methods of Physics

PHY5526: Laser Physics I

PHY 5527: Electronics

PHY 5621: Electrodynamics (core)

PHY 5622: Statistical Mechanics (core)

PHY 5623: Project (core)

PHY 5624: Solid State Physics II

PHY 5625: Quantum Mechanics II

PHY5626: Laser Physics II

PHY 5627: Nuclear and Particle Physics

MASTERS PROGRAMME:

PHY 6000: Research Project

Pre-requisites: Satisfactory completion of BSc (Hons) in Physics or any other equivalent qualification.

DOCTORAL PROGRAMME:

PHY 7000: Research Project

Pre-requisites: Satisfactory completion of MSc in Physics or any other equivalent qualification.

4.9.8 **STATISTICS DEPARTMENT:**

BSc HONS PROGRAMME:

For the BSc. Honours degree in Statistics, a student must pass at least five modules and STA 5700

ECO 5524 For students who are continuing with economics

ECO 5625 For students who are continuing with economics

STA 5541: Probability Theory

STA 5542: Multivariate Statistical Analysis

STA 5543: Statistical Quality Control

STA 5544: Sampling Survey and Research Methods

STA 5545: Generalised Linear Models

STA 5641: Demographic Methods

STA 5642: Time Series Analysis

STA 5643: Analysis of Discrete Data
STA 5644: Stochastic Processes
STA 5700: BSc HONOURS PROJECT
MASTERS PROGRAMME:
STA 6000: MSc Research Project.
Pre-requisites: Appropriate BSc Honours degree.

DOCTORAL PROGRAMME:
STA 7000: PhD Research.
Pre-requisites: Appropriate MSc degree.

4.9.9 ZOOLOGY DEPARTMENT:
BSc HONS PROGRAMME:

BSc (Honours) in Zoology (BSCHZO)
Core Modules
ZOO 5501 (16) Research Methodology ZOO 5700 (42) Research Project ZOO 5607 (16) Molecular Ecology ZOO 5609 (16) Applied Animal Ecophysiology BIO 5511 (16) Conservation Biology III
Elective Modules
Candidate must register one of the following: ZOO 5606 (16) Invertebrate Diversity and Conservation BIO 5510 (16) Freshwater Ecology

MASTERS PROGRAMME:
ZOO 6000: Research Project
Pre-requisites: Appropriate BSc (Honours) degree or a SENATE conferred equivalent qualification/status.

DOCTORAL PROGRAMME:
ZOO 7000: Research Project
Pre-requisites: Appropriate MSc degree or a SENATE conferred equivalent qualification/status.

SECTION 5:

THIS SECTION IS FOR ALL STUDENTS WHO ARE WERE REGISTERED FROM 2020 ON NEW QUALIFICATION/DEGREE CODES FOR UNDERGRADUATE AND POSTGRADUATE STUDIES

GENERAL RULES IN THE SCHOOL OF MATHEMATICAL AND NATURAL SCIENCES

1. SERVICE COURSES:

Students from other schools intending to register for modules in the School of Mathematical and Natural Sciences will only be permitted in accordance with a predetermined number of students for the relevant department and will only be permitted to register for modules for which they fulfil the pre-requisites of the modules.

2. MODULES FOR NON-DEGREE PURPOSES:

- (a) Students wishing to enroll for such modules must consult the appropriate Head of the Department and the Dean of the School.
- (b) A written application to this effect must be provided by the student and given to the Schools' Administrator who will confirm if the student qualifies for the additional modules.
- (c) The application letter will then be approved/not approved by the Dean and send to RAC for final decision.

3. REGISTRATION AND CHANGE OF REGISTRATION:

- (a) Students will only be allowed to register or change registration for modules if a full academic record, which includes marks for each module, accompanies the registration form.
- (b) Students will only be allowed to register for a module if the Pre-requisite/s has/have been satisfied except otherwise waived by the Head of Department after consultation and approval by the Dean.
- (c) Candidates may be admitted as students in the School based on relevant prior learning. Such candidates will be subjected to an evaluation by the School's Assessment and Recognition of Prior Learning (ARPL) committee. Final admission will only be granted by SENATE.

**COMPOSITION OF THE CURRICULUM FOR ALL OFFERED QUALIFICATIONS INCLUDING NQF LEVEL
AND THE CREDITS FOR MODULES**

DIPLOMA IN FRESHWATER TECHNOLOGY

1. ADMISSION REQUIREMENTS FOR DIPLOMA IN FRESHWATER TECHNOLOGY:

A national Senior Certificate with a minimum of 30% in the language of learning coupled with an achievement rating of 3 (Moderate Achievement, 40 – 49%) or better in four of the recognized 20-credit NSC subjects and a 4 in either Biology, Agricultural Sciences, Physical Sciences or Geography.

2. RULES FOR PROGRESSION:

- (a) The Diploma in Freshwater Technology is a three year full time qualification.
- (b) To obtain the Diploma in Freshwater Technology from the School, students must have earned at least 360 credits including all core and fundamental modules.
- (c) To complete the three-year diploma, students are required to enroll for at least 120 credits per year.
- (d) For a student to progress to the third-year level, a student must have passed **ALL** first- and second-year modules.
- (e) Assessment in the project-based modules of the second and third year of the Diploma in Freshwater Technology (FWT 2601, FWT 2602, FWT 3601 and FWT 3602) will not include a formal exam but students will be assessed through project portfolios that **have to be submitted** for assessment. In addition, the third-year module assessment will include the submission and assessment of a report completed by the appointed supervisor of the institution where the candidate had completed an industrial placement that forms part of the Work Integrated Learning (WIL) component of the diploma.
- (f) Modules are offered as block teaching that consist of six teaching blocks of 9 days in each year of study. In addition, two block practical work will be included in the first year of study. The first block is in January prior to the start of graduate lectures.

3. RE-REGISTRATION AND DEFERMENT OF STUDIES:

- (a) For the duration of the diploma, a student must register each year by the stipulated date.
- (b) Registration each year is subject to the recommendation of the Head of Department and may be rejected in any year on grounds of unsatisfactory progress. University rules do apply for all qualifications and students will not be allowed to take more than stipulated time allowed by University rules to obtain a qualification.
- (c) Students wishing to defer studies at any stage **must** submit a motivated application beforehand. If granted, such deferment will be for a period of **ONE** year only, after which a further application must be submitted. Deferment will, **at most**, be granted twice.

4. **DIPLOMA: DIPLOMA IN FRESHWATER TECHNOLOGY [CODE: MNDDFT]**

YEAR	SEMESTER	COMPULSORY MODULES	CREDITS
Year 1	1	BIO 1143 (16): Diversity of Life for diploma students BIO 1144 (16): Cell Biology for diploma students FWT 1141 (16): Introductory biometry HWR 1141 (10): Introductory Hydrology and Meteorology	120
	2	BIO 1245 (16): Ecology, Adaptation and Evolution for diploma students FWT 1241 (16): Introduction to Fluvial Geomorphology and the Physico-chemical aspects of Water FWT 1201 (28): An Introduction into Research Methodology and Project Planning and Project Management COM 0210 (4): Computer Literacy	
Year 2	1	FWT 2131 (20): Basic Freshwater Ecology FWT 2132 (20): Freshwater Biology FWT 2133 (20): Identification of Freshwater Organisms	120
	2	FWT 2201 (30): Aquatic Habitat Delineation and Classification (Project) FWT 2202 (30): Collection and Identification of Freshwater Organisms (Project)	
Year 3	1	FWT 3131 (20): Sampling Technology FWT 3132 (20): Introduction to Water Resource Management FWT 3133 (20): Biomonitoring Technology	120
	2	FWT 3201 (30): Sampling in Freshwater Ecosystems (Project) FWT 3202 (30): Biomonitoring of Freshwater Ecosystems (Project)	

PLEASE NOTE: THERE ARE NO ELECTIVE MODULES IN THIS DIPLOMA

FIRST YEAR MODULES:

BIO 1143: Diversity of Life for Diploma Students [credits 16]

*Pre-requisites: An achievement rating of 4 (NSC) **OR** E (HG) **OR** D (SG) in either matric Biology or Physical Science or Agricultural Science.*

This module will focus on:

- Origin of microbiology: Introduction to bacteria, fungi, protista and viruses.
- Control of microorganisms: Immunity and infection.
- Taxonomic classification concepts and rules.
- Introduction to microscopy.
- Survey of the diversity of organism groups.
- Review of the animal kingdom.
- Review of the plant kingdom.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%).
- Examination: The examination for this module consists of 1 three-hour paper.

BIO 1144: Cell Biology for Diploma Students [credits 16]

Pre-requisite: An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

This module will focus on:

- a) Organic chemistry: The scope of biochemistry, Organic compounds of importance to the living system (The structure, functional groups, stereo-chemistry and characteristics of the carbohydrates, lipids, proteins and nucleic acids), The chemical-physical principles of biochemical bonds, The matrix of life: weak interactions in an aqueous solution, The energetics of life.
- b) Cytology: The history of cell biology, the cell theory, Membrane biology, the structure and feature of eukaryotic cells, Techniques used in cytology, Prokaryotic cells.
- c) Genetics: DNA replication, Transcription and translation, introductory principles of mitosis and meiosis, Chromosome variation, sex determination and the mechanism of sex related inheritance, Mendelian genetics.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%).
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 1141: Introductory Biometry [credits 16]

Pre-requisites: An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

This module will focus on:

- (a) Introduction to the basis of Biometry and Statistics for biology students.
- (b) Introduction to Descriptive statistics, Inferential statistics, Comparative statistics, Association statistics, and frequency statistics, and Probability and Probability Distributions.
- (c) Introduction to Forecasting and Time-Series Analysis and Estimation.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%).
- b) Examination: The examination for this module consists of 1 three-hour paper.

HWR 1141: Introductory Hydrology and Meteorology [credits 10]

Pre-requisite: An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

This module will focus on:

Definition and scope of hydrology as an area of study; the hydrologic cycle; energy transformations and the water budget equation; the catchment and human interference; precipitation as a process; types of precipitation; artificially induced precipitation; measurement of precipitation; effective depth of precipitation; potential and actual evapo-transpiration and their measurements; factors influencing evaporation; increased water supplies through reduced evaporation; the runoff process; measurement of stream flow; the infiltration process; soil moisture, moisture storage and measurement; factors and elements of climate; impact of people on climate and the influence of climate on historical events; the atmosphere, its structure and composition; radiation, temperature, pressure, wind, humidity, precipitation, clouds, air masses and fronts; measurements; weather maps.

BIO 1245: Ecology, Adaptation and Evolution for Diploma Students [credits 16]

Pre-requisites: An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

This module will focus on:

- a) Ecosystems. Energy flow and nutrient cycling.
- b) Analysis of communities, ecological hierarchy and sampling methodology.
- c) Species area relationship.
- d) Latitudinal gradient. Common and rare species.
- e) Interactive networks and food webs. Niches and competition. Predation and disturbance.
- f) Demography. Dispersal. Darwinism.
- g) Microevolution and Macroevolution.
- h) Adaptation.
- i) History of life on earth.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 1241: Introduction to Fluvial Geomorphology and the Physico-Chemical aspects of Water [credits 16]

Pre-requisite: An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

This module will focus on:

- a) Fluvial geomorphology: The concept of fluvial geomorphology. Linking the river channel to the catchment and the concept of landscape connectivity. The geomorphological classification and zonation of rivers. Drivers of rivers systems.
- b) Water: The water molecule, the hydrological cycle, acids bases and buffers, gasses dissolved in water, the electrical conductivity of water, light, temperature, sediments, turbidity, suspended solids, dissolved substances and nutrients in water.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (80%) derived from formal tests and an assignment mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 1201: An introduction into Research Methodology, Project Planning and Project Management [credits 28]

Pre-requisites: An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

This module will focus on:

- a) The "Scientific Method" which *inter alia* includes problem identification, the setting of a research question, drawing up a hypothesis and defining the aims and objectives.
- b) The project planning will include time and resource management. As part of project management component, the student will be introduced to management concepts, approaches and applications.
- c) The theory will include case studies, and this will be backed up by the students planning research projects regarding hypothetical problems.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (80%) derived from formal tests and an assignment mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

COM 0210: Computer Literacy [credits 4]

Computer architecture and the human-computer interface. Operating systems and programming languages. Basic drawing and word-processing, Using statistical and introduction to database management systems. Networks: communication and information resources on the Internet.

SECOND YEAR MODULES:

FWT 2131: Basic Freshwater Ecology [credits 20]

Pre-requisites: FWT 1141, FWT 1241, BIO 1143, BIO 1144, BIO 1245, HWR 1141

This module will focus on:

- a) Defining limnology and introducing the relevant ecological concepts. Classification of water bodies.
- b) General introduction to Wetlands (definition, classification, functioning), Lentic water bodies (definition, origin, classification functioning, and zonation) and Lotic water bodies (the river continuum concept, zoning, reaches and habitats).
- c) The physico-chemical character of water bodies. Primary and secondary production and the cycling of nutrients and energy.
- d) The impacts of damming, alien invasive organisms, pollution and eutrophication on river systems.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 2132: Freshwater Biology [credits 20]

Pre-requisites: BIO 1143, BIO 1144, BIO 1245, FWT1141, FWT 1241, HWR 1141

This module will focus on:

- a) Bacteria in freshwater. Freshwater algae and their role in the aquatic environment.
- b) The structure and function of plant and animal communities of rivers and wetlands.
- c) Review of the biology of the crustaceans, aquatic insects and freshwater fish.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 2133: Identification of Freshwater Organisms [credits 20]

Pre-requisites: BIO 1143, BIO 1144, BIO 1245, FWT1141, FWT 1241, HWR 1141

This module will focus on:

- a) The role played by morphological characteristics in the identification of organisms.
- b) The use of keys and identification guides.
- c) The identification of microscopic organisms (algae and diatoms).
- d) The identification of aquatic macroinvertebrates.
- e) The identification of aquatic macrophytes with an emphasis on aquatic weeds and alien invasive organisms.
- f) The identification of freshwater fish.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 2201: Aquatic Habitat Delineation and Classification (Project) [credits 30]

Pre-requisites: COM 0210, FWT 1201, FWT 2131, FWT2132, FWT 2133

This module will focus on:

- a) Identifying, delineate and classify wetlands.
- b) Identify and delineate habitat types in lotic systems and their related riparian zones.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark is obtained from the portfolio which contains the project proposals for two practical projects.
- b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the reports on two projects.

FWT 2202: Collection and Identification of Freshwater Organisms (Project) [credits 30]

Pre-requisites: COM 0210, FWT 1201, FWT 2131, FWT 2132, FWT 2133

This module will focus on:

- a) applying the collection/sampling and identification methods to identified wetlands.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark is obtained from the portfolio which contains the project proposals for two practical projects.
- b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the reports on two projects.

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before successfully completing all first- and second-year modules.

FWT 3131: Sampling Technology [credits 20]

Pre-requisites: FWT 2131, FWT 2132, FWT 2133

This module will focus on:

- a) For water quality determination: The purpose of water quality, monitoring. Sampling design. Measurement of the physical properties of water (DO, temperature, pH, conductivity, Turbidity, Light penetration).
- b) Sampling techniques of water sediment and fish for chemical analyses (major inorganic ions, heavy and trace metals, organic compounds).
- c) Sampling techniques for biological and bacteriological analyses.
- d) Sampling techniques for toxicity testing. Early detection and eradication of alien invasive plants.
- e) Introduction and practical use of relevant apparatus.
- f) Sampling and preservation techniques of biological samples (algae/diatoms/plants/insects/fish).
- g) The role of voucher specimens and other specimens for future reference.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 3132: Introduction to Water Resource Management [credits 20]

Pre-requisites: FWT 2131, FWT 2132, FWT 2133

This module will focus on:

- a) Basic principles of management and sustainable development.
- b) Sustainable development and management of water resources.
- c) The principles and application of water and sewage treatment.
- d) Control of invasive plants and animals.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests and an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 3133: Biomonitoring Technology [credits 20]

Pre-requisites: FWT 2131, FWT 2132, FWT 2133

This module will focus on:

- a) Reasons for biomonitoring. The history and development of biomonitoring.
- b) EcoStatus and Ecological Reserve determination.
- c) Planning of a biomonitoring exercise.
- d) Introduction to indices currently in use in South Africa (FRAI, VEGRAI, IHI, MIRAI and SASS).

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
- b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 3201: Sampling in Freshwater Ecosystems (Project) [credits 30]

Pre-requisites: FWT 2201, FWT 2202, FWT 3131, FWT 3132, FWT 3133

This module will focus on:

- a) Students will be assigned a river/wetland for which they have to set up a sampling protocol (for repeated sampling for four weeks).
- b) Submission of a project proposal.
- c) Give a presentation of the project proposal.
- d) Perform in situ physico-chemical determinations, collect samples for major inorganic ion analyses
- e) Write a report on the in-situ findings.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- a) Semester mark: The semester mark is obtained from
 - The portfolio which contains the project proposals (70%)
 - Evaluation of an oral presentation of project plan (10%)
 - Report from WIL project mentor (20%)
- b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the project reports.

FWT 3202: Biomonitoring of Freshwater Ecosystems (Project) [credits 30]

Pre-requisites: FWT 2201, FWT 2202, FWT 3131, FWT 3132, FWT 3133

This module will focus on:

- a) Students will be assigned a river for which they have to assess the Eco-status using currently applicable biomonitoring indices such as IHI and SASS5.
- b) Submission of a project proposal.
- c) Give a presentation of the project proposal.
- d) Apply the relevant indices.
- e) Write a report on the findings.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

- (a) Semester mark: The semester mark is obtained from
 - The portfolio which contains the project proposals (70%)
 - Evaluation of an oral presentation of project results (10%)
 - Report from industrial partner mentor (20%)
- (b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the project reports

BACHELOR'S IN SCIENCE: EXTENDED DEGREE

1. **ADMISSION REQUIREMENTS FOR THE EXTENDED BSc PROGRAMME:**

- a) Candidates with a National Senior Certificate (NSC) stipulating admission to a bachelor's degree, and an achievement rating of **3** (40-49%) or better in matric English, Mathematics, Physical Science, Life Sciences [and any other related subject as judged by the HOD of responsible departments and approved by the Dean of the School of Mathematical and Natural Sciences], may be admitted to the Extended BSc degree Programme.
- b) Approved qualifications for which students will be registered in the Extended Degree:
BSc (Bachelor of Science) with specific approved streams
BENVSC (Environmental Sciences)
BENVM (Environmental Sciences)
BSCAGR (Agriculture)
- c) The following streams are available within the extended BSc degree:
- | | |
|---|--------------|
| • Extended BSc in BIOCHEMISTRY AND MICROBIOLOGY | CODE: MNEBSA |
| • Extended BSc in BIOCHEMISTRY AND BIOLOGY | CODE: MNEBSD |
| • Extended BSc in MICROBIOLOGY AND BOTANY | CODE: MNEBSE |
| • Extended BSc in MATHEMATICS AND APPLIED MATHEMATICS | CODE: MNEBSF |
| • Extended BSc in FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS | CODE: MNEBSG |
| • Extended BSc in MATHEMATICS AND PHYSICS | CODE: MNEBSH |
| • Extended BSc in MATHEMATICS AND STATISTICS | CODE: MNEBSI |
| • Extended BSc in PHYSICS AND CHEMISTRY | CODE: MNEBSJ |
| • Extended BSc in CHEMISTRY AND MATHEMATICS | CODE: MNEBSK |
| • Extended BSc in CHEMISTRY AND BIOCHEMISTRY | CODE: MNEBSL |
| • Extended BSc in CHEMISTRY AND APPLIED CHEMISTRY | CODE: MNEBSN |
| • Extended BSc in BOTANY AND ZOOLOGY | CODE: MNEBSO |
| • Extended BSc in COMPUTER SCIENCE | CODE: MNEBSP |
| • Extended BSc in COMPUTER SCIENCE AND MATHEMATICS | CODE: MNEBSQ |

2. **RULES FOR PROGRESSION:**

- (a) The BSc Extended Degree will be for a four (4)-year duration.
- (b) For a student to proceed to the 2nd year of mainstream studies, he/she **MUST** obtained 120 credits in the 1st year of the Extended Degree.
- (c) A student who failed to pass at least 6 modules **will not** be allowed neither to repeat the failed modules **nor to continue** with his/her studies.
- (d) A student who failed 3 OR 4 OR 5 modules can repeat the failed modules **ONLY ONE TIME**, of which failure to reach the minimum required 120 credits, the studies will be discontinued.
- (e) All Foundation modules must have been passed in year 2 of the extended degree. Students will not be allowed to continue before all Foundation modules are passed.

3. **ASSESSMENT FOR BSc EXTENDED DEGREE:**

- (a) Continuous Assessment will consist of tests, practical, tutorials, projects, assignments and reports.
- (b) Students will write examinations at the end of each semester on condition that they qualify to do so.
- (c) The minimum final pass mark in any module is 50%.
- (d) To obtain the degree or diploma *cum laude*, a candidate must attain an aggregate of 75% or higher.

4. **RE-REGISTRATION AND DEFERMENT OF STUDIES:**

- (a) For the duration of the degree, a student must register each year by the stipulated date.
- (b) Registration each year is subject to the recommendation of the Head of Department and may be rejected in any year on grounds of unsatisfactory progress following the progression rules.
- (c) Students wishing to defer studies at any stage must submit a motivated application beforehand. If granted, such deferment will be for a period of ONE year only, after which a further application must be submitted. Deferment will, at most, be granted twice.

FIRST YEAR MODULES:

Students will after successful completion of the 1st year, be allowed to continue in the BSc stream they have registered for.

Information on the 2nd, 3rd and 4th years can be seen under the MAINSTREAM BSc streams in the next section which describe each of the programme and provides detailed descriptions of the modules under each stream.

YEAR	SEMESTER	COMPULSORY MODULES	CREDITS
<u>Year 1</u>	1	FGS 1140 (12): Foundation Skills & Study Skills 1 FIT 1140 (12): Information Technology Fundamentals 1 FMT 1140 (12): Foundation Mathematics 1 FPH 1140 (12): Foundation Physics 1 FCH 1140 (12): Foundation Chemistry1 FBI 1140 (12): Foundation Biology 1	144
	2	FGS 1240 (12): Foundation Skills & Study Skills 1 FIT 1240 (12): Information Technology Fundamentals 1 FMT 1240 (12): Foundation Mathematics 1 FPH 1240 (12): Foundation Physics 1 FCH 1240 (12): Foundation Chemistry1 FBI 1240 (12): Foundation Biology 1	

Module description for fundamental/core modules in the first year of the Extended BSc degree Programme in the School of Mathematical and Natural Sciences

FGS 1140: Foundation Skills & Study Skills 1 [credits 12]

This is a first semester module which addresses Foundation students' linguistic and study skills, competence and performance and lays the foundation for their success throughout their university studies. The orientation of this module is the teaching of grammatical structures, study skills and academic writing skills for Science Foundation students to be able to succeed in their studies. Proficiency in a language is determined by one's ability to speak, read, write and listen with understanding to a language. This module aims to develop these language components within the context of the Science domain using texts and exercises largely drawn from Science related texts. The module will also improve the accuracy with which students use English in order to facilitate effective communication. The purpose of this course is to lay a strong foundation in the students' use of English and to develop their competence in oral and written communication in contexts related to their university studies and future workplace. As language is central to all teaching and learning activities at university, this module is closely linked to all other modules in the Science Foundation Programme. This module contributes to the competent completion and presentation of oral and written assignments and reports in other modules.

FIT 1140: Information Technology Fundamentals 1 [credits 12]

This course develops familiarity with modern computers and encourages their productive use. The module is designed for those with little or no prior computer background. Even if students have some experience about computers already, they might find that there is still a lot to learn! The course content is divided into the theoretical and practical components as follows:

Theory:

Uses of computers; components of a computer (hardware); processor; memory; input devices; output devices; computer software; computer networks and the Internet and an introduction to basic HTML.

Practical:

Use of the operating system; the file system; file management; the World Wide Web; electronic mail; and creation of Web Pages using HTML.

FMT 1140: Foundation Mathematics 1 [credits 12]

Foundation Mathematics is an introductory course designed to equip students with a good foundation in Mathematics. The course is divided into Algebra, Calculus, and Descriptive statistics frequency distribution and graphs. The following content is covered in this first semester module in order to lay a solid Mathematics foundation for the Science Foundation students: Powers, estimation and proportion; Using binary operations in algebra factorization and rational expression; Solving linear, quadratic and absolute value equations and inequalities; Differentiation, higher derivatives and application of differentiation as well as an overview of Statistics.

FPH 1140: Foundation Physics 1 [credits 12]

This is a first semester module which deals with the following concepts: *Measurements in Physics*: SI base and derived units; conversion of units; significances figures. *Vectors in Physics*: scalar and Vector quantities; vector representation; vector addition and subtraction; Vector components. *Motion in one and two dimensions*: average/instantaneous velocity and speed; kinematics equations; Free fall; Projectile Motion. *Laws of Motion and Momentum*: Newton's First Law of motion; inertia; Newton's second Law of motion; Force; weight; frictional forces; universal law of gravitation; mass and weight; impulse and momentum; change in momentum; types of collisions; conservation of linear momentum. *Work, power and energy*: work done by a force; kinetic energy; potential energy; conservative force; mechanical energy; work energy theorem. *Rotational Dynamics and static Equilibrium*: Torque; Center of mass and balance. *Hydrostatics and Thermodynamics*: Phases and Phase change; Phase equilibrium and Evaporation; Laws of Thermodynamics; Specific Heats; Conduction; Convection and Radiation.

FCH 1140: Foundation Chemistry 1 [credits 12]

The course aims to develop a broader knowledge and scope of the concept of Chemistry, as well as improve the students' understanding while promoting creativity. The course was mainly designed for Science Foundation students who under-performed in their Physical Science during their Grade 12 examination. The course aims to equip students with a better foundational level of Chemistry for entry into the mainstream. The pre-requisite for this course is that all learners must have studied Grade 12 Physical Science. The course also aims to introduce students to a more in-depth level of Chemistry as compared to what was taught at High School level. Revision of the Chemistry concepts taught in High School will firstly be dealt with to determine the students' understanding and prior knowledge of Chemistry. Introduction to more complex Stoichiometric Calculations will follow, together with an overview of the atomic structure and the scientists responsible for the origins of these. The periodic table and the various properties will be assessed, together with the types of Chemical Bonding. In Inorganic Chemistry, the various Sulphur and Nitrogen compounds and halogens will be taught.

FBI 1140: Foundation Biology 1 [credits 12]

The module aims to introduce students to different biological disciplines such as Medicine, Pharmacology, Bacteriology, Parasitology, etc. It also introduces students to the use and handling of a microscope. Furthermore, students will be given practical laboratory exposure to make certain that they are familiar with the use and handling of the microscope. Students will also familiarize with two different biological cells; they will know how to draw and label the various parts of these biological cells.

FGS 1240: Foundation Skills & Study Skills 1 [credits 12]

This is a second semester module which builds upon the linguistic knowledge and study skills acquired in the first semester and further develops Foundation students' linguistic competence and performance by developing their academic writing skills to enable them to succeed in their studies. Students are taught how to develop their knowledge of sentence construction into paragraph and essay writing. The module introduces students to general and scientific report writing as well as field reports with the foresight of preparing them for any field work that they may be required to undertake during the Science Foundation Programme as well as the rest of their undergraduate studies. In this module, students are also introduced to basic academic writing and referencing techniques and made aware of the seriousness of plagiarism as a serious academic offence and how best to avoid it.

FIT 1240: Information Technology Fundamentals 1 [credits 12]

This is a second semester course which is designed to develop knowledge with Application Software Package and to help students get used to different software application packages. It also introduces students to the basic notion of programming using C++. Although technology changes very rapidly, the basic knowledge stays the same. This module is designed for those with little or no prior computer background. But the course builds upon the basics taught in **FIT 1140**. This course covers the general theory of how to use application software packages, as well as standard and advanced practical uses of different Software Application Packages. The course also introduces basic concepts of programming using C++. The course content is divided into the theoretical and practical components where the following are taught:

Theory:

Uses of computers, theoretical aspects of word processors, spreadsheets, databases, presentation and introduction to basic concepts of C++.

Practical:

Use of operating system, Advance Training in Microsoft Package (Word, PowerPoint, Excel, and Access), code block and other software applications.

FMT 1240: Foundation Mathematics 1 [credits 12]

This is a second semester module which is designed to equip students with a good foundation in Mathematics and build upon the mathematical concepts taught in first semester. The course will include Integration: specifically indefinite and definite integrations for algebra; exponential, trigonometric and logarithmic functions; Calculation of area of the curve and solids of revolutions; Matrices: proving commutative of a square matrix; demonstration of multiplication of matrices; calculation determination and inverses of matrices of 2 by 2 and more sizes. Trigonometry: conversion of degrees into radians and angles of depression; solving trigonometric equations and triangles and Exponential functions: solving an exponential function and sketch the curves, Determinations of domain, Range and asymptote of the curve; Conversion for logarithmic functions into an exponential function as well as solving logarithmic functions.

FPH 1240: Foundation Physics 1 [credits 12]

This module deals with the following concepts: Electricity and Magnetism: Electric charge; electric Force and coulomb's Law; Electric current; resistance; electric circuits and Ohms Law. Kirchhoff's current and voltage Law, Power and energy, AC and DC, Introduction to Magnetism. Waves and Sound: Types of Waves; Reflection and refraction; Doppler effect; Interference; Nature of sound; Propagation of sound. Optics: Reflection; Mirrors; Diffraction interference; Polarization; Refraction; Lenses and images. Nuclear Physics: The nucleus; Radioactivity; Alpha; beta; and gamma decay; Half-lives.

FCH 1240: Foundation Chemistry1 [credits 12]

The course aims to develop a broader knowledge and scope of the concept of Chemistry, as well as improve the students' understanding while promoting creativity. The course aims to equip students with a better foundational level of Chemistry for entry into the mainstream. The pre-requisite for this course is that students must have successfully completed the first semester Chemistry module. The course engages the students to develop a more in-depth level of Chemistry as compared to what was taught during the first semester. The following content is covered during this second semester module: Phases of matter; with regards to the various states; physical and chemical properties and the classification of matter will be taught. Reaction rates (the various factors which affect reaction rates and Le Chatelier's Principle and its applications) and chemical and solubility equilibrium will follow. Thereafter, a more in-depth version of reduction-oxidation reactions and electrochemical cells will be dealt with compared to what was taught at the Grade 12 level. The next chapter deals with acids and bases, the properties; acid-base models; ionization of water and the pH and pOH scales and lastly volumetric analysis using acid-base titration methods. The final chapter includes the introduction of Organic Chemistry, i.e. the general properties and importance thereof; classification of organic compounds; and finally, students are taught how to name and draw organic compounds with their various functional groups.

FBI 1240: Foundation Biology 1 [credits 12]

The module introduces students to the substances that are biologically important, types of food they can consume for them to get the biologically important substances. Students will engage in the differentiation of different types of food stuffs following the types of compounds they contain. Students will also be familiarized with all the steps followed when one is conducting a scientific research.

BACHELOR OF SCIENCE DEGREE

1. **ADMISSION REQUIREMENTS FOR BACHELOR OF SCIENCE DEGREE (BSc)**

- (a) Candidates wishing to enroll for a BSc degree must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects:
 - English
 - Mathematics
 - Physical Science
 - Life Sciences
- (b) Any other related subject as judged by the HOD of the responsible departments and approved by the Dean of the School of Mathematical and Natural Sciences
- (c) Candidates may be subjected to a selection procedure as determined by the school board.
- (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered.
- (e) Students from the Extended BSc Degree Programme should have obtained 120 credits from the 12 modules registered for, before admission to the mainstream degree.

2. **RULES FOR PROGRESSION:**

- (a) A student may only progress to the second-year level when she/he has passed 60% of the 1st year modules in the mainstream BSc degree
- (b) A student from the Extended BSc degree programme are allowed in the mainstream programme with at least 120 credits passed from Foundation year modules.
- (c) All outstanding Foundation year modules must be registered for and passed during year 2 of the extended programme.
- (d) Students will not be allowed to move to year 3 of the extended programme or take any second year mainstream modules if they still have **outstanding extended/foundation 1st year modules**.
- (e) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules.
- (f) A candidate may not enroll for any third-year module unless **ALL** first-year modules have been passed.
- (g) A third-year extended programme student who has passed 60% of his/her second-year modules **may only** register third year modules whose Pre-requisites have been met, subject to the approval of the Head of Department and the Dean.
- (h) Students may not select modules that clash on the lecturing and practical timetables.
- (i) No curriculum change, whether within or from outside the School, will be recognized unless approved by the Dean.
- (j) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval** of the Head of Department and the Dean.
- (k) Students can register **ONLY** for modules for which **ALL** Pre-requisites have been satisfied.
- (l) Students retain credits for all modules passed.
- (m) In order to qualify for a BSc degree in the School of Mathematical and Natural Sciences, students **must obtain a minimum** of half of their credits in a learning stream within this School.

- (n) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the Bachelor of Science Learning streams listed in this document. Departments may prescribe additional credits **provided these do not exceed** 32 credits. To complete a three-year learning stream, students are required to enroll for at least 120 credits per year, with the minimum number of credits at each level of study (NQF 5,6, and 7) being 72 credits at that level.
- (o) The minimum registration period for a BSc. degree is three years and the maximum are n+2.

3. **ASSESSMENT FOR BSc DEGREE:**

- (a) Continuous Assessment will consist of tests, practical, tutorials, projects, assignments and reports.
- (b) Students will write examinations at the end of each semester on condition that they qualify to do so.
- (c) The minimum final pass mark in any module is 50%.
- (d) To obtain the degree or diploma *cum laude*, a candidate must attain an aggregate of 75% or higher.

4. **RE-REGISTRATION AND DEFERMENT OF STUDIES:**

- (a) For the duration of the degree, a student must register each year by the stipulated date.
- (b) Registration each year is subject to the recommendation of the Head of Department and may be rejected in any year on grounds of unsatisfactory progress.
- (c) Students wishing to defer studies at any stage must submit a motivated application beforehand. If granted, such deferment will be for a period of ONE year only, after which a further application must be submitted. Deferment will, at most, be granted twice.

5. **BSc DEGREE LEARNING STREAMS [CREDITS FOR EACH STREAM = 360]:**

The BSc degree in the School of Mathematical and Natural Sciences is a generic degree with the following learning streams in which students can register:

• BSc in BIOCHEMISTRY AND MICROBIOLOGY	CODE: MNBBSA
• BSc in BIOCHEMISTRY AND BIOLOGY	CODE: MNBBSD
• BSc in MICROBIOLOGY AND BOTANY	CODE: MNBBSSE
• BSc in MATHEMATICS AND APPLIED MATHEMATICS	CODE: MNBBSF
• BSc in FINANCIAL MATHEMATICS AND APPLIED MATEMATICS	CODE: MNBBSG
• BSc in MATHEMATICS AND PHYSICS	CODE: MNBBSH
• BSc in MATHEMATICS AND STATISTICS	CODE: MNBBSI
• BSc in PHYSICS AND CHEMISTRY	CODE: MNBBSJ
• BSc in CHEMISTRY AND MATHEMATICS	CODE: MNBBSK
• BSc in CHEMISTRY AND BIOCHEMISTRY	CODE: MNBBSL
• BSc in CHEMISTRY AND APPLIED CHEMISTRY	CODE: MNBBSN
• BSc in BOTANY AND ZOOLOGY	CODE: MNBBSO
• BSc in COMPUTER SCIENCE	CODE: MNBBSQ
• BSc in COMPUTER SCIENCE AND MATHEMATICS	CODE: MNBBSQ

BSc in BIOCHEMISTRY AND MICROBIOLOGY**CODE: MNBBSA**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for Applied Sciences BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell Biology MAT 1143 (8): Mathematics for Biological, Earth and Life Sciences I STA 1149 (8): Basic Statistics (for the Natural and Applied Sciences) COM 0110 (4): Computer Literacy ECS 1141 (10): English Communication Skills (Generic Module)	PHY 1125 (8): Physics for Natural Sciences I	132
	2	CHE 1221 (8): Inorganic Chemistry I CHE 1222 (8): Organic Chemistry I STA 1249 (8): Basic Statistical Inference (for the Natural and Applied Sciences) BIO 1243 (16): Ecology, Adaptation and Evolution COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	MAT 1243 (8): Mathematics for Life and Earth Sciences II PHY 1225 (8): Physics for Natural Sciences II	
Year 2 NQF Level 6	1	BCM 2121 (10): Structural and Functional Biochemistry I BCM 2122 (10): Biochemical and Molecular Techniques MBY 2121 (10): Bacteriology MBY 2122 (10): Immunology ZOO 2141 (16): Animal Physiology	BIO 2142 (16): Population Ecology BOT 2144 (16): Plant Anatomy and Morphology CHE 2121 (10): Inorganic Chemistry II CHE 2122 (10): Organic Chemistry II	112
	2	BCM 2221 (10): Structural and Functional Biochemistry II BCM 2222 (10): Metabolism MBY 2223 (10): Environmental Microbiology MBY 2224 (10): Virology	BOT 2245 (16): Plant Taxonomy and Reproductive Biology I BOT 2249 (16): Ethnobotany I CHE 2220 (10): Analytical Chemistry: Classical Techniques CHE 2223 (10): Physical Chemistry I ZOO 2248 (16): Animal Phylogeny	
Year 3 NQF Level 7	1	BCM 3121 (16): Protein Biochemistry BCM 3122 (16): Advanced Molecular Techniques MBY 3126 (14): Food Microbiology MBY 3127 (14): Industrial Microbiology	NONE	120
	2	BCM 3221 (16): Enzymology and Enzyme Biotechnology BCM 3222 (16): Gene Expression, Protein Synthesis and Bioinformatics MBY 3228 (14): Mycology and Phycology MBY 3229 (14): Parasitology	NONE	

In year 1:

- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 2:

- Take modules in total of 16 credits from the elective module list

BSc in BIOCHEMISTRY AND BIOLOGY**CODE: MNBBS**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for the Applied Sciences BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell Biology MAT 1143 (8): Mathematics for Biological, Earth and Life Sciences I COM 0110 (4): Computer Literacy ECS 1141 (10): English Communication Skills (Generic Module)	PHY 1125 (8): Physics for Natural Sciences I STA 1149 (8): Basic Statistics (for the Natural and Applied Sciences)	120
	2	CHE 1221 (8): Inorganic Chemistry I CHE 1222 (8): Organic Chemistry I BIO 1243 (16): Ecology, Adaptation and Evolution COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	MAT 1243 (8): Mathematics for Biological, Earth and Life Sciences II PHY 1225 (8): Physics for Natural Sciences II STA 1249 (8): Basic Statistical Inference (for the Natural and Applied Sciences)	
Year 2 NQF Level 6	1	BCM 2121 (10): Structural and Functional Biochemistry I BCM 2122 (10): Biochemical and Molecular Techniques BOT 2144 (16): Plant Anatomy and Morphology ZOO 2141 (16): Animal Physiology ZOO 2144 (16): Principles of Genetics	NONE	136
	2	BCM 2221 (10): Structural and Functional Biochemistry II BCM 2222 (10): Metabolism BOT 2245 (16): Plant Taxonomy and Reproductive Biology I BOT 2249 (16): Ethnobotany I ZOO 2248 (16): Animal Phylogeny	NONE	
Year 3 NQF Level 7	1	BCM 3121 (16): Protein Biochemistry BOT 3148 (10): Plant Systematics ZOO 3141 (16): Animal Ecophysiology	BCM 3122 (16): Advanced Molecular Techniques	104
	2	BCM 3221 (16): Enzymology and Enzyme Biotechnology BOT 3246 (10): Plant Physiology ZOO 3249 (20): Evolutionary Genetics	BCM 3222 (16): Gene Expression, Protein Synthesis and Bioinformatics BOT 3241 (10): Ethnobotany II BOT 3247 (10): Plant Ecophysiology	

In year 1:

- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 3:

- Take modules in total of 16 credits from the elective module list

BSc in MICROBIOLOGY AND BOTANY**CODE: MNBBSE**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for the Applied Sciences BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell Biology MAT 1143 (8): Math for Biological, Earth and Life Sciences I STA 1149 (8): Basic Statistics (for the Natural and Applied Sciences) COM 0110 (4): Computer Literacy ECS 1145 (10): English Communication Skills	PHY 1125 (8): Physics for Natural Sciences I	136
	2	CHE 1221 (8): Inorganic Chemistry 1 CHE 1222 (8): Organic Chemistry 1 STA 1249 (8): Basic Statistical Inference (for the Natural and Applied Sciences) BIO 1243 (16): Ecology, Adaptation and Evolution COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	MAT 1243 (8): Math for Biology, Earth and Life Sciences II PHY 1225 (8): Physics for Natural Sciences II	
Year 2 NQF Level 6	1	MBY 2121 (10): Bacteriology MBY 2122 (10): Immunology BOT 2144 (16): Plant Anatomy and Morphology BIO 2142 (16): Population Ecology	CHE 2121 (10): Inorganic Chemistry II CHE 2122 (10): Organic Chemistry II	118
	2	MBY 2223 (10): Environmental Microbiology MBY 2224 (10): Virology BOT 2245 (16): Plant Taxonomy and Reproductive Biology BOT 2249 (16): Ethnobotany I	ZOO 2248 (16): Animal Phylogeny CHE 2220 (10): Analytical Chemistry: Classical Techniques CHE 2223 (10): Physical Chemistry I	
Year 3 NQF Level 7	1	MBY 3126 (14): Food Microbiology MBY 3127 (14): Industrial Microbiology BOT 3143 (10): Plant Ecology BOT 3148 (10): Plant Systematics	NONE	106
	2	MBY 3228 (14): Mycology and Phycology MBY 3229 (14): Parasitology BOT 3241 (10): Ethnobotany II BOT 3246 (10): Plant Physiology BOT 3247 (10): Plant Ecophysiology	NONE	

In year 1:

- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 2:

- Take modules in total of 20 credits from the elective module list

BSc in MATHEMATICS AND APPLIED MATHEMATICS**CODE: MNBBSF**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematic Foundations I COM 1122 (8): Introduction to Computer Systems PHY 1121 (8): Mechanics STA 1142 (8): Introductory Probability ECS 1141 (10): English Communication Skills (Generic Module)	COM 1124 (8): Fundamentals of Computer Architecture PHY 1122 (8): Waves and Optics I STA 1141 (8): Introduction to Statistics	124
	2	MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundations II MAT 1246 (8): Mechanics I MAT 1247 (8): Numerical Analysis I ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	PHY 1223 (8): Properties of Matter Thermal Physics PHY 1224 (8): Electricity and Magnetism STA 1241 (8): Elementary Statistical Methods I- Introductory Interference STA 1242 (8): Elementary Statistical Methods II – Correlation and Regression	
	Year module	COM 1321 (16): Object Oriented Programming		
Year 2 NQF Level 6	1	MAT 2141 (10): Linear algebra MAT 2142 (10): Multivariable Calculus MAT 2148 (10): Mathematical Modelling I STA 2141 (10): Probability Distributions	COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals STA 2142 (10): Multiple Regression	120
	2	MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I MAT 2247 (10): Numerical Analysis II MAT 2248 (10): Vector Analysis STA 2241 (10): Statistical Computing	COM 2216 (10): Reasoning about Programs COM 2224 (10): Algorithms and Data Structures COM 2229 (10): Systems Analysis STA 2242 (10): Sampling Techniques	
Year 3 NQF Level 7	1	MAT 3141 (14): Real Analysis II MAT 3147 (14): Partial Differential Equations MAT 3149 (14): Ordinary Differential Equations II	STA 3141 (14): Statistical Interference STA 3142 (14): Industrial Statistics MAT 3142 (14): Group Theory	126
	2	MAT 3241 (14): Complex Analysis MAT 3246 (14): Mechanics II MAT 3247 (14): Numerical Analysis III	COM 3221 (14): Advanced Algorithms MAT 3242 (14): Rings and Fields MAT 3243 (14): Graph Theory MAT 3244 (14): Continuum Mechanics MAT 3248 (14): Mathematical Modelling II MAT 3249 (14): Geometry	

In year 1:

- Take modules in total of 16 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:

- Take modules in total of 30 credits from the elective module list

In year 3:

- Take modules in total of 42 credits from the elective module list

BSc in FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS**CODE: MNBBSG**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundation I STA 1142 (8): Introductory Probability PHY 1121 (8): Mechanics COM 1122 (8): Introduction to Computer Systems ECS 1141 (10): English Communication Skills (Generic Module)	COM 1124 (8): Fundamentals of Computer Architecture ECO 1141 (12): Basic Economics STA 1141 (8): Introduction to Statistics	124
	2	MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundations II MAT 1246 (8): Mechanics I MAT 1247 (8): Numerical Analysis I ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	STA 1241 (8): Elementary Statistical Methods I – Introductory Interference STA 1242 (8): Elementary Statistical Methods II – Correlation and Regression ECO 1241 (12): Basic Macro-economics	
	Year module	COM 1321 (16): Object Oriented Programming		
Year 2 NQF Level 6	1	MAT 2141 (10): Linear algebra MAT 2142 (10): Multivariable Calculus MAT 2148 (10): Mathematical Modelling I STA 2141 (10): Probability Distributions	COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals ECO 2141 (15): Intermediate Micro-economics STA 2142 (10): Multiple Regression	120
	2	MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I MAT 2247 (10): Numerical Analysis II STA 2241 (10): Statistical Computing	COM 2216 (10): Reasoning about Programs STA 2242 (10): Sampling Techniques ECO 2241 (15): Intermediate Macro-economics	
Year 3 NQF Level 7	1	MAT 3141 (14): Real Analysis II MAT 3146 (14): Finance Mathematics MAT 3147 (14): Partial Differential Equations MAT 3149 (14): Ordinary Differential Equations II MAT 3156 (14): Statistical Finance Mathematics	STA 3141 (14): Statistical Inference	126
	2	MAT 3247 (14): Numerical Analysis III MAT 3256 (14): Advanced Finance Mathematics	MAT 3241 (14): Complex Analysis MAT 3244 (14): Continuum Mechanics MAT 3248 (14): Mathematical Modelling II MAT 3249 (14): Geometry STA 3241 (14): Time Series Analysis	

In year 1:

- Take modules in total of 16 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:

- Take modules in total of 40 credits from the elective module list

In year 3:

- Take modules in total of 28 credits from the elective module list

BSc in MATHEMATICS AND PHYSICS**CODE: MNBBSH**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	PHY 1121 (8): Mechanics PHY 1122 (8): Waves and Optics I MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundations I CHE 1140 (16): General Chemistry for the Applied Sciences ECS 1145 (10): English Communication Skills	COM 1122 (8): Introduction to Computer Systems COM 1124 (8): Fundamentals of Computer Architecture STA 1141 (8): Introduction to Statistics STA 1142 (8): Introductory Probability	128
	2	PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundations II MAT 1247 (8): Numerical Analysis I ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	STA 1241 (8): Elementary Statistical Methods I – Introductory Interference STA 1242 (8): Elementary Statistical Methods II – Correlation and Regression	
	Year module	COM 1321 (16): Object Oriented Programming		
Year 2 NQF Level 6	1	PHY 2121 (10): Classical Mechanics PHY 2122 (10): Waves and Optics II MAT 2141 (10): Linear Algebra MAT 2142 (10): Multivariable Calculus	MAT 2148 (10): Mathematical Modelling I COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals STA 2141 (10): Probability Distributions	120
	2	PHY 2223 (10): Electrodynamics PHY 2224 (10): Modern Physics MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I MAT 2247 (10): Numerical Analysis II MAT 2248 (10): Vector Analysis	CHE 2220 (10): Analytical Chemistry: Classical Techniques CHE 2223 (10): Physical Chemistry I STA 2241 (10): Statistical Computing	
Year 3 NQF Level 7	1	PHY 3121 (14): Atomic and Nuclear Physics PHY 3122 (14): Solid State Physics MAT 3141 (14): Real Analysis II MAT 3147 (14): Partial Differential Equations MAT 3149 (14): Ordinary Differential Equations II	NONE	126
	2	PHY 3223 (14): Thermodynamics and Statistical Mechanics PHY 3224 (14): Quantum Mechanics MAT 3241 (14): Complex Analysis	MAT 3244 (14): Continuum Mechanics MAT 3247 (14): Numerical Analysis III MAT 3248 (14): Mathematical Modelling II	

In year 1:

- Take modules in total of 8 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:

- Take modules in total of 20 credits from the elective module list

In year 3:

- Take modules in total of 14 credits from the elective module list

BSc in MATHEMATICS AND STATISTICS**CODE: MNBBSI**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundations I PHY 1121 (8): Mechanics STA 1141 (8): Introduction to Statistics STA 1142 (8): Introductory Probability ECS 1145 (10): English Communication Skills	COM 1122 (8): Introduction to computer Systems COM 1124 (8): Fundamentals of Computer Architecture PHY 1122 (8): Waves and Optics I	124
	2	MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundations II STA 1241 (8): Elementary Statistical Method I - Introductory Interference STA 1242 (8): Elementary Statistical Methods II - Correlation and regression ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	MAT 1246 (8): Mechanics I MAT 1247 (8): Numerical Analysis I PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism	
	Year module	COM 1321 (16): Object Oriented Programming		
Year 2 NQF Level 6	1	MAT 2141 (10): Linear algebra MAT 2142 (10): Multivariable Calculus STA 2141 (10): Probability Distributions STA 2142 (10): Multiple Regression	COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals MAT 2148 (10): Mathematical Modelling I	120
	2	MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I STA 2241 (10): Statistical Computing STA 2242 (10): Sampling Techniques	COM 2216 (10): Reasoning about Programs COM 2224 (10): Algorithms and Data Structures COM 2229 (10): Systems Analysis MAT 2247 (10): Numerical Analysis II MAT 2248 (10): Vector Analysis	
Year 3 NQF Level 7	1	MAT 3141 (14): Real Analysis II STA 3141 (14): Statistical Inference	STA 3142 (14): Industrial Statistics STA 3143 (14): Introduction to Research and Official Statistics MAT 3142 (14): Group Theory MAT 3146 (14): Finance Mathematics MAT 3147 (14): Partial Differential Equations MAT 3156 (14): Statistical Finance Mathematics	126
	2	MAT 3241 (14): Complex Analysis STA 3242 (14): Experiential design	STA 3241 (14): Time Series Analysis STA 3243 (14): Multivariate Methods MAT 3247 (14): Numerical Analysis III MAT 3248 (14): Mathematical Modelling II MAT 3256 (14): Advanced Financial Mathematics	

In year 1:

- Take modules in total of 16 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:

- Take modules in total of 40 credits from the elective module list

In year 3:

- Take modules in total of 70 credits from the elective module list from either MAT or STA configured as: 28 credits from STA and 42 credits from MAT **or** 28 credits from MAT and 42 credits from STA

BSc in PHYSICS AND CHEMISTRY**CODE: MNBBSJ**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for the Applied Sciences PHY 1121 (8): Mechanics PHY 1122 (8): Waves and Optics I MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundation I COM 0110 (4): Computer Literacy ECS 1145 (10): English Communication Skills	BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell Biology COM 1321 (16): Object Oriented Programming [Please note: this is a year module] STA 1141 (8): Introduction to Statistics	136
	2	CHE 1221 (8): Inorganic Chemistry I CHE 1222 (8): Organic Chemistry I PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundation II COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	BIO 1243 (16): Ecology, Adaptation and Evolution STA 1241 (8): Elementary Statistical Method I - Introductory Interference	
Year 2 NQF Level 6	1	CHE 2121 (10): Inorganic Chemistry II CHE 2122 (10): Organic Chemistry II PHY 2121 (10): Classical Mechanics PHY 2122 (10): Waves and Optics II MAT 2141 (10): Linear Algebra MAT 2142 (10): Multivariable Calculus	COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals	120
	2	CHE 2220 (10): Analytical Chemistry: Classical Techniques CHE 2223 (10): Physical Chemistry I PHY 2223 (10): Electrodynamics PHY 2224 (10): Modern Physics	COM 2229 (10): Systems Analysis MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I	
Year 3 NQF Level 7	1	CHE 3120 (14): Analytical Chemistry: Instrumental Techniques CHE 3123 (14): Physical Chemistry II PHY 3121 (14): Atomic and Nuclear Physics PHY 3122 (14): Solid State Physics	NONE	112
	2	CHE 3221 (14): Inorganic Chemistry III CHE 3222 (14): Organic Chemistry III PHY 3223 (14): Thermodynamics and Statistical Mechanics PHY 3224 (14): Quantum Mechanics	NONE	

In year 1:

- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:

- Take modules in total of 20 credits from the elective module list

BSc in CHEMISTRY AND MATHEMATICS**CODE: MNBBSK**

YEAR	SEMESTER	COMPULSAORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for the Applied Sciences MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundation I PHY 1121 (8): Mechanics PHY 1122 (8): Waves and Optics I COM 0110 (4): Computer Literacy ECS 1141 (10): English Communication Skills (Generic Module)	BIO 1141 (12): The Tree of Life BIO 1142 (12): Cell Biology COM 1321 (16): Object Oriented Programming [Please note: this is a year module] STA 1141 (8): Introduction to Statistics	136
	2	CHE 1221 (8): Inorganic Chemistry I CHE 1222 (8): Organic Chemistry I MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundation II PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	STA 1241 (8): Elementary Statistical Method I - Introductory Interference MAT 1247 (8): Numerical Analysis I BIO 1243 (16): Ecology, Adaptation and Evolution	
Year 2 NQF Level 6	1	CHE 2121 (10): Inorganic Chemistry II CHE 2122 (10): Organic Chemistry II MAT 2141 (10): Linear Algebra MAT 2142 (10): Multivariable Calculus	COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals PHY 2121 (10): Classical Mechanics PHY 2122 (10): Waves and Optics II	120
	2	CHE 2220 (10): Analytical Chemistry: Classical Techniques CHE 2223 (10): Physical Chemistry I MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I	COM 2216 (10): Reasoning about Programs COM 2229 (10): Systems Analysis PHY 2223 (10): Electrodynamics PHY 2224 (10): Modern Physics MAT 2247 (10): Numerical Analysis II	
Year 3 NQF Level 7	1	CHE 3120 (14): Analytical Chemistry: Instrumental Techniques CHE 3123 (14): Physical Chemistry II MAT 3141 (14): Real Analysis II MAT 3142 (14): Group Theory	MAT 3147 (14): Partial Differential Equations	126
	2	CHE 3221 (14): Inorganic Chemistry III CHE 3222 (14): Organic Chemistry III MAT 3241 (14): Complex Analysis MAT 3248 (14): Mathematical Modelling II	MAT 3242 (14): Rings and Fields MAT 3247 (14): Numerical Analysis III	

In year 1:

- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:

- Take modules in total of 40 credits from the elective module list

In year 3:

- Take modules in total of 14 credits from the elective module list

BSc in CHEMISTRY AND BIOCHEMISTRY**CODE: MNBBSL**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for the Applied Sciences MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundation I BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell Biology PHY 1125 (8): Physics for Natural Sciences I COM 0110 (4): Computer Literacy ECS 1141 (10): English Communication Skills (Generic Module)	NONE	136
	2	CHE 1221 (8): Inorganic Chemistry I CHE 1222 (8): Organic Chemistry I MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundation II PHY 1225 (8): Physics for Natural Sciences II COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	NONE	
Year 2 NQF Level 6	1	BCM 2121 (10): Structural and functional Biochemistry I BCM 2122 (10): Biochemical and Molecular Techniques CHE 2121 (10): Inorganic Chemistry II CHE 2122 (10): Organic Chemistry II MBY 2121 (10): Bacteriology MBY 2122 (10): Immunology	NONE	120
	2	BCM 2221 (10): Structural and Functional Biochemistry II BCM 2222 (10): Metabolism CHE 2220 (10): Analytical Chemistry: Classical Techniques CHE 2223 (10): Physical Chemistry I MBY 2223 (10): Environmental Microbiology MBY 2224 (10): Virology	NONE	
Year 3 NQF Level 7	1	CHE 3120 (14): Analytical Chemistry: Instrumental Techniques CHE 3123 (14): Physical Chemistry II BCM 3121 (16): Protein Biochemistry BCM 3122 (16): Advanced Molecular Techniques	NONE	120
	2	CHE 3221 (14): Inorganic Chemistry III CHE 3222 (14): Organic Chemistry III BCM 3221 (16): Enzymology and Enzyme Biotechnology BCM 3222 (16): Gene Expression, Protein Synthesis and Bioinformatics	NONE	

In year 1: Take either COM 0110 **OR** COM 0210

BSc in CHEMISTRY AND APPLIED CHEMISTRY**CODE: MNBBSN**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	CHE 1140 (16): General Chemistry for the Applied Sciences MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundations I PHY 1121 (8): Mechanics PHY 1122 (8): Waves and Optics I COM 0110 (4): Computer Literacy ECS 1141 (10): English Communication Skills (Generic Module)	BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell Biology COM 1124 (8): Fundamentals of Computer Architecture COM 1321 (16): Object Oriented Programming [Please note: this is a year module] STA 1141 (8): Introduction to Statistics	136
	2	CHE 1221 (8): Inorganic Chemistry I CHE 1222 (8): Organic Chemistry I MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundations II PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	BIO 1243 (16): Ecology, Adaptation and Evolution STA 1241 (8): Elementary Statistical Method I - Introductory Interference	
Year 2 NQF Level 6	1	CHE 2121 (10): Inorganic Chemistry II CHE 2122 (10): Organic Chemistry II CHE 2124 (10): Industrial Chemistry CHE 2125 (10): Applied Organic Chemistry PHY 2122 (10): Waves and Optics II	COM 2123 (10): Imperative Programming COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals MAT 2141 (10): Linear Algebra MAT 2142 (10): Multivariable Calculus MBY 2121 (10): Bacteriology PHY 2121 (10): Classical Mechanics	120
	2	CHE 2220 (10): Analytical Chemistry: Classical techniques CHE 2223 (10): Physical Chemistry I CHE 2226 (10): Introductory Chemometrics CHE 2229 (10): Environmental Chemistry Fundamentals PHY 2224 (10): Modern Physics	COM 2229 (10): Systems Analysis MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I PHY 2223 (10): Electrodynamics MBY 2223 (10): Environmental Microbiology	
Year 3 NQF Level 7	1	CHE 3120 (14): Analytical Chemistry: Instrumental Techniques CHE 3123 (14): Physical Chemistry II CHE 3124 (14): Applied Chemical Analysis and Food Science CHE 3125 (14): <i>Capita Selecta</i> in Applied Chemistry	NONE	112
	2	CHE 3221 (14): Inorganic Chemistry III CHE 3222 (14): Organic Chemistry III CHE 3226 (14): Process Technology CHE 3227 (14): Chemistry of Materials	NONE	

In year 1:

- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:

- Take modules in total of 20 credits from the elective module list

BSc in BOTANY AND ZOOLOGY**CODE: MNBBSO**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	BIO 1141 (16): The Tree of Life BIO 1142 (16): Cell biology CHE 1140 (16): General Chemistry for the Applied Sciences MAT 1143 (8): Mathematics for Biological, Earth and Life Sciences I PHY 1125 (8): Physics for Natural Sciences I STA 1149 (8): Basic Statistics (for the Natural and Applied Sciences) COM 0110 (4): Computer Literacy ECS 1141 (10): English Communication Skills (Generic Module)	NONE	132
	2	BIO 1243 (16): Ecology, Adaptation and Evolution PHY 1225 (8): Physics for Natural Sciences II MAT 1243 (8): Math for Biological, Earth and Life Sciences II STA 1249 (8): Basic Statistical Inference (for the Natural and Applied Sciences) COM 0210 (4): Computer Literacy ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	NONE	
Year 2 NQF Level 6	1	BIO 2142 (16): Population Ecology BOT 2144 (16): Plant Anatomy and Morphology ZOO 2141 (16): Animal Physiology ZOO 2144 (16): Principles of Genetics	NONE	128
	2	BIO 2246 (16): Conservation Biology I BOT 2245 (16): Plant Taxonomy and Reproductive Biology BOT 2249 (16): Ethnobotany I ZOO 2248 (16): Animal Phylogeny	NONE	
Year 3 NQF Level 7	1	BOT 3148 (10): Plant Systematics BIO 3144 (16): Basic Freshwater Ecology BOT 3143 (10): Disturbance and Plant Ecology ZOO 3141 (16): Animal Ecophysiology	NONE	118
	2	BIO 3246 (16): Conservation Biology II BOT 3241 (10): Ethnobotany II BOT 3246 (10): Plant Physiology BOT 3247 (10): Plant Ecophysiology ZOO 3249 (20): Evolutionary Genetics	NONE	

In year 1: Take either COM 0110 **OR** COM 0210

BSc in COMPUTER SCIENCE**CODE: MNBBSP**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	COM 1122 (8): Introduction to Computer Systems COM 1124 (8): Fundamentals of Computer Architecture MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundations I ECS 1141 (10): English Communication Skills (Generic Module)	PHY 1121 (8): Mechanics PHY 1122 (8): Waves and Optics I STA 1141 (8): Introduction to Statistics	138
	2	COM1226 (8): Computer Technology MAT1241 (8): Integral Calculus MAT1242 (8): Mathematics Foundations II ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism STA 1241 (8): Elementary Statistical Method I-Introductory Interference	
	Year module	COM 1321 (16): Object Oriented Programming		
Year 2 NQF Level 6	1	COM 2120 (10): Digital Design Techniques COM 2123 (10): Imperative Programming COM 2125 (10): Operating Systems COM 2126 (10): Human-Computer Interaction COM 2128 (10): Artificial Intelligence Fundamentals COM 2129 (10): Database Fundamentals	NONE	120
	2	COM 2216 (10): Reasoning about programs COM 2224 (10): Algorithms and Data Structures COM 2226 (10): Data Communication and Computer Networks COM 2228 (10): Contemporary Object-Oriented Concepts COM 2229 (10): Systems Analysis	NONE	
	Year module	COM 2301 (10): Computer Science Lab		
Year 3 NQF Level 7	1	COM 3120 (14): Software Engineering I COM 3121 (14): Distributed Operating Systems COM 3128 (14): Systems Design and Implementation	NONE	126
	2	COM 3217 (14): Professional Issues in Computing and Information Technology COM 3220 (14): Software Engineering II COM 3221 (14): Advanced Algorithms COM 3226 (14): Artificial Intelligence COM 3227 (14): Evaluation of Information Systems COM 3229 (14): Database Design and Implementation	NONE	

In year 1:

- Take modules in total of 32 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2: The compulsory year module must be registered in the 1st semester

BSc in COMPUTER SCIENCE AND MATHEMATICS**CODE: MNBBSQ**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 NQF Level 5	1	COM 1122 (8): Introduction to Computer Systems COM 1124 (8): Fundamentals of Computer Architecture MAT 1141 (8): Differential Calculus MAT 1142 (8): Mathematics Foundation I STA 1142 (8): Introductory Probability ECS 1141 (10): English Communication Skills (Generic Module)	PHY 1121 (8): Mechanics PHY 1122 (8): Waves and Optics I STA 1141 (8): Introduction to Statistics	132
	2	MAT 1241 (8): Integral Calculus MAT 1242 (8): Mathematics Foundations II COM 1226 (8): Computer Technology ECS 1245 (10): English Communication Skills for Natural and Agricultural Sciences	MAT 1247 (8): Numerical Analysis I PHY 1223 (8): Properties of Matter and Heat PHY 1224 (8): Electricity and Magnetism STA 1241 (8): Elementary Statistical Method I – Introductory Interference	
	Year module	COM 1321 (16): Object Oriented Programming		
Year 2 NQF Level 6	1	COM 2123 (10): Imperative Programming COM 2129 (10): Database Fundamentals MAT 2141 (10): Linear Algebra MAT 2142 (10): Multivariable Calculus MAT 2148 (10): Mathematical Modelling I	COM 2120 (10): Digital Design Techniques COM 2125 (10): Operating Systems COM 2126 (10): Human-Computer Interaction COM 2128 (10): Artificial Intelligence Fundamentals STA 2141 (10): Probability Distribution	120
	2	COM 2224 (10): Algorithms and Data Structures COM 2226 (10): Data Communication and Computer Networks MAT 2241 (10): Real Analysis I MAT 2242 (10): Ordinary Differential Equations I	COM 2216 (10): Reasoning about programs COM 2228 (10): Contemporary Object-Oriented Concepts COM 2229 (10): Systems Analysis STA 2241 (10): Statistical Computing MAT 2247 (10): Numerical Analysis II	
	Year module	COM 2301 (10): Computer Science Lab		
Year 3 NQF Level 7	1	MAT 3141 (14): Real Analysis II MAT 3142 (14): Group Theory	MAT 3147 (14): Partial Differential Equations COM 3120 (14): Software Engineering I COM 3121 (14): Distributed Operating Systems COM 3128 (14): Systems Design and Implementation	112
	2	COM 3217 (14): Professional Issues in Computing and Information Technology COM 3221 (14): Advanced Algorithms COM 3229 (14): Database Design and Implementation MAT 3241 (14): Complex Analysis MAT 3243 (14): Graph Theory	MAT 3242 (14): Rings and Fields MAT 3247 (14): Numerical Analysis III MAT 3248 (14): Mathematical Modelling II MAT 3249 (14): Geometry COM 3226 (14): Artificial Intelligence COM 3227 (14): Evaluation of Information Systems	

In year 1:

- Take modules in total of 32 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:

- The compulsory year module must be registered in the 1st semester
- Take modules in total of 40 credits from the elective module list

In year 3:

- Take modules in total of 14 credits from the elective module list

BSc DEGREE PROGRAMME - UNDERGRADUATE MODULES

BIOCHEMISTRY DEPARTMENT

SECOND YEAR MODULES:

BCM 2121 : Structural and functional Biochemistry I [credits 10]

Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142

The chemistry of biomolecules (peptides, protein, vitamins, enzymes, co-enzymes), pH and buffers, bio-energetics

BCM 2122 : Biochemical and Molecular Techniques [credits 10]

Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142

Spectroscopy, Electrophoresis, Chromatography, Immunochemical techniques, Microscopy, cell Disruption Methods, Centrifugation, Protein Purification Methods and Introduction to Bioinformatics.

BCM 2221 : Structural and Functional Biochemistry II [credits 10]

Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142

Carbohydrates (classification, structure-function, configuration and conformation, derivatives of sugars, Structural Polysaccharides [Cellulose and Chitin], Storage Polysaccharides [Starch and Glycogen], Glycoproteins); lipids and membranes (classification [including sphingolipids and their roles in neurotransmission], structure-function, derivatives of lipids [including steroid hormones], lipoproteins); and nucleic acids (levels of structure in nucleic acids, DNA and RNA).

BCM 2222 : Metabolism [credits 10]

Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142

Carbohydrate metabolism; alternative routes of glucose metabolism; Krebs cycle, electron transport and oxidative phosphorylation, introduction to plant biochemistry and growth factors, lipid metabolism; amino acid metabolism, nucleic acid metabolism, xenobiotic metabolism [including cytochrome P450].

THIRD YEAR MODULES

Students are not allowed to proceed to do third year modules before clearing first year modules.

BCM 3121 : Protein Biochemistry [credits 16]

Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222

Structural organization of proteins, the concept of protein folding, protein structure and function, protein domains, intracellular signal transduction pathways (including neurotransmission biochemistry), role of proteins in transport

BCM 3122 : Advanced Molecular Techniques [credits 16]

Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222

LC-MS; biophysical techniques (ITC, circular dichroism, surface plasmon resonance, NMR, crystallography); flow cytometry; advanced electrophoresis; fluorescence; protein-protein interaction; advanced immuno-techniques; microarrays; RNA-interference and DNA sequencing.

BCM 3221 : Enzymology and Enzyme Biotechnology [credits 16]

Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222

Structure and function of enzymes, enzyme kinetics and mechanisms of enzyme catalyzed reactions, applications of enzyme technology (including industrial enzyme biotechnology).

BCM 3222 : Gene expression, Protein Synthesis and Bioinformatics [credits 16]

Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222

Central dogma, replication, transcription, translation, protein synthesis, protein targeting to subcellular organelles, post translational modification, protein degradation, nucleotide analogues [as mutagens and chemotherapeutic agents], DNA damage and repair, recombinant DNA technology, gene therapy, DNA sequencing, introduction to genomics and proteomics, bioinformatics [blast, sequence alignment, major online genomic databases, homology modelling, predictive target ligand interactions, phylogeny].

BOTANY DEPARTMENT

(a) Modules presented jointly by the Botany and Zoology Departments

FIRST YEAR MODULES:

BIO 1141 : The Tree of Life [credits 16]

Pre-requisites(s) : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in Matric Biology (Life Sciences), Physical Science and Mathematics.

Biological principles and the science of biology, the origin and chemistry of life, classification and phylogeny of animals, review of bacteria, fungi and viruses, kingdom protista (classification 7 characteristics), kingdom animalia (a general review), kingdom plantae (review, life cycles and theories of their possible origin).

BIO 1142 : Cell Biology [credits 16]

Pre-requisites(s) : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in Matric Biology (Life Sciences), Physical Science and Mathematics.

Organic chemistry: the scope of biochemistry, organic compounds of importance to the living system, structure, functional groups, stereochemistry and characteristics of the carbohydrates, lipids, proteins and nucleic acids, chemical-physical principles of biochemical bonds, matrix of life: weak interactions in an aqueous solution, energetics of life.

Cytology: history of cell biology, cell theory, membrane biology, structure and features of eukaryotic cells, techniques used in cytology. Prokaryotic cells.

Genetics: The nature and structure of the hereditary material introductory principles of mitosis and meiosis, Chromosome variation, sex determination and the mechanism of sex related inheritance.

BIO 1243 : Ecology, Adaptation and Evolution [credits 16]

Pre-requisites(s) : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in Matric Biology (Life Sciences), Physical Science and Mathematics.

Ecosystems, Energy flow and nutrient cycling, Analysis of communities, ecological hierarchy and sampling methodology, species and their relationship, common and rare species, latitude gradients, interactive network and food webs, niches and competition, demography, dispersal, evolution and natural selection, microevolution, macroevolution, origin of life

SECOND YEAR MODULES:

BIO 2142 : Population Ecology [credits 16]

Pre-requisites : BIO 1141, BIO 1243

Population distribution and abundance, population dynamics, population growth, life histories, competition, predation, herbivory, parasitism, mutualism; energy flow and nutrient cycling in ecosystems; biomes and factors determining spatial distribution of life zones in the world and South Africa.

(b) Modules Presented by the Botany Department

SECOND YEAR MODULES:

BOT 2144 : Plant Anatomy and Morphology I [credits 16]

Pre-requisites : BIO 1141, BIO 1142

Introduction to plant tissues and their specialization: the leaf: adaptations of xerophytes and hydrophytes, processes in leaves, the stem: development, adaptation to desert, saline and aquatic habitats, transport, the root: tissues, mycorrhizae, nodules, differentiation, adaptation to xeric conditions, system of the root and the stem, mineral absorption, plant nutrient requirements, nitrogen and phosphorus cycle, specialized morphological features of plants, in relation to their role in adaptation, reproductive biology and classification.

BOT 2245 : Plant Taxonomy and Reproductive Biology I [credits 16]

Pre-requisites : BIO 1141, BIO 1243

History of classification systems, species concept, principles of identification, nomenclature, description and classification of plants. Construction and use of keys, herbaria and botanical gardens, selected plant families. Pollination syndromes and seed dispersal mechanisms, evolution of flowers as reproductive organs, co-evolution of the flower-pollinator relationship.

BOT 2249 : Ethnobotany I [credits 16]

Pre-requisites : BIO 1141, BIO 1243

Definitions, history of the discipline, concrete and abstract relationships, scope of ethnobotany, indigenous knowledge systems, sub disciplines of ethnobotany, socio-ethnobotany, plants/animals and folklore, plants/animals and public education, protection of intellectual property rights, plants/animals and environmental management

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

BOT 3143 : Plant Ecology [credits 10]

Pre-requisites : BIO 2142 or BOT 2144

Population structure and parameters, demographic techniques, introduction to population growth models, meta-populations, density and density-independent factors, competition, herbivory and predation, disturbance, disturbance parameters, agents mechanisms and effects of disturbance, population and community responses to disturbance, patch dynamics, habitat destruction and fragmentation, mechanism of alien invasion, characteristics of alien plant species, disturbance models, application of disturbance theory.

BOT 3148 : Plant Systematics [credits 10]

Pre-requisites : BOT 2245

Introduction. Brief History of Systematics. Species Concepts. Infra-specific Taxa. The integration of taxonomy (identification, nomenclature, classification emphasizing flowering plants), Plant systematics will explore the origin and diversification of land plants while emphasizing flowering plants. Taxonomic characters. Plant nomenclature. Morphology and terminology of vegetative and reproductive parts of plants. Phylo-genetics, Gymnosperm and Angiosperm classifications: Cronquist, and Tahitian. Reproductive features. Detailed study of selected families from monocotyledonous and dicotyledonous families and their economic importance with special emphasis to South Africa. Laboratory emphasis on representative families and genera of flowering plants in South Africa, their economic importance, use of keys and manuals, Plant collection, identification and herbarium techniques.

BOT 3241 : Ethnobotany II [credits 10]

Pre-requisites : CHE 1140, BOT 2249

Data collection, organization, analysis, presentation and protection. Techniques of participatory rural appraisal; planning a long-term community project; history of plant based medicine; ecological role of secondary compounds: alkaloids, essential oils, phenolics and terpenoids. Basis and methodology for biological and chemical screening of plants and animal extracts for nutritional, medicinal and industrial properties (concepts, methods, tools and techniques). Conservation and community development.

BOT 3246 : Plant Physiology [credits 10]

Pre-requisites : CHE 1140, BOT 2244

Uptake, transportation and metabolism of some important minerals and water, photosynthesis, responses of plants to elevated atmospheric CO₂ concentrations and salinity.

BOT 3247 : Plant Ecophysiology [credits 10]

Pre-requisites : BOT 2144, BOT 2245

Ecophysiological research methodologies, climatic determinants, electromagnetic radiation, environmental factors and plant productivity, plant energy budgets, stable isotopes, temperature limits to plant life, soils, plants and disturbance in ecosystems and biogeochemical cycling.

CHEMISTRY DEPARTMENT**(a) Service Modules:**

Note: Students registered for service modules wouldn't be permitted to register for second year mainstream modules and/or subsequent mainstream modules.

FIRST YEAR MODULES:**CHE 1145 : General Chemistry for the Applied Services [credits 12]**

Pre-requisites : As per admission requirement of the School

The nature of Chemistry, scientific method, measurement and properties of matter. Phase equilibria, kinetic-molecular theory, chemical reactions and their laws (stoichiometry). Atomic structure and chemical bonding.

Classification of compounds, oxidation numbers, redox reactions, and electrochemistry. Thermochemistry, chemical equilibrium, and chemical kinetics. Solutions and their description: solubility and concentration; colligative properties: freezing point depression, osmosis.

CHE 1223 : Inorganic Chemistry for the Applied Sciences [credits 12]

Pre-requisites : As per admission requirement of the School

Co-requisites : CHE 1140 or CHE 1145

Periodic relationships among the elements. Descriptive chemistry of representative elements of Groups I to VIII: General characteristics; atomic and ionic radii; ionization energies; important binary and ternary salts; variations from the group norms; metals, metalloids and non-metals; preparation and uses; catenation: rings and chains; organometallic compounds; hydrides, halogen-halogen bonding; compounds and ions of the noble gases. Acid-base chemistry: Definitions of acids and bases; theories based on anion transfer; Lewis theory - electron-pair donors and acceptors; the Usanovich definition; relationship between acid-base and oxidation-reduction reactions; proton donors and acceptors in aqueous solution; soft and hard acids and bases; quantitative aspects of Lewis acid-base theory.

CHE 1224 : Organic Chemistry for the Applied Sciences [credits 12]

Pre-requisites : As per admission requirement of the School

Co-requisites : CHE 1140 or CHE 1145

Structure of organic compounds, stereoisomerism. Nomenclature, preparation and reactions of saturated and unsaturated hydrocarbons. Descriptive aliphatic chemistry according to the most important functional groups. Haloalkanes, aryl halides and alkanols - substitution and elimination reactions. Introduction to optical isomerism. Chemistry of the carbonyl group and amines. Aromaticity and nitration, sulfonation, halogenation, and alkylation of benzene.

(b) Mainstream Modules:

FIRST YEAR MODULES:

CHE 1140 : General Chemistry for the Applied Sciences [credits 16]

Pre-requisites : As per admission requirement of the School

Introductory concepts: the nature of Chemistry, scientific method, measurement and properties of matter. Phase equilibria: kinetic-molecular theory: intermolecular forces, solids, liquids, and gases. Chemical reactions and their laws (stoichiometry). Atomic structure and chemical bonding. Classification of compounds, oxidation numbers and redox reactions. Thermochemistry: enthalpy of formation, enthalpy of reaction. Solutions and their description: solubility and concentration; colligative properties: freezing point depression, osmosis. Chemical kinetics: rate of reaction, effect of temperature, pressure, and concentration on reaction rate, catalysis. Chemical equilibrium: reversibility, equilibrium constant, effect of temperature, pressure, and concentration on equilibria. Electrochemistry: electrolytic and voltaic cells.

CHE 1221 : Inorganic Chemistry I [credits 8]

Pre-requisites : As per admission requirement of the School

Co-requisites : CHE 1140 or CHE 1145

Periodic relationships among the elements. Descriptive chemistry of representative elements of Groups I to VIII: General characteristics; atomic and ionic radii; ionization energies; important binary and ternary salts; variations from the group norms; metals, metalloids and non-metals; preparation and uses; catenation: rings and chains; organometallic compounds; hydrides, halogen-halogen bonding; compounds and ions of the noble gases. Secondary chemical interactions: Electrostatic energies and dipole moments; dipole-dipole interactions; ion-dipole interactions; hydration of ions by solvent water; induced dipoles; hydrogen bonding; inclusion compounds. Acid-base chemistry: Definitions of acids and bases; theories based on anion transfer; Lewis theory - electron-pair donors and acceptors; the Usanovich definition; relationship between acid-base and oxidation-reduction reactions; proton donors and acceptors in aqueous solution; soft and hard acids and bases; quantitative aspects of Lewis acid-base theory.

CHE 1222 : Organic Chemistry I [credits 8]

Pre-requisites : As per admission requirement of the School

Co-requisites : CHE 1140 or CHE 1145

Structure, bonding and geometry of organic compounds. Nomenclature, preparation and reactions of saturated and unsaturated hydrocarbons. Aromaticity and nitration, sulfonation, halogenation, and nitration of benzene. Descriptive aliphatic chemistry according to the most important functional groups, with emphasis on mechanisms. Haloalkanes, aryl halides and alkanols - substitution and elimination reactions. Introduction to molecular symmetry and optical isomerism. Chemistry of the carbonyl group and amines.

SECOND YEAR MODULES:

CHE 2121 : Inorganic Chemistry II [credits 10]

Pre-requisites : CHE 1221

Transition elements: properties common to the transition elements; oxidation state tendencies and their causes; comparison of the 3d, 4d, and 5d elements, occurrence, isolation, and uses of the free elements; coordination compounds and complex ions; low coordinate geometries, tetrahedral, square planar, and intermediate geometries; structural, geometrical and optical isomerism; trigonal bipyramidal, square pyramidal, and intermediate geometries; octahedral and distorted octahedral complexes. Structure and bonding models in ionic and covalent compounds: Crystal and Ligand Field Theories and Molecular Orbital Theory; the linear combination of atomic orbitals approach; molecular orbital designations; heteronuclear diatomic molecules, polyatomic molecules; covalent bonds and bond energies; shapes and polarities of molecules; ionic bonding and the solid state.

CHE 2122 : Organic Chemistry II [credits 10]

Pre-requisites : CHE 1222

Conformational analysis of alkanes and cycloalkanes, stereochemistry of additions to alkenes and alkynes. Static stereochemistry: Chirality, sequence rules, enantiomers, diastereomers, *meso* compounds and racemic mixtures. Chemistry of haloalkanes: Dynamic stereochemistry, kinetics and thermodynamics of nucleophilic substitution (S_N1 and S_N2) and elimination (E_1 and E_2) reactions. Electrophilic aromatic substitution: substituent effects. Chemistry of the carbonyl group: nucleophilic addition, alpha substitution, condensation reactions. Aliphatic and aromatic amines and phenols. Application of IR and UV-Visible spectroscopy in organic chemistry.

CHE 2124 : Industrial Chemistry [credits 10]

Pre-requisites : CHE 1140, CHE 1221, CHE 1222.

Co-requisites : CHE 2121, CHE 2122

Introduction to the chemical industry: characteristics, scale, socioeconomic factors, major sectors, environmental issues. History and development of the chemical industry, the future, SA industry. Raw material sources: minerals, oil, natural gas, synthesis gas, C_1 building blocks. Heavy industrial inorganic chemicals: sources, limestone and derivatives, salt and soda, fertilizers. Process applications: chlor-alkali, cement, ammonia, nitric acid, sulphuric acid.

CHE 2125 : Applied Organic Chemistry [credits 10]

Pre-requisites : CHE 1222.

Co-requisites : CHE 2122, CHE 2124.

Introduction to heavy industrial organic chemistry. Olefins: hydrocarbon cracking, special syntheses, metathesis, diolefins: butadiene, isoprene, chloroprene. Ethylene oxidation products: ethylene oxide and derivatives, acetaldehyde, acetic acid, ketene. Biochemical materials, introduction to polymer chemistry: thermoplastics and thermosets, tacticity, olefin polymerization, natural rubber and poly-isoprene, formaldehyde resins, terephthalates, nylon, polyurethane, epoxy resins.

CHE 2220 : Analytical Chemistry: Classical techniques [credits 10]

Pre-requisite : CHE 1140

Co-requisites : CHE 2121

Sampling, sample preparation and statistical analysis of analytical data. Gravimetry. Principles of titrimetry. Precipitation titrimetry. Complex-formation titrimetry. Oxidation-reduction titrimetry. Choice of analytical methods, statistical analysis.

CHE 2223 : Physical Chemistry I [credits 10]

Pre-requisite : CHE 1140

Co-requisites : MAT 1141, MAT 1241, PHY 1125, PHY 1225.

Gases and their laws, the First Law of thermodynamics. Heat capacities, mechanical (PV) work, thermochemistry. The Second Law of thermodynamics, free energy functions and the chemical potential. Phase equilibria, binary mixtures, chemical reactions and chemical equilibrium.

CHE 2226 : Introductory Chemometrics [credits 10]

Pre-requisites : MAT 1142, MAT 1242

Co-requisites : CHE 2220

Sampling and sample preparation, choice of analytical methods. Statistical treatment of chemical data, experimental design, quality assurance.

CHE 2229 : Environmental Chemistry Fundamentals [credits 10]

Pre-requisites : CHE 1140, CHE 1221, CHE 1222

Environmental change over time and space, Global cycles, Qualitative and quantitative criteria of environmental quality. The atmosphere: emissions, dust and aerosols. Water: Chemistry of continental waters and the oceans; quality criteria for drinking water, sewage treatment and waste disposal. The geosphere: Silicate materials, chemical weathering and leaching, sediments and clays. Natural and anthropogenic unwanted additives and contaminants in food. Managing hazardous substances: Ecotoxicology and risk assessment. Measuring environmental change: Methodology and analytical methods.

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

CHE 3120 : Analytical Chemistry: Instrumental Techniques [credits 14]

Pre-requisites : CHE 2220

Co-requisites : CHE 3123

Instrumentation, principles and applications selected from: UNIVEN-Visible instrumentation and analysis; separation methods: extraction, chromatography, electrophoresis, mass spectrometry; electrochemical methods of analysis: potentiometry, coulometry, polarography; flame emission and atomic absorption spectrometry; fluorescence and phosphorescence; thermal analysis.

CHE3123 : Physical Chemistry II [credits 14]

Pre-requisites : CHE 2223.

Topics selected from: Surface chemistry, electrochemistry, Chemical kinetics and reaction mechanisms.

CHE 3124 : Applied Chemical Analysis and Food Science [credits 14]

Pre-requisites : CHE 2122

Co-requisites : CHE 2220, CHE 3120

Surface analysis, thermal methods, chromatography, chemistry and technology of food.

CHE 3125 : *Capita Selecta* in Applied Chemistry [credits 14]

Pre-requisites : CHE 2226

Co-requisites : CHE 3120, CHE 3123, CHE 3124.

Topics selected from, *inter alia*: Multiple and curvilinear regression. Optimization and operations research. Quality and environmental standards: ISO9000 and ISO14000. Intellectual property rights: Copyright, trademarks, trade secrets, patents.

CHE 3221 : Inorganic Chemistry III [credits 14]

Pre-requisites : CHE 2121

Co-requisites : CHE 3120, CHE 3123, CHE 3222.

Transition metal complexes: coordination chemistry, theory, structure and reactivity. Bonding models for transition metal complexes in detail (CFT, LFT, MOT). Binuclear complexes, metal salts and solvate complexes; ligand substitution reactions; oxidation-reduction reactions; oxidative addition and reductive elimination reactions. Organometallic chemistry and catalysis: synthesis, structure and bonding, reaction pathways. Lanthanides, actinides and transactinides. Reaction kinetics of coordination compounds. Thermodynamic and related aspects of ligand fields. Solid state and coordination compounds. Bonding in cluster compounds.

CHE 3222 : Organic Chemistry III [credits 14]

Pre-requisites : CHE 2122

Co-requisites : CHE 3120, CHE 3123, CHE 3221.

Aromatic and hetero-aromatic compounds. Introductory heterocyclic chemistry and synthesis of heterocyclic compounds. Carbonyl addition reactions: enamines, imines, oxazolines, aldol condensation and variations. MS and NMR spectroscopy.

CHE 3226 : Process Technology [credits 14]

Pre-requisites : CHE 2223

Co-requisites : CHE 3123, CHE 3221, CHE 3222, CHE 3227

Principles of chemical process technology. Flow diagrams, mass and energy balances, heat transfer and mass transfer. Reactor types, unit operations: distillation, extraction and flotation. Petro-chemistry and microbiological processes. Process control.

CHE 3227 : Chemistry of Materials [credits 14]

Pre-requisites : CHE 1140, CHE 2121, CHE 2122

Co-requisites : CHE 3221, CHE 3226

Chemistry and technology of: Metals and alloys; ceramics; polymers, paints and adhesives; glass; construction materials such as cement, concrete and bricks.

COMPUTER SCIENCE AND INFORMATION SYSTEMS DEPARTMENT

FIRST YEAR MODULES:

(a) Service Modules

COM 0110 OR COM 0210 : Computer Literacy [credits 4]

Introduction to Computers, Types of Computers, Hardware Components, Data Representation, Computer Arithmetic, Operating Systems, Applications Software, Computer Networks, Internet, Emailing, MS Windows, MS Word, MS Excel, MS PowerPoint, MS Access.

(b) Mainstream Modules

COM 1122 : Introduction to Computer Systems [credits 8]

Pre-requisites : Matric Mathematics E (HG) or D (SG)

History of computers, Basic computer architecture, Operating systems, Computer languages, Networks, The world-wide web and Writing reports and presentations

COM 1124 : Fundamentals of Computer Architecture [credits 8]

Pre-requisites : Matric Mathematics E (HG) or D (SG)

Digital systems, Signed integer representations, the basic instruction set, accessing memory, Input/Output, Floating point: IEEE 488 Standard coprocessors and Overview of RISC architecture

COM 1226 : Computer Technology [credits 8]

Pre-requisites : COM 1524

Co-requisites : MAT 1541, MAT 1642

Simple DC circuit analysis, CMOS VLSI MOS transistors, CMOS gates, The VLSI process, Designing a simple CMOS processor chip, Performance, System design, Component-based, system-on-chip, (SoC), CPU/RAM/ROM/peripherals, Address decoding, On-chip buses, Interrupts, DMA Interfaces: Digital Signal Processing, Pipelining, Monitors, Video Standards, storage devices, LANs, Serial lines, Keyboards and mice, Printers Interface Standards.

COM 1321 : Object Oriented Programming [credits 16]

Pre-requisites : Matric Mathematics E (HG) or D (SG)

Introduction to programming, Software development and objects, Programming basics, Numerical data and encoding, Processing input, Defining instantiable classes, Selection Statements, Repetition Statements, Characters and strings and Arrays.

SECOND YEAR MODULES:

COM 2120 : Digital Design Techniques [credits 10]

Pre-requisites : COM 1124

System specification, Top-level behavioural description, Architectural design, Register Transfer Level design, Hardware description languages, Testability, Timing and clocking, Logic design and Logic to layout.

COM 2123 : Imperative Programming [credits 10]

Pre-requisites : COM 1321

Basics, Aggregate types, Pointers and memory management, Examples of dynamic data structures: linked lists, trees, Function pointers and callbacks, I/O in C, Esoteric features, Basic C++, Inheritance and virtual functions, Templates and the STL.

COM 2125 : Operating Systems [credits 10]

Pre-requisites : COM 1122, COM 1124

Processes, Memory Systems, File Systems, Case studies: Windows 2000/XP, Unix, Linux.

COM 2126 : Human-Computer Interaction [credits 10]

Pre-requisites : COM 1122 or COM 1321

User-centred design of human-computer interaction, Social security and safety aspects of computing and of using computers, Interaction devices, Principles of design for understandability and usability, Design and evaluation of interactive systems.

COM 2128 : Artificial Intelligence Fundamentals [credits 10]

Pre-requisites : COM 1321

Introduction to AI, Introduction to frames and rules, Knowledge representation, logic and language, Problem solving and search, Uncertainty, probability, Bayes' Rule, and belief nets, Introduction to planning, Knowledge-based systems, agents, time, space, and ontologies and Learning.

COM 2129 : Database Fundamentals [credits 10]

Pre-requisites : COM 1321, COM 1124

Fundamental database concepts, Relational database model and normalization, Entity-relationship modelling, Transaction management and concurrency control, Distributed database management systems, Object-oriented databases, Client/server systems, Data warehousing, Databases in electronic commerce.

COM 2216 : Reasoning About Programs [credits 10]

Pre-requisites : MAT 1141, MAT 1142

Co-requisites : COM 1321

Introduction to universes, First-order logic, Pre-post-condition specifications, Commands as predicate transformers, Weakest pre-conditions, Path functions, Verification conditions, and testing *vs* proving.

COM 2224 : Algorithms and Data Structures [credits 10]

Pre-requisites : COM 1321

Co-requisites : COM 2123

Objects and classes, Inheritance, Algorithm, analysis, Abstract data types, Lists, stacks and queues, Recursion, Sorting algorithms, Trees and binary search trees, Graphs and paths, and Complexity analysis.

COM 2226 : Data Communication and Computer Networks [credits 10]

Pre-requisites : COM 1122, COM 1124, COM 1321, MAT 1141, MAT 1142

Communication and network architectures, The OSI and TCP/IP models, Data-link protocols, HDLC, PPP, Media Access Control (MAC) protocols, Network technologies, Internetworking issues, Internetworking facilities, switches, bridges, routers, and gateways, Routing protocols, Transport, Application, Application protocols.

COM 2228 : Contemporary Object-Oriented Concepts [credits 10]

Pre-requisites : COM 1321

Co-requisites : COM 2229

Basic object-oriented concepts, Models for the object-oriented approach, Simple object-oriented requirements models, Generalization/specialization and whole-part hierarchies, Object-oriented SDLCs, Object-oriented design, Object-oriented development.

COM 2229 : Systems Analysis [credits 10]

Pre-requisites : COM 1122 or COM 1124 or COM 1321

Co-requisites : COM 2129

Psychological and behavioral aspects, decision models, the value of information, IS in organizations: Organization models, types of organizational information systems, DSS, distributed processing, information systems planning, Players in the systems game, system building blocks, Information system development, systems analysis, Requirements discovery, Data modelling and analysis, Process modeling, Feasibility and the system proposal.

COM 2301 : Computer Science Laboratory [credits 10]

Pre-requisites : COM 1321

Co-requisites : COM 2123, COM 2224

The module provides essential practical work associated with taught course modules. The laboratory exercises undertaken depend on the choice of modules. The topics covered in each module laboratory are described in the separate module syllabi.

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

COM 3120 : Software Engineering I [credits 14]

Pre-requisites : COM 1321

Scope of software engineering, the software process, software life cycle models, teams, tools of the trade, testing, planning, estimating, Object Oriented Software Development using UML, System Specification using Z, Requirements Analysis, User Interface Evaluation.

COM 3121 : Distributed Operating Systems [credits 14]

Pre-requisites : COM 2125

Operating system structures, Distributed systems, Resource management, Protection and security, Distributed file systems, Example distributed systems.

COM 3128 : Systems Design and Implementation [credits 14]

Pre-requisites : COM 2229

The structured lifecycle model, IS building blocks, Structured design methodology, design aids and phase products, Systems design and construction, Database design and prototyping, User interface design, Application system development methodologies, Systems implementation and support, Cost/benefit analysis

COM 3217 : Professional Issues in Computing and Information Technology [credits 14]

Pre-requisites : COM 3120

Problems of ethical decision-making, Professionals, professional societies and their codes of conduct and practice, Case studies: Describing steps to resolve the current situation, Preparing policies and strategies, Graduate careers in the 21st century, Building the foundations to future career success, The law and contracts, Safety-critical systems and legal liability, A business view of contracts, Computer misuse and the law in South Africa, UK, and the USA, Health and safety issues.

COM 3220 : Software Engineering II [credits 14]

Pre-requisites : COM 3120

Introduction, Notations for design, Challenges and pitfalls of software design, Interaction models of humans and computers, Ergonomics, Interaction styles, Screen design and layouts, Architecture, Code construction, Configuration management, Quality assurance, Testing, Metrics, Software engineering in the real world.

COM 3221 : Advanced Algorithms [credits 14]

Pre-requisites : COM 2224

Complexity classes and NP-completeness, Machine model, Undecidability, Complexity classes and their relations, Reduction and completeness, Structure of the polynomial hierarchy, NP-complete problems, Graphs, trees and geometry, DFS, BFS and other search methods, Algorithms based on search techniques, Trees and acyclic digraphs.

COM 3224 : Architectural Support for Languages and Operating Systems [credits 12]

Pre-requisites : COM 2123, COM 2125

Architectural support for high-level languages: Instruction sets, Stacks, CISC versus RISC architectures, Scalar arithmetic, Data structures, Control constructs, Runtime Stack. Architectural support for operating systems: Address translation, Caching, Support for higher computational performance.

COM 3226 : Artificial Intelligence [credits 14]

Pre-requisites : MAT 1141, MAT 1242

The following are covered; Bayesian decision and classification, Introduction to learning theory and model evaluation, Neural networks, Learning from non-numerical data, Non-symbolic search techniques, Reinforcement Learning.

COM 3227 : Evaluation of Information Systems [credits 14]

Pre-requisites : COM 3120

The module emphasizes the essential role information system play in today's successful businesses and covers; Evaluation of business processes, Evaluation of IS investment, Evaluation of IS processes and products.

COM 3229 : Database design and implementation [credits 14]

Pre-requisites : COM 2129

The module develops practical skills in database implementation and manipulation and covers; Using commercial relational database management software, Implementing database designs, Using SQL (Structured Query

Language) to build application programs, Database administration and management, Executing and managing database transactions and concurrency control by means of SQL

MATHEMATICS AND APPLIED MATHEMATICS DEPARTMENT

FIRST YEAR MODULES:

(a) Service Modules:

MAT 0143/0243 : Basic Service Mathematics [credits 12]

Pre-requisites : None

Arithmetic operations, Ratio and proportion, Percentages, Simple interest, Averages, Basic Algebra, Factorization, Indices and Logarithms, Angles and straight lines, triangles, Geometrical constructions, Simple equations, Formulae, Simultaneous equations, Quadratic equations, Areas and Volumes, Graphs, Variations, Quadrilaterals and Polygons, The circle, Loci, trigonometry and Scale drawing

MAT 0144/0244 : Service Mathematics [credits 12]

Pre-requisites : At least F (HG) or E (SG) in Matric Mathematics or MAT 0543/0643

Differential Calculus, Integration, Proof of Theorems, The sine and cosine rules, Solid Geometry, Triangles of Velocities, The sphere, Latitude and Longitude, Sets, Matrices, Arithmetic and Geometric series and the Remainder Theorem

MAT 1143 : Mathematics for Biological, Earth and life Sciences I [credits 8]

Pre-requisites : MAT 0144 or at least an E (HG) or D (SG) in Matric Mathematics

Functions, Linear Programming, Limits, Continuity, The derivatives and differentiation, Exponential and Logarithmic functions, Curve Sketching, Optimization and other applications of derivatives, Trigonometric Functions, Definite and indefinite Integrals, Applications of the definite to Areas, Volumes, and Centers of Mass.

MAT 1145 : Business Mathematics I [credits 12]

Pre-requisites : MAT 0154/0244 or least an E (HG) or D (SG) in Matric Mathematics

Linear equations: Graphs of linear equations, algebraic solution of simultaneous linear equations, supply and demand analysis. National income determination. Revenue, cost, profit, exponential and natural logarithm functions. Mathematics of finance: compound interest, sinking fund, loan repayment, annuity and investment appraisal. Differentiation: rules of differentiation, marginal functions, optimization of economic functions and the derivatives of the exponential and natural logarithm functions.

MAT 1149 : Mathematics for Planners [credits 12]

Pre-requisites : MAT 0244 or MAT 0144

Basic concepts in mensuration, trigonometry; geometry, linear and matrix algebra; population growth models. Descriptive Statistics; sampling and collection of data, frequency distributions and graphical representations. Descriptive measures of location and dispersion. Probability and inference and Statistical distributions. Sampling frames, techniques and distributions. Estimation theory and hypothesis testing of sampling averages and proportions.

MAT 1243 : Mathematics for Biological, Earth and Life Sciences II [credits 8]

Pre-requisites : MAT 1143

Sample Space and Events, Probability, Counting methods, Probability and genetics, binomial and normal distribution, 1st and 2nd order equations, Oscillatory solutions, Systems of Difference equations applied to 1st and 2nd order Equations. Vectors in two dimensions, the inner product, Relative velocities, Matrices and their application

MAT 1245 : Business Mathematics II [credits 12]

Pre-requisites : MAT 1145

The gradient of a function and rates of change, Differentiation, Optimization, Curve sketching, Partial derivatives, optimization of functions of two variables. Application of differential calculus in economics: Demand and supply functions, elasticity, total revenue, marginal revenue and price elasticity. Introduction to Integral calculus: Area under a curve, the indefinite integral, and properties of definite integrals, techniques of integration.

MAT 2249 : Quantitative Methods in Planning [credits 12]

Pre-requisites : MAT 1249

Review of probability and descriptive Statistics. Types and sources of basic planning data. Forecasting models in planning: continuous functions applied to planning forecast, population projection techniques. Cohort survival and other techniques, gravity and migration models. Practical uses and application of Spreadsheets and Statistical packages; Tests of significance for multiple samples using nominal, original and ratio scale samples.

(b) Mainstream Modules:

MAT 1141 : Differential Calculus [credits 8]

Pre-requisites : FMT 1140, FMT 1240 or at least an E (HG) or D (SG) in Matric Mathematics

Introductory concepts: Functions, real numbers, definition of a function, graphs of elementary functions, limits, continuity; Differentiation of functions: derivatives, differentials, mean-value theorems for derivatives, Taylor's formula, L'Hospital's rule, curve sketching, differential of an arc, curvature.

MAT 1142 : Mathematics Foundation I [credits 8]

Pre-requisites(s) : FMT 1140, FMT 1240 or at least an E (HG) or D (SG) in Matric Mathematics

Elements of Sets and Logic. Real Number System and Inequalities. Complex Numbers, De Moivre's Theorem and Roots of Complex Numbers. Polynomials, Real and Complex Roots of Polynomials. Composite Functions and Inverse Functions. Trigonometric Functions and their Inverses. Euclidean Algorithm. Modular Arithmetic. Mathematical Induction. Permutations and Combinations. The Binomial Theorem

MAT 1241 : Integral Calculus [credits 8]

Pre-requisites : MAT 1141

Indefinite Integrals: antiderivative, indefinite integral, basic integration methods, techniques of integration, trigonometric and hyperbolic functions, transcendental functions. Definite integrals: definite integral, the limit of a sum, geometrical and physical meaning, improper integrals, basic properties, mean-value theorem for integrals, geometrical applications- areas, arc lengths, volumes, area of a surface, other applications-moments, centres of gravity; work of a variable force

MAT 1242 : Mathematics Foundation II [credits 8]

Pre-requisites : MAT 1142

The Straight Line, Introduction of Conic Sections, Parabolas, Ellipses, Hyperbolas, Rotation of Axes, Polar Coordinates and parametric Equations. Matrices and Determinants. Rank of a Matrix. System of Linear Equation, Crammer's Rule and Gaussian Elimination method. Vectors and Scalars. The Dot and Cross Product. Planes in 3D-space.

MAT 1246 : Mechanics I [credits 8]

Pre-requisites : PHY 1121

Vector calculus, vector product, scalar product, divergence, grad, curl, curvilinear coordinate systems. Conservation of energy and momentum, elastic and inelastic collisions, simple systems of particles. Projectile motions, variable mass motion, rigid body motion.

MAT 1247 : Numerical Analysis I [credits 8]

Pre-requisites : MAT 1141

Approximating a number: numerical errors and computer arithmetic. Solution of nonlinear equations in one variable: isolation of roots, graphical methods, bisection method, method of chords, Newton-Raphson method, fixed point method, evaluation or errors for various methods. Taylor series expansions, finite difference of derivatives, Computer problems.

SECOND YEAR MODULES:

MAT 2141 : Linear Algebra [credits 10]

Pre-requisites : MAT 1242

Vector spaces and subspaces, Linear Dependences, Basis and Dimensions, Linear Transformations, Eigenvalues and Eigenvectors, Inner Product Spaces and Cauchy Schwartz Inequality, Applications.

MAT 2142 : Multivariable Calculus [credits 10]

Pre-requisites : MAT 1241

Functions of several variables: introductory concepts, continuity and partial derivatives, directional derivatives, higher order derivatives and differentials, tangent plane, normal to a surface, Taylor's formula, extremum, space curves, Multiple and line integrals: double and triple integrals, and geometrical and physical applications, improper integrals dependent on a parameter and improper multiple integrals, line and surface integrals

MAT 2148 : Mathematical Modelling I [credits 10]

Pre-requisites : MAT 1241 or MAT 1246

Introductory concepts, descriptions of problems that can be investigated and indication of relevant mathematical topics, mathematical modelling of the problems, Models on real-world systems, Models that involve the concept of proportionality, derivatives, integrals, matrices, linear systems of equations, Simplifying of the model as required,

Examples from different fields of applications. Solving some of these models through graphical and other methods already learnt.

MAT 2241 : Real Analysis I [credits 10]

Pre-requisites : MAT 1142

The Real Number System: Algebraic property, Order Property and Completeness property. Sequences of real numbers: limits, convergence, divergence, limsup, liminf, subsequences, Cauchy sequences. Series: infinite series, series tests, power series. Topology of the real line: open sets, limits, closed sets, bounded sets, compact sets, Bolzano-Weierstrass theorem, Heine Borel Theorem, Functions: injective, surjective, inverses, compositions, limits of functions, continuity, Fixed Point Theorem. Differentiation in \mathbb{R} : Riemann sums, Riemann-Stieltjes integration

MAT 2242 : Ordinary Differential Equations I [credits 10]

Pre-requisites : MAT 1241

Introductory concepts: - basic definitions, families of curves, initial/boundary conditions, existence and uniqueness of solutions, models. Techniques of solving First Order Differential Equations:- separable variables, homogeneous equations, exact equations, linear equations and the integrating factor, the equations of Bernoulli, Riccati and Clairaut. Applications: - orthogonal trajectories, growth and decay, cooling, circuits and mixtures. Higher Order Differential equations with constant coefficients:-independence of solutions, the Wronskian, the superposition principle, characteristic equations, undetermined

MAT 2247 : Numerical Analysis II [credits 10]

Pre-requisites : MAT 1647

Direct and indirect methods for approximating solutions of linear systems: Gaussian elimination with pivoting and scaled partial pivoting, LU-decomposition, error analysis. Iterative schemes-Jacob scheme, Gauss-Seidel method, convergence of iterative schemes. Linear programming: introductory examples, graphical solution, simplex method, general linear programs, coordinate shift method, 2-phase method, discrete Chebyshev method. Numerical differentiation and integration: approximating the derivative, error analysis, trapezoidal and Simpson's rules, interpolatory and Gaussian quadratures. Using computer programming and packages.

MAT 2248 : Vector Analysis [credits 10]

Pre-requisites : MAT 2142

Introductory concepts: scalar and vector algebra. Vector function of a scalar argument, differential geometry of curves; Scalar and vector fields; Line, surface and volume integrals, integral theorems; Potential fields; Curvilinear coordinates; Cartesian tensor

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

MAT 3141 : Real Analysis II [credits 14]

Pre-requisites : MAT 2241

Construction of the real number system: Dedekind cuts, Cantor Sets. Introduction to Metric space Topology in \mathbb{R}^n : neighborhoods, cluster points, open sets, Compact sets, bounded sets, connected sets, Cantor's intersection Theorem, Bolzano-Weierstrass theorem, Heine-Borel Theorem, Lebesgue Covering Theorem. Functions in \mathbb{R}^n : Limits of functions, Continuity, Global continuity, bounded continuous functions, Continuity of the inverses, Lipschitz condition and contraction, continuity and compactness, continuity and connectedness, Brauer's Fixed point Theorem, Contraction of fixed points. Sequences in \mathbb{R}^n : Limits, convergence, divergence, subsequences. Sequence of functions: Uniform convergence, Cauchy's Criterion. Differentiation in \mathbb{R}^n .

MAT 3142 : Group Theory [credits 14]

Pre-requisites : MAT 2141

Groups and Subgroups, Cyclic groups. Groups of permutations and Cayley Theorem. Normal Subgroups, cosets and Quotient Groups. Direct Products and the Fundamental theorem of Finite Abelian Groups. Homomorphism and Isomorphism Theorems for Groups.

MAT 3146 : Finance Mathematics [credits 14]

Pre-requisites : MAT 2156, STA 2241

A simple market model: basic notions and assumptions. No-arbitrage principle. One-step Binomial model. Risk and return. Options and replication. Risk-free and risky assets: Simple interest, periodic and continuous compounding. Dynamics of stock prices. Expected return. Binomial and trinomial tree model. Martingale property. Discrete time market models: basic notions of a portfolio, self-financing, and predictability. Principle of arbitrage with its applications.

MAT 3147 : Partial Differential Equations [credits 14]

Pre-requisites : MAT 2242

Introduction: what are PDEs? Classification, PDEs with associated conditions as mathematical models. First Order Equations: quasilinear equations, method of characteristics, existence and uniqueness theorem, conservation laws, nonlinear equations. Second Order Equations in 2D: classification, canonical form of hyperbolic, parabolic and elliptic equations. Heat equation: method of separation of variables. One-dimensional Wave Equation: general solution, Cauchy problem

MAT 3149 : Ordinary Differential Equations II [credits 14]

Pre-requisites : MAT 2242

Differential equations with variable coefficients: - Cauchy-Euler equations, power series solutions, Bessel's equation, Legendre's equation. Laplace Transformation: - Laplace transforms and inverse transforms, translation theorems, solution of a differential equation. Linear systems of differential equations: - solutions using eigenvectors and eigenvalues, matrix exponential, stability of the systems. Nonlinear systems and stability: - introductory concepts, stability of the systems, conservative systems, phase plane methods.

MAT 3156 : Statistical Finance Mathematics [credits 14]

Pre-requisites : MAT 2156

Review on probability theory. Probabilities and events. Conditional probability. Random variables and expected values. Optimization models: A review on optimization theory. A deterministic optimization model. Probabilistic optimization problems with financial applications. Valuing by expected utility: Valuing investments by expected utility. The portfolio selection problem.

MAT 3241 : Complex Analysis [credits 14]

Pre-requisites : MAT 2241

Functions of complex variable. Complex valued functions. Analytic functions. Complex differentiation. Complex integration. Transformations. Power series of complex valued functions: Taylor series, Maclaurian series, and Laurent series. Singularities, poles, and residues of complex valued function.

MAT 3242 : Rings and Fields [credits 14]

Pre-requisites : MAT 3142

Basic properties of Rings and fields. Divisors of Zero. Integral Domains. Ideals and Quotient Rings. Maximal and Prime Ideals. Rings of Polynomial. Unique factorization Domains and Euclidean Domains.

MAT 3243 : Graph Theory [credits 14]

Pre-requisites : MAT 3142

Introductory concepts, Sub graphs, Complements, Graph Isomorphism, Vertex degree, Eulerian Graphs, Euler's Formula, Multigraphs and Euler's circuits, Connectivity, Hamilton Graphs, Chromatic number, Trees and their applications

MAT 3244 : Continuum Mechanics [credits 14]

Pre-requisites : MAT 1246 or PHY 2121, MAT 3147

Continuous material system, Algebra and calculus of Cartesian tensors, Stress and strain tensors. Generalized equations of motion. Introduction to theory of elasticity and plasticity with applications

MAT 3246 : Mechanics II [credits 14]

Pre-requisites : MAT 1246, MAT 3147

Dynamics and Statistics of a particle, moving coordinate systems, systems of particles and rigid bodies, Lagrange's equations and Hamiltonian theory

MAT 3247 : Numerical Analysis III [credits 14]

Pre-requisites : MAT 2247

Polynomial Interpolation. Approximation of Functions. Matrix eigenvalue problem. Power method, Schur's and Gershgorin's theorems. QR-algorithm for eigenvalue problem. Computer programming and packages

MAT 3248 : Mathematical Modelling II [credits 14]

Pre-requisites(s) : MAT 2148, MAT 2242

Differential equations used as mathematical models, qualitative analysis of differential equations with phase portraits, application to population growth, economics, finance, ecological models, and mechanics.

MAT 3249 : Geometry [credits 14]

Pre-requisites : MAT 2142, MAT 2242

Topics in projective planes, Euclidean and non-Euclidean Geometry

MAT 3256 : Advanced Financial Mathematics [credits 14]

Pre-requisites : MAT 3146

Portfolio management: Risk and expected return on portfolio with two securities and several securities. Options: General properties. Option pricing and applications. Financial modelling: Computer applications.

MICROBIOLOGY DEPARTMENT**SECOND YEAR MODULES:****MBY 2121 : Bacteriology [credits 10]**

Pre-requisites : BIO 1141, CHE 1140, CHE 1221 or CHE 1222

Historical perspective of Microbiology. Characteristics of different groups of microorganisms. General structure of bacteria, functions of the different bacterial organelles, shapes of bacteria, Gram- positive and Gram- negative bacteria. Factors affecting bacterial growth and bacterial growth curve. Bacterial nutrition, metabolism and genetics. Mechanisms and modes of spread of bacterial infections. Staphylococci. Streptococci. Corynebacteria. Bacilli. Lactobacilli. Neisseria. Clostridia. The Enterobacteriaceae- Escherichia, Salmonella, Shigella, Campylobacter, Helicobacter. Vibrio, Klebsiella, Proteus, Yersinia. Aeromonas. Plesiomonas. Haemophilus. Mycobacterium tuberculosis. Mycobacterium leprae. Brucella. Bordetella. Rickettsiae. Mycoplasma. Coxiella. Treponemas. Bacterial chemotherapy. Seminars.

MBY 2122 : Immunology [credits 10]

Pre-requisites : BIO 1141, CHE 1140, CHE 1221 or CHE 1222

This module introduces the student to the basic concepts, components and functions of the vertebrate immune system: Innate immunity. Acquired immunity. Cells and tissues of the immune system. Classification. Structure and properties of antibodies, monoclonal antibodies. Concepts of antigen and antigenicity. Immunogen and immunogenicity. Haptens. Adjuvants. Human leucocyte antigens. Antigen-antibody reactions. Definitions of tolerance. Autoimmunity. Immunodeficiencies. Hypersensitivity and immunosuppression. Principles of immunization, EPA in South Africa. Immunotherapy, immunoprophylaxis. Bacterial/viral/parasitic/fungal immunity. Seminars reports.

MBY 2223 : Environmental Microbiology [credits 10]

Pre-requisites : MBY 2121

Microorganisms in the various environments: viruses, bacteria, fungi, algae, protozoans, helminths. Soil classification, characteristics of microorganisms in the soil environment, Microbial activities in soil/soil borne pathogens. Role of microorganisms in nutrient/biogeochemical cycles- oxygen, water, carbon, nitrogen, sulphur. Mycorrhiza, lichens. Microbial interactions. Microorganisms in aquatic environment. Water and food borne pathogens. Indicator organisms. Domestic waste and waste treatment. Drinking water treatment and distribution. Microbiological Standards/criteria for water quality control. Airborne pathogens/toxins, bioaerosols and their control, microbial survival in the air. Beneficial and pathogenic microorganisms in Agriculture. Bioremediation. Biofilms. Microbial corrosion/biofilms. Environmental sample collection- specific methods for the isolation of pathogens from stools, food, water, air, soil. Introduction to molecular techniques. Pollution factors. Seminars/reports

MBY 2224 : Virology [credits 10]

Pre-requisites : MBY 2121

Nature and general characteristics of viruses: Structure and classification of viruses. Chemical composition of viruses. Viral susceptibility to chemical and physical agents/chemical composition of virus Cultivation of viruses/growth and detection of viruses in the laboratory. Viral cell interactions- lytic, steady and integrated State. Viral replication. Host responses to viral infections and outcome of viral infections. Viral genetics, viral interference and interferon. Some Virus infections: Hepatitis viruses, SARS virus infections, Herpes virus infections, Viral infections of the respiratory tract, alimentary tract, skin and mucous surfaces. Viral infections of the fetus and target organs. Measles, mumps, Rubella viruses. Enteroviruses. Influenzae and parainfluenza viruses. Ebola and Marburg viruses. Dengue fever and Lassa fever viruses. Rhabdovirus, Bacteriophages, viroids, virusoids and prions. Virus chemotherapy. Animal and plant viruses. Seminars

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

MBY 3126 : Food Microbiology [credits 14]

Pre-requisites : MBY 2121, MBY 2223, MBY 2224

Roles and significance of microorganisms in food. Incidence and types of bacteria, molds and yeasts, viruses, parasites in meat, seafood and vegetables, dairy products, delicatessen and related products, frozen foods, dehydrated foods. Intrinsic and extrinsic parameters of food that affect microbial growth. Food Spoilage- fruit and vegetables, fresh and processed meat, poultry and seafood, dairy products, canned foods, beers/wines/fermented foods, sugars/candies. Food preservation- with chemical/irradiation, with low temperature/high temperatures, with drying/fermentation. Microbiological Standards and criteria for food safety. Guidelines for different foods (National and International). Indicators for food sanitary quality. Determination of microorganisms in food: culture sampling methods, microscopic method, physical methods, chemical methods, immunological methods, bioassay, cell culture system. Factors affecting microbial growth in food. Food borne infections and food intoxications- Aetiology, transmission, pathogenesis, epidemiology and control of food and water borne diseases. Quality assurance of food. Seminars/reports

MBY 3127 : Industrial Microbiology [credits 14]

Pre-requisites : MBY 2121, MBY 2223, MBY 2224

This module introduces students to the broad application of microorganisms in industrial processes: Essentials of DNA technology and genetic engineering: plasmids, transposons, plasmid DNA isolation, bacterial transformation and expression, polymerase chain reaction, restriction enzymes, electrophoretic techniques; biodiversity; economics of industrial processes; metabolism and regulation of metabolism; nutrient supply; application of microbes in the production of enzymes, alcoholic beverages, antibiotics, and proteins; concepts of biofilm, bioremediation, and microbial corrosion; plant biotechnology. Seminars/reports

MBY3228 : Mycology and Phycology [credits 14]

Pre-requisites : MBY 2121, MBY 2223, MBY 2224

Structure and features of fungi and algae. Classification of fungi: Zygomycetes, Basidiomycetes, Ascomycetes, Deuteromycetes, Yeasts, Lichens. Fungal cells growth and reproduction/life cycle. Role of fungi and algae in nature and human life: Fungal diseases of humans Fungal diseases of plants and animals. Importance of fungi in agriculture. Industrial uses of fungi. Mycorrhiza. Diagnosis of fungal infections. Mycotoxins. Antifungal agents. Seminars/reports.

MBY3229 : Parasitology [credits 14]

Pre-requisites : MBY 2121, MBY 2223, MBY 2224

Introduction to parasites. Classification of parasites. Structure and features of protozoan. Life cycle patterns of protozoan- Amoebae, Flagellates, Haemoflagellates, Ciliates, Sporozoa. Epidemiology, pathogenesis, symptoms, laboratory diagnosis, treatment, prevention and control of protozoa diseases. Classification of Helminths. General features/characteristics of helminthes. Life cycle patterns of helminthes. Epidemiology, pathogenesis, symptoms, laboratory diagnosis, treatment, prevention and control of - Trematodes, Cestodes and Nematodes infections. Host-parasite relationship/immune response to parasitic infections. Arthropds and Arthropod borne infections. Seminars/reports.

PHYSICS DEPARTMENT

FIRST YEAR MODULES:

(a) Service Modules (Non-Calculus based Physics)

Note: Natural (Biological & Health) Science students who require Physics must take both the modules

PHY 1125 : Physics for Natural (Biological & Health) Sciences I [credits 8]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Motion in one and two dimensions, Newton's laws, Work, Energy, Power, Moments, elasticity, fluids, Temperature, Gas laws, Thermal properties of Matter. [Applications will be focused on Natural (Biological & Health) Sciences]

PHY 1225 : Physics for Natural (Biological & Health) Sciences II [credits 8]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Co-requisite : PHY 1125

Electrical forces and Potentials, Electric current and Nerve Conduction, Magnetism, Electromagnetic Induction, Geometrical Optics and Optical Instruments, Radioactivity, Atomic Structures and X-rays [Applications will be focused on Natural (Biological & Health Sciences)]

Note: Environmental and Agricultural Science students who require Physics must take both the following modules:

PHY 1127 : Physics for Environmental & Agricultural Sciences I [credits 12]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Motion in one and two dimensions, Newton's laws, Work, Energy, Power, Moments, elasticity, fluids, Temperature, Gas laws, Thermal properties of Matter. (Applications will be focused on Environmental & Agricultural Sciences)

PHY 1227 : Physics for Environment & Agricultural Sciences II [credits 12]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Co-requisite : PHY 1527

Electrical forces and Potentials, Electric current and Nerve Conduction, Magnetism, Electromagnetic Induction, Geometrical Optics and Optical Instruments, Radioactivity, Atomic Structures and X-rays. (Applications will be focused on Environmental & Agricultural Sciences)

(b) Main Stream Modules: (Calculus based Physics)

PHY 1121 : Mechanics [credits 8]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Co-requisites : MAT 1141

Rectilinear Motion, Vectors, Motion in two dimensions, Newton's laws and their applications, Circular motion, Work, Energy, Power, Linear Momentum, static equilibrium.

PHY 1122 : Waves and Optics I [credits 8]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Co-requisites : MAT 1141

Description and Properties of Waves, Properties of Sound Waves, Doppler Effect, Spherical Mirrors, Lenses and their Applications, Wave Properties of Light, Interference.

PHY 1223 : Properties of Matter and Heat [credits 8]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Co-requisites : MAT 1241

Elasticity, Fluid Mechanics, Temperature, Thermal expansions, Ideal Gas Law, Heat and First Law of Thermodynamics, Kinetic Theory of Gases, Heat Engines, Entropy and the Second Law of Thermodynamics.

PHY 1224 : Electricity and Magnetism [credits 8]

Pre-requisites : As per admission requirement of the School of Maths & Natural Science

Co-requisites : MAT 1241

Electric Fields, Gauss' Law, Electric Potential, Capacitance and Dielectrics, Current and Resistance, Direct Current Circuits, Magnetic Fields, Sources of the Magnetic Fields (Biot-Savart Law)

SECOND YEAR MODULES:

PHY 2121 : Classical Mechanics [credits 10]

Pre-requisites : PHY 1121, MAT 1141, MAT 1241

Vector Algebra, Rigid Body Dynamics, Angular Momentum, Moment of Inertia, General Motion in Three-Dimensions, Fundamentals of Lagrangian and Hamiltonian Mechanics.

PHY 2122 : Waves and Optics II [credits 10]

Pre-requisites : PHY 1122, MAT 1141, MAT 1241

Differential Wave Equations, Simple Harmonic Motion, Free and Forced Vibrations, Superposition of Waves, Group and Phase Velocities, Interference (by division of wave-fronts and amplitudes), Optical Interferometry, Diffraction, Polarisation.

PHY 2223 : Electrodynamics [credits 10]

Pre-requisites : PHY 1224, MAT 1141, MAT 1241

Electrostatics, Electric Fields in Matter, Magnetostatics, Magnetic Fields in Matter, Electrodynamics, and AC Circuit Analysis.

PHY 2224 : Modern Physics [credits 10]

Pre-requisites : PHY 1121, MAT 1141, MAT 1241

Special Theory of Relativity, Quantization of Charge, Light and Energy, Photo-electric and Compton Effects, Wave-like Properties of Particles, Schrödinger Equation.

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

PHY 3121 : Atomic and Nuclear Physics [credits 14]

Pre-requisites : PHY 2224

Rutherford Scattering, Bohr Atomic Model, Correspondence Principle, Atomic Spectra, Nuclear Properties, Nuclear Forces, Nuclear Models, Nuclear Decay and Radioactivity, Nuclear Reactions.

PHY 3122 : Solid State Physics [credits 14]

Pre-requisites : PHY 2121, PHY 2224

Crystallography, X-ray Diffraction, Crystal Defects, Lattice Vibrations, Heat Capacity, Metallic behaviour and Free Electron Gas, Energy Bands.

PHY 3125 : Energy Physics [credits 14]

Pre-requisites : PHY 2122, PHY 2223

Theory and Technology on the Production, Transmission and Storage of Energy with Special Reference to the Physics of Nuclear Energy, Electrical Energy, Solar Energy, Wind Energy And Fuel Cells.

PHY 3223 : Thermodynamics and Statistical Mechanics [credits 14]

Pre-requisites : PHY 2121

Laws of Thermodynamics and their Applications, Joule-Thompson Effect, Chemical Potential, Basic Concepts of Statistical Mechanics, Maxwell-Boltzmann Statistics, Bose-Einstein Statistics, Fermi-Dirac Statistics.

PHY 3224 : Quantum Mechanics [credits 14]

Pre-requisites : PHY 2224

Schrödinger Equation and Probability Interpretation, Eigenfunctions and Eigenvalues, One-dimensional Potentials, Operator Methods, Harmonic Oscillator, Schrödinger Equation in Three Dimensions, Angular Momentum, Hydrogen Atom.

PHY 3226 : Electronics [credits 12]

Pre-requisites : PHY 2223

DC Circuit Theorems, Semiconductor Diodes, Diode Applications, Bipolar Junction Transistors, DC Biasing: BJT's, Field-Effect Transistors, FET Biasing, Operational Amplifiers.

PHY 3227 : Project [credits 12]

Pre-requisites : PHY 2121, PHY 2122, PHY 2223, PHY 2224

STATISTICS DEPARTMENT

FIRST YEAR MODULES:

(a) Service Modules:

STA 1148 : Basic Statistics (Business, Economics and the Social Sciences) [credits 8 credits]

Pre-requisites : MAT 0144 or equivalent.

Overview of Statistics; Scales of measurement. Descriptive Statistics Frequency distribution and graphs; Measures of central tendency; Measures of variation. The Normal distribution. Central limit theorem.

STA 1149 : Basic Statistics (for the Natural and Applied Sciences) [credits 8]

Pre-requisites : MAT 0144 or equivalent.

Overview of Statistics; Scales of measurement. Descriptive Statistics Frequency distribution and graphs; Measures of central tendency; Measures of variation. The Normal distribution. Central limit theorem.

STA 1248 : Basic Statistical Inference (Business, Economics and the Social Sciences) [credits 12]

Pre-requisites : STA 1148

Confidence intervals, Hypothesis testing with one sample and with two samples: means and proportions, Tests of independence and goodness of fit. Comparing of variance. ANOVA: comparing of several means.

STA 1249 : Basic Statistical Inference (for the Natural and Applied Sciences) [credits 8]

Pre-requisites : STA1149

Confidence intervals, Hypothesis testing with one sample and with two samples: means and proportions, Tests of independence and goodness of fit. Comparing of variance. ANOVA: comparing of several means.

STA 3248 : Biometry [credits 12]

Pre-requisites : STA 1248 or STA 1249

Biometrical Analysis of Agricultural Experiments, Statistical tests of hypotheses, Correlation and regression, ANOVA.

STA 3249 : Fundamentals of Agronomic Experimentation [credits 12]

Pre-requisites : STA 1249 or STA 1248

Principles of field experimentation, Analysis of different experimental designs: completely randomized, randomized block designs, and Latin squares. Factorial Designs, missing plots.

STA 5249 : Experimental Design [credits 12]

Pre-requisites : STA 1248 or STA 1249

Topics: Principles of Experimental Design, Basic Experimental Designs: Completely randomized, Randomised Block, Latin Squares and Factorial Designs, Fixed and random effects.

STA 7249 : Experimental Design [credits 12 or 14]

Pre-requisites : STA 1248 or STA 1249

Advanced experimental designs: Balanced incomplete block designs, 2^k factorial designs, missing plot techniques, Nested and Split-plot design. Analysis of covariance.

(b) Mainstream Modules:

STA 1141 : Introduction to Statistics [credits 8]

Pre-requisites : MAT 0544/MAT 0644 (Service Mathematics)

Measurement scales. Descriptive Statistics: Measures of location and spread. Graphical presentation. Shapes of distributions. Populations and samples. The Central limit theorem and its application. Sampling distribution of a Statistic – the t , F and Chi -Square distributions.

STA 1142 : Introductory Probability [credits 8]

Pre-requisites : MAT 0544/MAT 0644 (Service Mathematics)

Co-requisites : STA 1541

Mathematical counting techniques. Probability and relative frequency, properties, addition rule, mutually exclusive events. Conditional probability, Baye's Theorem and independence. Random variables and probability distributions. Sample spaces and assignment of probabilities to events. Special discrete probability distributions and the normal distribution.

STA 1241 : Elementary Statistical Methods I – Introductory Inference [credits 8]

Pre-requisites : STA 1141, STA 1142

Confidence Intervals for the mean and variance of a normal distribution; Confidence Intervals for means and proportions with large samples; Testing hypotheses about the mean and variance of a normal distribution; Testing Hypotheses about means and proportions with large samples. Comparing several means - Analysis of Variance

STA 1242 : Elementary Statistical Methods II – Correlation and Regression [credits 8]

Pre-requisites : STA 1141, STA 1142

The simple linear regression model. Estimation of the parameters of the simple linear regression model. Hypothesis testing in simple linear regression. Pearson's product-moment and Spearman's rank correlation coefficients; Testing hypothesis about the correlation coefficient. Relation between regression and correlation. Analysis of contingency tables – the chi-square test. Case Studies

SECOND YEAR MODULES:

STA 2141 : Probability Distributions [credits 10]

Pre-requisites : STA 1142, MAT 1141, MAT 1241

Co-requisite : MAT 2141

Random variables. Probability density functions and cumulative distribution functions. Special discrete probability distributions; special continuous probability distributions. Characteristic functions and their properties. Covariance and correlation. Joint, marginal and conditional distributions. Expectation and variance. Moments and moment generating functions. Functions of random variables and their properties. Limit Theorems.

STA 2142 : Multiple Regression [credits 10]

Pre-requisites : STA 1241, STA 1242, MAT 1242

Co-requisite : MAT 2141

Multiple regression models. Estimation of parameters. Inference about regression parameters and mean response; Extra sums of squares. Prediction intervals. Residual analysis. Multi-collinearity and its effects. Diagnostics and remedial measures. Model building – stepwise procedures. Case Studies

STA 2241 : Statistical Computing [credits 10]

Pre-requisites : STA 1142, MAT 1141, MAT 1241

This course is about acquiring the fundamental computing skills necessary for effective careers as statisticians and data analysts. Computation data analysis is an essential part of modern statistical sciences. Competent statisticians must not just be able to run existing programs, but to understand the principles on which they work. They must also be able to read, modify and write code, so that they can assemble the computational tools needed to solve their data-analysis problems, rather than customizing problems to fit tools provided by others.

At the heart of this course, students will learn the core of ideas of programming functions, objectives, data structures, flow control, input and output, debugging, logical design and abstraction. In the content of Statistics and data analysis through writing code to assist in numeric and graphical statistical analyses. Students will in particular learn how to write maintainable code, and to test code for correctness. A language of currency, e.g. R, SAS, Stata, should be used for this course and emphasis should be on hands on skills acquisition.

STA 2242 : Sampling Techniques [credits 10]

Pre-requisites : STA 1241, STA 1242

The need for sampling. Carrying out a sample survey. Probability and non-probability sampling. Simple random Sampling. Estimation. Sampling from stratified populations. Cluster and multistage sampling. Case studies.

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

STA 3141 : Statistical Inference [credits 14]

Pre-requisites : STA 2141

Sampling distributions. Point and interval estimation. Optimal properties of estimators. Methods of estimating parameters. UMP tests and Neyman-Pearson lemma. Likelihood ratio tests. p -values and errors. Tests of hypotheses about means, variances, proportions, difference between means, ratio of variances.

STA 3142 : Industrial Statistics [credits 14]

Pre-requisites : STA 2141

Quality Improvement in the Modern Business Environment. Modeling Process Quality. Inferences about Process Quality. Methods and Philosophy of Statistical Process Control (SPC). Control Charts for Variables.

STA 3143 : Introduction to Research and Official Statistics [credits 14]

Pre-requisites : STA 1241, STA 1242

Rationale for research. Research design. Sources of data. Sampling procedures. Demographical population parameters. Basic projections of population parameters. Use of Statistical packages.

STA 3241 : Time Series Analysis [credits 14]

Pre-requisites : STA 2141

Introduction to the Classical Approach to Time Series Analysis. The decomposition of a time series. Trend analysis. Smoothing methods. Analysis of seasonal effects. Forecasting. Case Studies.

STA 3242 : Experimental Design [credits 14]

Pre-requisites : STA 1241, STA 2141

Principles of ANOVA. Completely randomized designs. Randomized block designs. Analysis of covariance. Two-way experimental layouts. Other Factorial Designs. Latin Squares. Response surfaces. Case Studies

STA 3243 : Multivariate Methods [credits 14]

Pre-requisites : STA 2141, MAT 2247

Multivariate distributions. Sampling from the multivariate normal distribution. Transformations to near normality. Inferences about the mean vector. Comparison of several multivariate means.

ZOOLOGY DEPARTMENT**(a) Degree modules presented jointly by the Botany and Zoology departments:****FIRST YEAR MODULES:****BIO 1141 : The Tree of Life [credits 16]**

Pre-requisites : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in Matric Biology (Life Science), Physical Science and Mathematics.

Biological principles and the science of biology, the origin and chemistry of life, classification and phylogeny of animals, review of bacteria, fungi and viruses, kingdom protista (classification 7 characteristics), kingdom animalia (a general review), kingdom plantae (review, life cycles and theories of their possible origin).

BIO 1142 : Cell Biology [credits 12]

Pre-requisites : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in Matric Biology (Life Science), Physical Science and Mathematics.

Organic chemistry: the scope of biochemistry, organic compounds of importance to the living system, structure, functional groups, stereochemistry and characteristics of the carbohydrates, lipids, proteins and nucleic acids, chemical-physical principles of biochemical bonds, matrix of life: weak interactions in an aqueous solution, energetics of life. Cytology: history of cell biology, cell theory, membrane biology, structure and features of eukaryotic cells, techniques used in cytology. prokaryotic cells. Genetics: The nature and structure of the hereditary material introductory principles of mitosis and meiosis, Chromosome variation, sex determination and the mechanism of sex related inheritance.

BIO 1243 : Ecology, Adaptation and Evolution [credits 16]

Pre-requisites : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in Matric Biology (Life Science), Physical Science and Mathematics.

Ecosystems, Energy flow and nutrient cycling, Analysis of communities, ecological hierarchy and sampling methodology, species and their relationship, common and rare species, latitude gradients, interactive network and food webs, niches and competition, demography, dispersal, evolution and natural selection, microevolution, macroevolution, origin of life

(b) Degree modules presented by the Zoology department:**BIO 1244 : Introductory Human Anatomy and Physiology [credits 12]**

Pre-requisites : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.

Introduction to human Physiology and Anatomy: chemical basis of life, introduction to cytology and cell physiology, histology: skin and integument, support and movement, integration and coordination, reproduction, processing and transportation

SECOND YEAR MODULES:**BIO 2142 : Population Ecology [credits 16]**

Pre-requisites : BIO 1141, BIO 1243

Conditions and resources. Geometric population growth. Logistic population growth. Key factor. Life table and survivorship curve. Life history. Demographic stochasticity. Niche partitioning. Sample species richness.

BIO 2246 : Conservation Biology I [credits 16]

Pre-requisites : BIO 1141, BIO 1243

The natural world; principles and concepts; human impacts; habitat destruction and disturbance; sustainability; history of conservation biology; selecting protected areas, *in situ* and *ex situ* conservation issues; the landscape mosaic; managing for biodiversity; ecological restoration.

ZOO 2141 : Animal Physiology [credits 16]

Pre-requisites : BIO 1142, BIO 1243

Introduction to cell structure and functions of cell organelles, specialized cell types, cell division, principles of cellular transport, Structure and function of tissues, organs and organ systems, Nutrition and feeding, Structure and function of the respiratory systems, including movement of respiratory gases in, out and around the body, Structure and function of the urinary system, and its role in regulating body fluids, Characteristics of body structure of a range of invertebrates and vertebrates in particular to type of skeletal systems, and movement, structure and function of the nervous system including sense organs, initiation and transmission of nerve impulses and conduction across the synapse, co-ordination of the body in terms of sensory, integrative and motor functions of the nervous system

ZOO 2144 : Principles of Genetics [credits 16]

Pre-requisites : BIO 1142, BIO 1243

An introduction to the central principles of Genetics, covering the following topics: Genes and loci, Genetic markers and variation, DNA replication, Mutation, Recombination, Transcription, Protein synthesis (Translation), Regulation of gene expression, Epigenetics, Genetic engineering, Genetic structure, Gene flow, Genetic drift, Selection, Artificial selection and domestication, Assortative mating/Sexual selection, Evolution, Mendelian Genetics, Hardy Weinberg Equilibrium.

ZOO 2248 : Animal Phylogeny [credits 16]

Pre-requisites : BIO 1141, BIO 1243

Introduction to evolutionary biology, the tree of life: classification and phylogeny, patterns of evolution, evolution in the fossil record, history of life on earth, biogeography, evolution of biodiversity. Major animal body plans

THIRD YEAR MODULES:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

BIO 3144 : Basic Freshwater Ecology [credits 16]

Pre-requisites : BIO 2142, BIO 2246

Identify the applicable ecological concepts, the physico-chemical aspects of water, the hydrological cycle, the global and national water situation. The definition, structure, classification and functioning of wetlands and riparian areas. The origin, classification, zonation and functioning of lentic water bodies. The origin, geomorphology, zoning and functioning lotic water bodies. A review of rivers, fresh water lakes and wetland types in a global and regional perspective. Processes within water bodies (gasses, nutrients, primary and secondary production and cycling of nutrients).

BIO 3246 : Conservation Biology II [credits 16]

Pre-requisites : BIO 2142, BIO 2246

Biodiversity, the creation of ecosystems; ethics of 21st century conversation, the central role of people ; political issues; ecosystem services; climate change and biodiversity; invasive alien organism; protected areas; species conservation "green" economics; conserving the evolutionary process; conservation in forest-, savanna-, marine, drylands-, freshwater-, agricultural- and urban systems; conservation efforts, agreements and treaties.

ZOO 3141 : Animal Ecophysiology [credits 16]

Pre-requisites : ZOO 2141, ZOO 2144

The physics of heat exchange, heat transfer, heat balance and control systems, animal responses to the thermal environment, physics of water movement, evaporative water loss and water turnover rates, nutritional requirements, energy, energy metabolism and the energy budgets, communication in the ecosystem.

ZOO 3249 : Evolutionary Genetics [credits 20]

Pre-requisites : ZOO 2144, ZOO 2248

The Central Dogma, Genes and Genomes, Extranuclear DNA, Molecular genetics, Darwin and Selection, Sexual selection, Adaptation, Mendel and Inheritance, Gene frequencies and allele frequencies, The Modern Synthesis, Genetic Drift and Migration, Recombination, Neutral vs Functional Variation, Epigenetics, Speciation, Molecular ecology, Conservation genetics, Ancient DNA, Measuring Genetic Diversity and Structure, Population genetics, Modelling and model testing, Coalescence, Phylogenetics, Gene trees, Species trees, Phylogenomics, Phylogeography.

BACHELOR OF HONOURS DEGREE (BSc HONS)

1 **ADMISSION REQUIREMENTS FOR BACHELOR OF SCIENCE HONOURS DEGREE:**

- (a) A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE.
- (b) Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval.
- (c) Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

2 **RULES FOR PROGRESSION:**

- (a) The general rules of the University will apply, **unless** otherwise specified for the School of Mathematical and Natural Sciences.
- (b) The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration.
- (c) **Project reports have to be handed in before the 30th of November of the academic year in order to graduate in May graduation.**
- (d) Except with the special permission of SENATE, the duration of the full-time study will not exceed TWO years
- (e) The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the school rules and unless he/she has been registered for one year at this University.

3 **ASSESSMENT FOR BSc HONS DEGREE:**

- (a) Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%.
- (b) A student must attain a minimum of 50% pass in each of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module.
- (c) All written examinations will be taken only during official examination sessions.
- (d) A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting.
- (e) To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher.
- (f) To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level.
- (g) Special examinations will **not** be offered in the BSc Hons degree.
- (h) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination:
 - By illness on the day of the examination or assessment, or immediately before the examination or assessment, provided that a medical certificate from a registered medical practitioner is submitted to SENATE, and/or provided that the student's application is supported by the invigilator concerned or another responsible person; or
 - As a result of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, provided that the SENATE judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

4 **RE-REGISTRATION AND DEFERMENT OF STUDIES:**

- (a) For the duration of the degree, the student must register by the stipulated date.
- (b) Registration each year is subject to the recommendation of the Head of Department and may be rejected in the 2nd year on grounds of unsatisfactory progress.
- (c) Students wishing to defer studies at any stage must submit a motivated application beforehand. If granted, such deferment will be for a period of ONE year only.

4 **BSC HONS DEGREES OFFERED IN SCHOOL [CREDITS FOR EACH = 120]**

- | | |
|---|--------------|
| • BSc HONS in BIOLOGICAL SCIENCES: BIOCHEMISTRY | CODE: MNHHBC |
| • BSc HONS in BIOLOGICAL SCIENCES: BOTANY | CODE: MNHHBT |
| • BSc HONS in BIOLOGICAL SCIENCES: ZOOLOGY | CODE: MNHHZO |
| • BSc HONS in MATHEMATICS | CODE: MNHSHM |
| • BSc HONS in APPLIED MATHEMATICS | CODE: MNHHAM |
| • BSc HONS in CHEMISTRY | CODE: MNHSHC |
| • BSc HONS in COMPUTER SCIENCE | CODE: MNHHCS |
| • BSc HONS in PHYSICS | CODE: MNHSHP |
| • BSc HONS in MICROBIOLOGY | CODE: MNHSMH |
| • BSc HONS in STATISTICS | CODE: MNHSHS |

6. **MODULE DESCRIPTIONS AND SPECIFIC RULES IN DEPARTMENTS IN THE SCHOOL:**

BIOCHEMISTRY DEPARTMENT

BSc HONS IN BIOLOGICAL SCIENCES: BIOCHEMISTRY [CODE: MNHHBC]

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
BCM 5123 (12): Genomics, Proteomics and Bioinformatics	BCM 5222 (12): Research Techniques
BCM 5125 (12): Applied Biochemistry and Biotechnology	BCM 5223 (12): Physiological Biochemistry and Cell Biology
	BCM 5224 (12): Protein Folding and Advanced Enzyme Kinetics
COMPULSORY YEAR MODULES	
BCM 5300 (45): Research Project and Report	
BCM 5301 (15): Research Methods and Seminars	
Total Credits = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Biochemistry Department:

BCM 5123 : Genomics, Proteomics and Bioinformatics [credits 12]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

Genomics: Comparative and functional genomics (including at the host parasite interface); genome sequence acquisition; mutations and their consequences; epigenetics; biomedical genome research; gene mapping (including ESTs, SNPs, pseudogenes, transposable elements); DNA microarrays and chemotherapy; recombinant DNA technology; applications of recombinant DNA;

Proteomics: protein interaction networks; post translational modifications; various approaches to proteomic studies;

Bioinformatics: applications of bioinformatics to map out gene and protein networks; genome mining; application of bioinformatics tools in functional genomics and proteomics.

BCM 5125 : Applied Biochemistry and Biotechnology [credits 12]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

Applied aspects of basic biological sciences and how to develop an innovative approach to science in general; recombinant DNA technology and synthetic biology (with respect to its application in the production of novel products such as antibiotics, biopolymers, enzymes, unnatural amino acids and nucleotides; and its application in

the technologies such biosensors, industrial enzymes); protein folding and engineering; bioreactors (biofuels production as case study); nanobiotechnology (with respect to application in bio-distribution, nano-drug delivery, bio-imaging).

BCM 5222 : Research Techniques [credits 12]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

Hands-on applications of various advanced biochemical research techniques with emphasis on: extraction and purification of biomolecules; ultrasonication and ultracentrifugation; 2DGE; spectrometric methods (including SEC, fluorimetry, UV-Vis, CD-, FTIR, and MS- spectrometric); microscopic methods (fluorescence, SEM, TEM, HRTEM); NMR; FACS; microarrays; biomolecular interaction studies (including slot blot, far-Western, SPR, pull-down assays).

BCM 5223 : Physiological Biochemistry and Cell Biology [credits 12]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

Cell structure and function (prokaryotes and eukaryotes); replication and cell division; cancer biology; signal transduction; biogenesis of proteins and targeting; microtubules; cell motility; membrane trafficking; endocytosis and exocytosis; compartment and sorting; nutrient malabsorption and drug metabolism.

BCM 5224 : Protein Folding and Advanced Enzyme Kinetics [credits 12]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

The concept of protein folding; molecular chaperones; protein misfolding diseases; protein quality control; advanced enzyme kinetics and mechanistic abilities of enzymes; non-protein biocatalysis; catalytic nucleic acids; regulation; allosteric enzymes; covalent modifications for enzyme regulation; co-factors; vitamin essential metals; zymogens; practical applications of enzymes as biological catalysts in industrial processes.

BCM 5300 : Research Project and Report [credits 45]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

Students design and execute a research project. They learn to plan and structure appropriate experimental approaches to achieve particular aims of their projects. They finally compile a scientific report (mini-dissertation). The project is written up in a formal document comprising: Introduction/Background, Aims (objectives), Materials and Methods, Results, Discussion, Conclusions and recommendations.

BCM 5301 : Research Methods and Seminars [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.

Research planning, data handling and scientific writing; presentation of research proposal and research progress (seminars); analysis of biochemistry research publications are conducted towards developing critical understanding (journal club). Ethical and philosophical issues in biochemistry research are addressed.

BOTANY DEPARTMENT:

BSc HONS IN BIOLOGICAL SCIENCES: BOTANY [CODE: MNHHBT]

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
BOT 5101 (16): Research Methodology	
Candidates must select a minimum of four modules from the following selection which must include two Botany (BOT) modules:	
BOT 5104 (16): Applied Plant Ecology	BOT 5206 (16): Plant Physiology
BOT 5105 (16): Applied Plant Ecophysiology	BOT 5208 (16): Plant Systematics
BIO 5110 (16): Freshwater Ecology	BOT 5212 (16): Applied Ethnobotany
BIO 5111 (16): Conservation Biology III	ZOO 5207 (16): Molecular Ecology
BCM 5301 (15): Research Methods and Seminars	BCM 5222 (15): Research Techniques
	MBY 5204 (15): The role of Microorganisms in Industrial Processes
	MBY 5205 (15): The Role of Micro-organisms in the Environment
COMPULSORY YEAR MODULES	
BOT 5302 (42): Research Project	
Total Credits only = 120	

Each programme consists of six modules with a minimum total credit value of 120. In order to qualify for the BSc Honours degree a candidate must pass a minimum of **SIX** modules listed in the programme. The core and optional modules offered in an academic year may vary depending on the staffing situation in the departments. Students are advised to consult the head of the department regarding the modules offered in a particular year.

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Botany Department

BOT 5101 : Research Methodology [credits 16]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.
History and philosophy of science, the scientific method, literature search and administration, compilation and presentation of a literature review, project proposal, hypotheses, project report and scientific paper, computer as a research tool. Applied biometry, questionnaire survey, selected research techniques. The module code depends on the supervision of the Research Project. Candidates supervised by a staff member from the Botany Department will register for BOT and candidates supervised by a staff member from the Zoology Department will register for ZOO.

BOT 5104 : Applied Plant Ecology [credits 16]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3143

Discussion of the biomes of South Africa, community sampling techniques, introduction to aerial-photo interpretation, plant community structure, composition and function, plant life forms, floristic vegetation analysis, succession, population structure and demographic processes, resource allocation and reproductive effort, population sampling techniques, population models, life history classification, plant reproductive strategies, regeneration ecology, species interactions, ecology of alien invasive plants.

BOT 5105 : Applied Plant Ecophysiology [credits 16]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3247

Plant distribution, function, response and performance with respect to drought, fire, cutting, grazing and so on; biochemical co-evolution.

BOT 5206 : Plant Physiology [credits 16]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3246

Plant mineral nutrition and ion uptake, nitrogen cycling in nature, metabolism of nitrogen, chemistry of photosynthesis, C₄ photosynthesis and crassulacean acid metabolism, Respiration in plants, mycorrhiza, responses of plants to elevated atmospheric and rhizospheric CO₂ concentration, salinity and water stress and photosynthesis, nutrient uptake and growth, seed physiology.

BOT 5208 : Plant Systematics [credits 16]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3148.

Introduction to different classification systems. Scientific methods in plant systematics, floral terminology, Plant nomenclature. International Code of Botanical Nomenclature. The species concept. Natural and artificial classification methods. Rules and regulation of nomenclature. Biogeography. Systematics in biodiversity and conservation. Description and documentation and analysis of biological diversity. Detailed study of Gymnosperms, monocotyledonous and dicotyledonous families of major plant groups and their economic importance. Guide to Plant Collection, Identification and preservation. Field Techniques. Herbarium techniques.

Major project will be involved in the collection, identification, economic importance, and systematic study of a particular genera or species or plants of interest in Limpopo Province.

BOT 5212 : Applied Ethnobotany [credits 16]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BIO 3241

Approaches to field methodology; plant resources and plant products; scientific methodology and quantitative techniques; plant based products: composition, validation and innovation; policies and ethics; conservation and sustainable development.

BOT 5302 : Research Project [credits 42]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.
A research project centered on the theme "sustainable utilization and conservation of natural resources".

CHEMISTRY DEPARTMENT

BSc HONS IN CHEMISTRY [CODE: MNHSHC]

This programme is designed for students who intend to graduate as professional chemists. The module content offered in a particular year or semester may vary according to the availability of staff. The core and optional modules offered in an academic year may vary depending on the staffing situation in the departments. Students are advised to consult the head of the department regarding the modules offered in a particular year. In order to qualify for the BSc Honours degree a candidate must pass a minimum of **SIX** modules and CHE 5300 listed in the programme.

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
CHE 5130 (14): Analytical Chemistry	
CHE 5131 (14): Inorganic Chemistry	
CHE 5132 (14): Organic Chemistry	
CHE 5133 (14): Physical Chemistry	
OPTIONAL SEMESTER 1 MODULES	OPTIONAL SEMESTER 2 MODULES
CHE 5138 (14): Analytical and Inorganic Chemistry of Natural Products	CHE 5238 (14): Natural Products Chemistry
A student who fails one module in the first semester may be allowed to replace the failed module by an additional, equivalent 2nd semester module in consultation with the HOD.	
	CHE 5230 (14): <i>Capita Selecta: Analytical Chemistry</i>
	CHE 5231 (14): <i>Capita Selecta: Inorganic Chemistry</i>
	CHE 5232 (14): <i>Capita Selecta: Organic Chemistry</i>
	CHE 5233 (14): <i>Capita Selecta: Physical Chemistry</i>
COMPULSORY YEAR MODULES	
CHE 5300 (42): Research project	
Total Credits only = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Chemistry Department:

CHE 5130 : Analytical Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Separation methods: chromatography, electrophoresis and mass spectrometry. Atomic and molecular spectroscopy. Statistical treatment of analytical results.

CHE 5131 : Inorganic Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Inorganic polymers: chains, rings, cages and clusters. Recent developments in coordination chemistry: organometallic complexes, nonaqueous solvents. Transition metal storage, transport and biomineralization. Reaction pathways of zinc enzymes and related biological catalysts. Calcium in biological systems.

CHE 5132 : Organic Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Spectroscopy: Physical methods for the structure elucidation of natural products. Synthesis design: functional group transformations, protection and C-C bond formation strategies. Modern synthetic methods, including neighbouring group participation, carbanion and carbene chemistry; heteroatom-stabilized carbanions. Advanced heterocyclic and heteroaromatic chemistry.

CHE 5133 : Physical Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

The introduction of quantum mechanics and the early models. Modern quantum mechanics. Quantum chemical description of relevant cases. The hydrogen atom. Multi-electron atoms. The study of molecules.

CHE 5138 : Analytical and Inorganic Chemistry of Natural Products [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Transition metal storage, transport, and bio-mineralization. Calcium in biological systems. Biological and synthetic dioxygen carriers. Ferredoxins, hydrogenases, and nitrogenases; metal sulphide proteins. Metals in medicine. GC-MS and its analytical applications in natural products chemistry. Electroanalytical methods: Polarography, cyclic voltammetry. UNIVEN-Visible spectrophotometry.

CHE 5230 : Capita Selecta: Analytical Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Co-requisites : CHE 5130

A detailed study of the theory and applications of selected analytical techniques, such as: Polarography and other electrochemical methods; radiochemical methods; X-ray methods; thermal analysis.

CHE 5231 : Capita Selecta: Inorganic Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Co-requisites : CHE 5131

Occurrence and pathways of organometallic compounds in the environment. Toxicities of organometallic compounds; coordination preferences for environmental complexation by organometallic compounds. Organometallic compounds in polymers - their interaction with the environment. Environmental aspects of organolead, organoarsenic, organomercury, organotin and organosilicon compounds.

CHE 5232 : Capita Selecta: Organic Chemistry [credits 15]

Pre-requisite : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Co-requisites : CHE 5132

Recent developments in advanced Organic Chemistry, as published internationally, such as: Modern methods of asymmetric synthesis; synthesis and biosynthesis of natural products; physical organic chemistry; orbital symmetry.

CHE 5233 : Capita Selecta: Physical Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major;

Co-requisites : CHE 5133

The spectra of atoms. Molecular spectroscopy. Nuclear magnetic resonance. Statistical thermodynamics: the distribution of molecular states; relating molecular properties and thermodynamic quantities.

CHE 5238 : Natural Products Chemistry [credits 14]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

Classes of natural products. Biosynthetic routes. Spectrometric methods for different classes of natural products.

CHE 5300 : Research project [credits 42]

Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major;

Seminars on research methodology and philosophy in Chemistry: choosing a topic, planning and executing a research project, characteristics of successful project proposals and reports. Participating in a current research project in the Department.

COMPUTER SCIENCE AND INFORMATION SYSTEMS DEPARTMENT**BSc HONS IN COMPUTER SCIENCE****[CODE: MNHCS]**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
COM 5131 (10): Introduction to Grid Computing	COM 5231 (10): Introduction to Wireless and Ad hoc Networking
COM 5132 (10): Software Engineering Methodology	COM 5232 (10): Forensic Computing
COM 5133 (10): Information Systems Security	COM 5233 (10): Compiler Principles
COM 5134 (10): Scientific Research Method	COM 5234 (10): Guided Reading II
COM5135 (10): Guided Reading I	
COMPULSORY YEAR MODULES	
COM 5300 (30): BSc Honours Research Project	
Total Credits only = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Computer Sciences Department:

COM 5131 : Introduction to Grid Computing [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Fundamentals of Service Oriented Architecture (SOA) and Grid. Benefits of Grid Computing. Terms and Terminology, Types of Grid. Grid Architecture, Overview of Grid Standards (OGSA, OGSA-DAI, GridFTP, WSRF, OGSI, etc). Security in Grid, Grid Topology, Practical Issues in Resource Allocation, deployment and Optimization in Grid. Creating Grid Environment with Globus Toolkit 4.

COM 5132 : Software Engineering Methodology [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Software Specification Styles and Methods, Software Engineering for Mobile Commerce (analysis, design, wireless intranet Stack etc). Component-Based Development. Web Services architecture, management and development. Architectural Design of Product lines. Change Control, Software Evolution and their relationship to Configuration Management. Necessity of Change as a fact of life for Software Systems. Evolution of Legacy Systems and Re-use. Impact Analysis and Refactoring in Software. Tools for Software Comprehension and Maintenance.

COM 5133 : Information Systems Security [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Access Control Mechanisms, Application Security towards software application development, Business Continuity and Disaster Recovery Planning, Cryptography- Confidentiality, integrity, authorization and authentication, Information Security and Risk Management, Legal, Regulations, Compliances and Investigations, Operations Security, Physical (Environmental) Security, Security Architecture and Design

COM 5134 : Scientific Research Method [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Introduction to Research Methods; Criteria for good scientific practice, Literature Review, Critical Use of existing knowledge, Generalize and define limits of new findings, Scientific Publishing. Classification of Conferences and Journals, Judging what material is publishable, publishing, Referee Process, Theory of Science: Theory of Science and Computational Science, viz Innovation, Systemizing and Classifying, Hypothesis development and testing, Establishing laws and Models, Criticizing own and others work. Ethics: Computer Ethics in Research. Ethics and Plagiarism. Development of Research Plan

COM 5135 : Guided Reading I [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

For modules whose title is "**Guided Reading**", the contents would be variable and would reflect current professional issues in Computer Science. This is because there is a rapid evolution in the field of computer science and this requirement reflects the new framework for Honours programme in Computer Science

COM 5231 : Introduction to Wireless and Ad hoc Networking [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Basics of Networking and Protocols, Network Standards and the OSI Network layered model, Transmission Basics and Media, Network Layer protocols and Network Routing, Topologies and Access Methods, WANs, Internet Access and Remote Connectivity, Internet and TCP/IP Protocols, Socket Programming basics, Multimedia Communications and QoS Basics, Troubleshooting Network Problems: Error detection and Correction

COM 5232 : Forensic Computing [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Understanding the computer crime and the people on the scene; Modus Operandi; Motive and Technology, Nature of digital evidence and its value to forensic investigation. Collection and preservation of digital evidence; forensic analysis of different operating systems and Networks. Using digital evidence in an investigation. Building the computer crime case; legal issue in an investigation. Stream and Block Ciphers, Public Key Encryption, Hash functions and Data Integrity. Identification of Entry Authentication. Digital Signatures. Key Management Techniques.

COM 5233 : Compiler Principles [credits 10]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Introduction to Compilation. General structure of a Compiler. Overview of compilation technology. Phases of Compilation – Lexical, Syntax and Semantic Analysis, Regular Expressions, Finite-State Machines – DFA and NFA. Type Checking, Intermediate Code generations and Scanner generator tools, Grammars and Languages, Tokens, Lexeme

COM 5234 : Guided Reading II [credits 10]*Pre-requisites : Successfully completed BSc degree with Microbiology as major*

For modules whose title is "Guided Reading", the contents would be variable and would reflect current professional issues in Computer Science. This is because there is a rapid evolution in the field of computer science and this requirement reflects the new framework for the BSc Honours programme in Computer Science

COM 5300 : Honours Research Project [credits 30]*Pre-requisites : Successfully completed BSc degree with Microbiology as major*

Students would be expected to carry out a research project on a topic of their choice within the computing field. A qualified member of Staff will offer guidance in the carrying out of the research.

MATHEMATICS AND APPLIED MATHEMATICS DEPARTMENT

Students are advised to seek for guidance from the Head of the Department in the matters concerning the programmes to be followed and pre-requisites, other than just a BSc degree with Mathematics or Applied Mathematics as a major, for certain modules. For example: a student who wishes to follow the Applied Mathematics degree would require certain modules, like MAT 3247, which are electives in some undergraduate programmes.

BSc HONS IN APPLIED MATHEMATICS [CODE: MNHHAM]

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MAT 5130 (15): Numerical Solution of ODEs	MAT 5230 (15): Numerical Solution for Partial Differential Equations
MAT 5149 (15): Partial differential Equations	
Candidate must select any THREE (3) of the following modules:	
MAT 5132 (15): Functional Analysis	MAT 5233 (15): Integral Equations
MAT 5133 (15): Calculus of Variations	MAT 5241 (15): Financial Mathematics
MAT 5137 (15): Measure and Integration Theory	MAT 5243 (15): Graph Theory
MAT 5140 (15): Matrix Analysis	MAT 5246 (15): Topics in stability and Optimization
MAT 5141 (15): Stochastic Differential Equations	MAT 5253 (15): Control Theory
MAT 5143 (15): Fluid Mechanics	STA 5244 (16): Stochastic processes
STA 5141 (16): Advanced Probability Theory	
COMPULSORY YEAR MODULES	
MAT 5301 (30): Project	
Total Credits only = 120	

BSc HONS IN MATHEMATICS**[CODE: MNHSHM] - package 1**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MAT 5134 (15): Algebra I	MAT 5232 (15): General Topology
MAT 5137 (15): Measure and Integration Theory	MAT 5236 (15): Algebra II
Candidate must select any TWO (2) of the following modules:	
MAT 5132 (15): Functional Analysis	MAT 5250 (15): Number Theory II
MAT 5133 (15): Calculus Of Variations	
MAT 5136 (15): Complex Analysis	
MAT 5138 (15): Number Theory I	
MAT 5140 (15): Matrix Analysis	
COMPULSORY YEAR MODULES	
MAT 5301 (30): Project	
Total Credits only = 120	

BSc HONS IN MATHEMATICS**[CODE: MNHSHM] - package 2**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MAT 5138 (15): Number Theory I	MAT 5244 (15): Combinatorics II
MAT 5144 (15): Combinatorics I	MAT 5250 (15): Number Theory II
Candidate must select any TWO (2) of the following modules:	
MAT 5134 (15): Algebra I	MAT 5243 (15): Graph Theory
MAT 5136 (15): Complex Analysis	MAT 5252 (15): Partition Theory II
MAT 5140 (15): Matrix Analysis	
MAT 5151 (15): Theory of Computer Algebra	
MAT 5152 (15): Partition Theory I	
COMPULSORY YEAR MODULES	
MAT 5301 (30): Project	
Total Credits only = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Mathematics Department:

MAT 5130 : Numerical Solution of ODEs [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
Initial Value Problems for ODEs. Boundary Value Problems for ODEs.

MAT 5132 : Functional Analysis [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
Metric spaces, Banach spaces, Hilbert spaces. Fundamental theorems for normed and Banach spaces. Banach's Fixed Point Theorem. Approximation theorem. Spectral theory of linear operators in normed spaces. Spectral theory of bounded self – adjoint operators

MAT 5133 : Calculus of Variations [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
The fundamental problem of calculus of variation. Euler differential equation. Euler Poisson equation. Ostradisky problem. Brachistochrone equation. Transversality condition. Extrema conditions. Jacobi condition. Legendre condition. Weierstrass condition. Canonical forms. Direct methods. Ritz method. Kantorovich method. Applications.

MAT 5134 : Algebra I [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
Exact sequences of modules, Projective and injective modules, Simple and semi –simple modules, An outline of Homology theory, Tensor product of modules, Simple and Primitive Rings, The Jacobson Radical, Semi-simple rings, The Prime Radical and the Prime/Semi-prime rings.

MAT 5136 : Complex Analysis [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
To be selected from the following topics: Conformal mappings. Singularities, Harmonic functions, Entire functions. Analytic function continuation. Asymptotic methods. Laplace transform and application.

MAT 5137 : Measure and Integration Theory [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
Set theory, rings, sigma-rings, fields, sigma-fields, Borel measure, measure, outer measure. Caratheodory, extension procedure for measures on a ring. Measurable functions. Lebesgue measure on a real line. Lebesgue integrals. Convergence Theorems. Fatou's Lemma and Fubini's theorem.

MAT 5138 : Number Theory I [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school
Divisibility, Prime Number, Greatest Common divisors and Prime factorization, Congruences, Multiplicative Functions, Primitive Roots, Quadratic Residues, Decimal Fractions and Continued Fractions and Nonlinear Diophantine equations.

MAT 5140 : Matrix analysis [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Eigenvalues, eigenvectors and similarity. Unitary equivalence and normal matrices. Canonical forms. Hermitian and symmetric matrices. Matrix norms. Location and perturbation of matrices. Positive definite Matrices

MAT 5141 : Stochastic Differential equations I [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Preliminaries. Ito integrals. Ito processes and Ito formula. Stochastic Differential Equations

MAT 5143 : Fluid mechanics [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Cartesian tensors, Conservation laws, Incompressible flow, properties of fluid flows, small disturbance theory, shallow water theory, Compressible flow. Shock waves

MAT 5144 : Combinatorics I [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Introduction to combinatorics and the pigeon hole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5149 : Partial Differential Equations [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Sturm-Liouville Problems and eigenfunction expansion. Elliptic Equations: basic properties, maximum principle, Green's identities, separation of variables. Green's Functions and Integral Representations: Dirichlet problem, Neumann's function in the plane, heat kernel. Variational Methods: calculus of variations, function spaces and weak formulation.

MAT 5151 : Theory of Computer Algebra [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Introduction to cryptography, codes and computer algebra, fundamental algorithms, Euclidean algorithms and applications of Euclidean algorithms.

MAT 5152 : Partition Theory I [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Elementary Theory of Partitions, Inversions in permutations and q – identities, Infinite series generating functions, Restricted partitions and permutations.

MAT 5230 : Numerical Solution of Partial Differential Equations [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Elliptic boundary value problems, finite differences; Parabolic initial boundary value problems, finite differences; hyperbolic Partial Differential Equations

MAT 5232 : General Topology [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Basic set theory. Topological spaces and their construction. Continuous functions. Connectedness, compactness. Separation axioms. Urysohn's Lemma. Tychonoff theorem. Stone-Cech Compactification. Metrizable spaces.

MAT 5233 : Integral Equations [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Integral equations of Fredholm's type. Fredholm's Theorems. Solvability. Systems of integral equations. Equations with degenerate kernels. Equations with symmetric kernels. The resolvent. Equations involving weak singularities. Singular equations. Equations of Volterra type. Integral equations of the first kind.

MAT 5234 : Transformation Geometry [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Isometries and similarity transformations in Euclidean plane and Euclidean space. Preservation properties of isometries. Existence and classification of isometries in the Euclidean plane. Application to concepts and problems in geometry, physics and modern algebra and to the analysis of congruence and similarity.

MAT 5236 : Algebra II [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Finite groups, simple and non-simplicity tests. The group generator, group classification, dihedral groups and mirrors. Symmetry groups; Lie groups with applications to differential equations. Crystallographic groups with examples from Solid State Physics.

MAT 5241 : Financial Mathematics [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Topics will be chosen from the following: Expectation pricing. Arbitrage pricing. Expectation vs. arbitrage. Discrete processes. Stochastic calculus. Ito calculus. Change of measure-the C-M-G theorem. Martingale representation theorem. Construction strategies. Black-Scholes model. Black-Scholes action. Pricing market securities. Interest rates. Bigger models.

MAT 5243 : Graph Theory [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Structure of graphs, trees and connectivity, Eulerian and Hamilton graphs, planar graphs, graph embeddings, graph colorings and factorizations, subgraphs and degree sequence

MAT 5244 : Combinatorics II [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Numbers, Powers and logarithms, Sums and products, Integer functions, Harmonic numbers, Fibonacci numbers, Bernoulli numbers and sequences, analysis of algorithm, Euler summation formula and asymptotic approximations.

MAT 5246 : Topics in stability and Optimization [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Liapunov's Stability theory. Pontryagin's theorem.

MAT 5250 : Number Theory II [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Introduction to combinatorics and the pigeonhole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5252 : Partition Theory II [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Partition Identities, Jacobi's triple product, Gaussian polynomials and inversions, representation of numbers as sums of squares, Engel's expansion.

MAT 5253 : Control Theory [credits 15]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

Introduction to control theory: examples; continuous-time systems, discrete-time systems. Linear control systems; controllability, observability and polynomials; linear feedback, State observers, realization of constant systems, discrete-time systems. Optimal control; Performance indices. Variational methods. Potryagin's principle. Linear regulator.

MAT 5301 : Project [credits 30]

Pre-requisites : As per the departmental requirements subject to admission rules of the school

The research project shall be based on individual effort in the preparation of the research proposal and carrying out of the actual research with the assistance of a qualified member of Staff. The research shall be done on any topic of interest picked up from either pure mathematics or applied mathematics.

MICROBIOLOGY DEPARTMENT**BSc HONS IN MICROBIOLOGY [CODE: MNHSMH]**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MBY 5102 (15): Advanced Immunological Concepts and Techniques	MBY 5204 (15): The Role of Microorganisms in Industrial Processes
MBY 5103 (15): The Role of Microorganisms in Disease	MBY 5205 (15): The Role of Microorganisms in the Environment
COMPULSORY YEAR MODULES	
MBY 5300 (30): Research Project and Report	
MBY 5301 (30): Advanced Research Methodology and Seminars	
Total Credits = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Microbiology Department:

MBY 5102 : Advanced Immunological Concepts and Techniques [credits 15]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Overview of the vertebrate immune system; production and use of monoclonal antibodies; tolerance induction; immunosuppression; immunodeficiencies; autoimmunity, hypersensitivity reactions; blood transfusion and transplantation immunology; applications of agglutination, precipitation, complement system and human leucocyte antigen-MHC; enzyme immunoassays; immunofluorescence microscopy; flow cytometry; nucleic acid isolation; reverse transcriptase, multiplex and real-time PCR; endonuclease digest analysis; DNA sequencing, editing and bioinformatics; viral infectivity assays; vaccine design, development and evaluation.

MBY 5103 : The Role of Microorganisms in Disease [credits 15]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Epidemiology, transmission, pathogenesis, clinical presentations, diagnosis, treatment and prevention and control of common bacterial, viral, fungal and parasitic diseases including: Staphylococcal and streptococcal diseases, anthrax, brucellosis, diarrhea/dysentery, gonococcal and meningococcal infections, syphilis, tuberculosis and leprosy, meningitis, whooping cough, diphtheria, clostridial infections, HIV, viral hepatitis, enterovirus diseases, yellow fever, herpes virus, measles infections, CMV and EBV infections, HPV infections, Lassa fever, Ebola, influenza viral infections, other haemorrhagic fever virus. amoebiasis, giardiasis, trichomoniasis, trypanosomiasis, leishmaniasis, malaria, cryptosporidiosis, schistosomiasis, hookworm, ascariasis, taeniasis, enterobiasis, onchocerciasis/loasis, dracunculosis, pneumocystis infection and other parasitic diseases, cryptococcosis, histoplasmosis, blastomycosis, candidiasis, aspergillosis, pityriasis versicolor, scaly cutaneous mycosis, and cutaneous fungal infections. Prions

MBY 5204 : The Role of Microorganisms in Industrial Processes [credits 15]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Gene loss, amplification and arrangement; lac and galactose operons; gene library; recombination and screening; sequencing; restriction fragment length polymorphism analysis and related techniques; restriction mapping; plant biotechnology; fermentation systems; production of antibiotics and antibiotic sensitivity assays. Application of bacteria and fungi in industry. Quality control and quality assurance; intellectual property rights.

MBY 5205 : The Role of Microorganisms in the Environment [credits 15]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Advanced lecture on different microbes in the environment- soil, aquatic environment, air. Beneficial and pathogenic microorganisms in agriculture. Water and food borne pathogens- bacteria, fungi, parasites. Advanced lecture on indicator organisms. Biogeochemical cycles: (water, carbon, nitrogen, Sulphur, iron, phosphorous, oxygen). Bioremediation, biofilm formation and significance in bioremediation, corrosion, and disease. Environmental sample collection and identification of organisms. Water treatment- chlorination, chloramination, ozonation, irradiation. Domestic water treatment.

MBY 5300 : Research Project and Report [credits 30]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

MBY 5301 : Advanced Research Methodology and Seminars [credits 30]

Pre-requisites : Successfully completed BSc degree with Microbiology as major

Research methodology. Preparation of research proposal. Art of scientific writing. Poster presentation. Oral presentation. Statistical methods. Seminars

PHYSICS DEPARTMENT**BSc HONS IN PHYSICS [CODE: MNHSH]**

In order to qualify for the degree, a student must pass **eight modules**. The fundamental modules and optional modules offered in an academic year vary depending on the staffing situation in the department. Students are advised to consult the Head of department about the modules offered in a particular year.

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
PHY 5121 (14): Classical Mechanics	PHY 5221 (14): Electrodynamics
PHY 5122 (14): Quantum Mechanics I	PHY 5222 (14): Statistical Mechanics
PHY 5123 (14): Solid State Physics I	PHY 5223 (30): Project
Candidate must select any TWO (2) of the following modules:	
PHY 5124 (10): Renewable Energy	PHY 5224 (10): Solid State Physics II
PHY 5125 (10): Mathematical Methods of Physics	PHY 5225 (10): Quantum Mechanics II
PHY 5126 (10): Laser Physics I	PHY 5226 (10): Laser Physics II
PHY 5127 (10): Electronics	PHY 5227 (10): Nuclear and Particle Physics
Total Credits only = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Physics Department:

PHY 5121 : Classical Mechanics (core) [credits 14]

Pre-requisites : As per the admission requirement of the school

Application of Lagrangian and Hamiltonian Mechanics, Central Force Field, Theory of Vibration, Canonical Transformation, Poisson's and Lagrange's Brackets.

PHY 5122 : Quantum Mechanics I (core) [credits 14]

Pre-requisites : As per the admission requirement of the school

Schrödinger Equation, Wave Function and Operator Algebra, Principles of Wave Mechanics, Harmonic Oscillator, One-dimensional Potentials, The WKB Approximation, Variational Methods, Vector Space, Eigenvalues and Eigenvectors of Operators and Applications.

PHY 5123 : Solid State Physics I (core) [credits 14]

Pre-requisites : As per the admission requirement of the school

Crystal Bonding, Free Electron Theory of Metals, the Quantized Free Electron Theory, the Band Theory, Magnetic Properties of Solids, Ferromagnetism, Anti-Ferromagnetism and Ferrimagnetism

PHY 5124 : Renewable Energy [credits 10]

Pre-requisites : As per the admission requirement of the school

Solar radiation, Solar Cells and Collectors and Applications, Wind Energy, Bio-Mass, Bio-Fuels, Environmental Effects.

PHY 5125 : Mathematical Methods of Physics [credits 10]

Pre-requisites : As per the admission requirement of the school

Vector Calculus, Matrices and Applications, Fourier Transforms, Special Functions and Polynomials, Integral Transforms.

PHY 5126 : Laser Physics I [credits 10]

Pre-requisites : As per the admission requirements of the school

Will be offered in collaborations with National Laser Centre, CSIR

PHY 5127 : Electronics [credits 10]

Pre-requisites : As per the admission requirement of the school

Semiconductor Devices, Transistor Amplifiers (Single and Multiple transistors), Operational and Feedback Amplifiers and its Applications, Digital Circuits and Integrated Circuits, Logic Gates, Flip-flops, Multi-vibrators and Digital to Analogue and Analogue to Digital Converters

PHY 5221 : Electrodynamics (core) [credits 14]

Pre-requisites : As per the admission requirement of the school

Electrostatics, Boundary Value Problems, Green Functions, Multipole Expansion, Dielectric Media, Magnetostatics, Time-varying Fields, Maxwell's Equations.

PHY 5222 : Statistical Mechanics (core) [credits 14]*Pre-requisites : As per the admission requirement of the school*

Methods of Ensembles, Rotational, Vibrational and Nuclear Spin Effect of Simple Molecules, Applications of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac Statistics.

PHY 5223 : Project (core) [credits 30]*Pre-requisites : As per the admission requirement of the school***PHY 5224 : Solid State Physics II [credits 10]***Pre-requisites : PHY 5123*

Phonons I: Crystal vibrations, Phonon II: Thermal Properties, Thermal Conductivity, Imperfection in Crystals, Optical Properties and Physics of Semiconductors.

PHY 5225 : Quantum Mechanics II [credits 10]*Pre-requisites : PHY 5122*

Angular Momentum, Spherically Symmetric Potentials, Scattering, Principles of Quantum Dynamics, Spin, Rotations and other Symmetry Operations, Perturbation Theory.

PHY5226 : Laser Physics II [credits 10]*Pre-requisites : PHY 5126*

Will be offered in collaborations with National Laser Centre, CSIR

PHY 5227 : Nuclear and Particle Physics [credits 10]*Pre-requisites : PHY 5122*

Nucleon Structure, Nuclear Forces, Bulk Properties of Nuclei, Nuclear Excitation and Decay, Elementary Particle Dynamics, Symmetries, Bound States, Feynman Calculus.

STATISTICS DEPARTMENT**BSc HONS IN STATISTICS [CODE: MNHSHS]**For the BSc. Honours degree in Statistics, a student must pass **five** modules and STA 5300

Select any FIVE (5) of the following modules:	
SEMESTER 1 MODULES:	SEMESTER 2 MODULES:
STA 5141 (18): Probability Theory	STA 5241 (18): Demographic Methods
STA 5142 (18): Multivariate Statistical Analysis	STA 5242 (18): Time Series Analysis
STA 5143 (18): Statistical Quality Control	STA 5243 (18): Analysis of Discrete Data
STA 5144 (18): Sampling Survey and Research Methods	STA 5244 (18): Stochastic Processes
STA 5145 (18): Generalised Linear Models	
COMPULSORY YEAR MODULES	
STA 5300 (30): Research Project	
Total Credits = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Statistics Department:**STA 5141 : Probability Theory [credits 18]***Pre-requisites : As per the admission requirement of the school*

Probability spaces and random variables. Distribution functions. Mathematical expectation. Conditional distribution and Independence. Characteristic Functions. Convergence concepts: Weak convergence, convergence in probability, convergence concepts. Laws of Large numbers. Central Limits Theorems and applications.

STA 5142 : Multivariate Statistical Analysis [credits 18]*Pre-requisites : As per the admission requirement of the school*

Matrix Algebra and Multivariate normal distribution, Test of hypotheses on means and MANOVA. Classification by discriminant functions. Structure of multivariate components: principal components and factor analysis.

STA 5143 : Statistical Quality Control [credits 18]*Pre-requisites : As per the admission requirement of the school*

Quality assurance (QAC) of a production process: control charts for attributes and for variables, specific QAC procedures, Acceptance Sampling Control, sequential sampling plans. Concepts of AQL, LTPQ, AOQL, ASN. Rectifying inspection. ASC for variables: known Standard deviation, unknown Standard deviation) ASC for continuous production. Statistical procedures for industrial experiments and optimization.

STA 5144 : Sampling Survey and Research Methods [credits 18]*Pre-requisites : As per the admission requirement of the school*

Conceptual Issues in research, Statistical Issues in designing research, Sample Surveys and Designed Experiments. Cluster sampling. Multi-stage sampling. Complex surveys. Non-response and missing values. Categorical data analysis and regression in complex surveys.

STA 5145 : Generalised Linear Models [credits 18]*Pre-requisites : As per the admission requirement of the school*

Introduction and review of Linear models; Model Fitting; Exponential Family and Generalized Linear Models; Estimation; Inference; Normal Linear Models; Binary Variables and Logistic Regression; Nominal and Ordinal Logistic Regression; Count Data, Poisson Regression and Log-Linear Models

STA 5241 : Demographic Methods [credits 18]*Pre-requisites : As per the admission requirement of the school*

Data collection: census, survey, vital registration. Evaluation of data quality. Analysis of fertility. Analysis of mortality. Analysis of migration. Population development. Population health and economy.

STA 5242 : Time Series Analysis [credits 18]*Pre-requisites : As per the admission requirement of the school*

Theoretical background of Box-Jenkins ARIMA and SARIMA models. Estimation and forecasting. Spectral density and spectral analysis. Stationary process in frequency domain. Modeling non-stationary time series. Modeling multivariate time series. Transfer function analysis. Linear systems in time and frequency domain.

STA 5243 : Analysis of Discrete Data [credits 18]*Pre-requisites : As per the admission requirement of the school*

Cross-classified tables. Log-linear models. Hierarchical models. Model selection. Polytomous and multivariate response variables. Logistic regression

STA 5244 : Stochastic Processes [credits 18]*Pre-requisites : As per the admission requirement of the school*

Elements of stochastic processes, Markov chains, Recurrence, Limit theorems of Markov Chains, Renewal processes, Martingales, Brownian motion

STA 5300 : BSc Honours Project [credits 30]*Pre-requisites : As per the admission requirement of the school***ZOOLOGY DEPARTMENT****BSc HONS IN BIOLOGICAL SCIENCES: ZOOLOGY****[CODE: MNHHZO]**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
ZOO 5101 (15): Research Methodology	ZOO 5207 (15): Molecular Ecology
BIO 5111 (15): Conservation Biology III	ZOO 5209 (16): Applied Animal Ecophysiology
Candidate must register ONE (1) of the following:	
BIO 5110 (15): Freshwater Ecology	ZOO 5206 (15): Invertebrate Diversity and Conservation
COMPULSORY YEAR MODULES	
ZOO 5300 (45): Research Project	
Total Credits = 120	

Module description and Pre-requisites for specific modules in the Honours Programmes presented by Zoology Department:

ZOO 5101 : Research Methodology [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.
History and philosophy of science, the scientific method, literature search and administration, compilation and presentation of a literature review, project proposal, hypotheses, project report and scientific paper, computer as a research tool. Applied biometry, questionnaire survey, selected research techniques.

ZOO 5300 : Research Project [credits 45]

Pre-requisites: A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.
A research project centered on the theme: sustainable utilization and conservation of natural resources.

BIO 5110 : Freshwater Ecology [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for BIO 3144.

We examine four fundamental ecological questions that aquatic ecologists ask when assessing the distribution and abundance of organisms in freshwater systems. Fundamental ecological questions are used to identify key ecological processes that can play a role in determining the abundance of organisms in any freshwater ecosystem. Approaches to examine the regulation of water regimes, pollution, biomanipulation of food webs to improve water quality, and managing the impact of introduced species.

BIO 5111 : Conservation Biology III [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for BIO 3246.

Concepts (niche, life history, migration and dispersion, small populations, meta-populations, population interactions, succession, food webs, ecosystem functioning, biodiversity, island biogeography, sustainability) and the applications (invasive aliens, restoration, conservation, minimum viable populations, habitat fragmentation, global climate change, economic thresholds, biological control, integrated pest management, eutrophication, agriculture, ecosystem health, conservation planning, economic implications).

ZOO 5206 : Invertebrate Diversity and Conservation [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for BIO 3246

Basic arachnid morphology; higher classification of the Arachnida; basic insect morphology; higher classification of the Class Insecta; designing sampling protocols; collecting and recording invertebrates; biodiversity and assemblage studies.

ZOO 5207 : Molecular Ecology [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher ZOO 3249

Human Evolution: from Africa to the world, Host-parasite interactions, Inferring Genetic Structure, Inferring Admixture, Models and model testing, Maximum Likelihood vs Bayesian Inference, Heuristic parameter estimation, Markov Chain Monte Carlo Simulations, Approximate Bayesian Computation, Coalescent Theory, Migration-Drift Equilibrium, Changes in Effective Population Size, Trees vs Networks, "Model-free" inference, Genetic landscapes

ZOO 5209 : Applied Animal Ecophysiology [credits 15]

Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for ZOO 3141

Costs of living: Cost of production and cost of maintenance, cost of reproduction, trade-offs and their measurements, Physiological energetic (feeding, metabolism and growth): the comparative physiology of animal digestive system, feeding and digestion, optimal foraging and optimal digestion, constraints imposed by food items, Growth in animals: central concept, growth curves, metabolism and growth, physiology and cellular aspects of growth, the regulation and integration of growth, hormonal influences, environmental factors and growth, environmental tolerance, environmental stressors, Niche overlap and diet analysis: measurement of niche breadth and niche overlap, dietary preferences and indices, Reproduction: endocrine control, species difference in reproductive mechanisms, ovulation rate, embryonic mortality, gestation length, patterns of reproduction, pregnancy and lactation, the costing of reproduction, types of costing, trade-offs and their causes, the environment and reproduction

MASTER OF SCIENCE DEGREE

1 **ADMISSION REQUIREMENTS FOR MASTER OF SCIENCE DEGREE (MSc)**

- (c) To be admitted to the MSc degree Programme, a candidate must have obtained the Honours Bachelor's degree with 60% in the subject for which he/she wishes to enroll **OR** have had equivalent status conferred on him/her by SENATE.
- (d) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the School's Higher Degrees Committee.

2 **RULES FOR PROGRESSION**

- (c) Before a candidate's application for registration can be considered, the title or topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department and School's Higher Degrees Committee concerned for recommendation to the School of Postgraduate Studies and approval by SENATE. The Research proposal must be approved by the School's Higher Degrees Committee.
- (d) Unless otherwise decided by SENATE and subject to special provisions in the school:
 - The Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime.
 - The maximum period of study is FOUR years full time, subject to SENATE approval.
 - Extension may be granted only in exceptional cases and for only ONE year.
 - A student who desires an extension must submit a motivated application for consideration by SENATE.
- (e) The MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Academic Board.
- (f) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination.
- (g) The general rules of the University will apply, **unless** otherwise specified for the School of Mathematical and Natural Sciences.
- (h) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress.
- (i) Students who wish to defer their studies at **any stage** must apply to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice.
- (j) Unless otherwise decided by SENATE and subject to special provision in the school rules, the degree may be conferred if the candidate has been registered for a minimum of one academic year.
- (k) Before registration for 2nd or further years, the student must write a progress report which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Dean. **No** student will be allowed to register without the approval of the Dean

3 **ASSESSMENT FOR MSc PROGRAMME:**

- (a) Procedures as per post-graduate policies and guidelines will be followed

4 **MSc DEGREE BY COURSE WORK AND MINI DISSERTATION OFFERED IN SCHOOL:**

MASTERS IN E-SCIENCE DEGREE

[Code: MNMSES]

- (a) The Masters in E-Science degree extends over a maximum of twenty-four months of full-time study.
- (b) The programme extends over a maximum of 24 months of full time study and comprises compulsory and elective modules, and a mini-dissertation.
- (c) Cross-disciplinary data-driven projects are offered both within the University and from a wide range of industry partners.
- (d) In order to qualify for this degree, an appropriate BSc Honours degree in Mathematics or Applied Mathematics **or** Statistics **or** Computer Science **or** Physics **or** its equivalent obtained from elsewhere.
- (e) A candidate must undertake and successfully complete the required modules [90 credits total] and a mini-project/dissertation [90 credits] to obtain the degree in one of the following departments: Mathematics or Applied Mathematics **or** Statistics **or** Computer Science **or** Physics [please discuss with the HOD of the specific department].
- (f) Students are advised to seek for guidance from the HODs of Mathematics or Applied Mathematics **or** Statistics **or** Computer Science **or** Physics on matters concerning the programme and the required prerequisites for the modules, other than just a BSc Honours degree.

MSc IN E-SCIENCE [CODE: MNMSES]

YEAR 1 (WITS UNIVERSITY)	
COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
6141 (15 credits) Research Methods and Capstone Project in Data Science	
6142 (15 credits) Data Privacy and Ethics	
SELECTIVE MODULES* (Select any 4 modules to make up 60 credits)	
6143 (15 credits) Mathematical Foundations of Data Science	6241 (15 credits) Large Scale Computing Systems and Scientific Programming
6144 (15 credits) Statistical Foundations of Data Science	6242 (15 credits) Large Scale Optimisation for Data Science
6145 (15 credits) Adaptive Computation and Machine Learning	6343 (15 credits) Special Topics in Data Science
6146 (15 credits) Data Visualisation and Exploration	
YEAR 2 (UNIVEN)	
MNS 6000 [credits 90] Mini project/dissertation	
Total credits - 180	

** Not all elective courses will be offered in every year.*

Module description for specific modules in the MSc E-Science Programme presented WITS University in the first year:

6141 Research Methods and Capstone Project in Data Science (15 credits)

Scientific writing styles; Layouts for assignments, projects, theses or publications; Research methodologies; Scientific assignments; Integration of all the aforementioned content items for a Capstone Project in Data Science.

6142 Data Privacy and Ethics (15 credits)

Technical processes of data collection, storage, exchange and access; Ethical aspects of data management; Legal and regulatory frameworks in South Africa and in relevant jurisdictions; Data policies; Data privacy; Data ownership; Legal liabilities of analytical decisions and discrimination; and the Technical and algorithmic approaches to enhance data privacy, and relevant case studies.

6143 Mathematical Foundations of Data Science (15 credits)

Advanced areas of data science require a deeper understanding of the fundamental mathematics pertaining to the field. In order to bridge this mathematical gap and provide a foundation for further learning this course will place more emphasis on topics such as high-dimensional space, best-fit subspaces and singular value decomposition, random walks and Markov chains, statistical machine learning, clustering, random graphs, topic models, non-negative matrix factorization, hidden Markov models, graphical models, wavelets, and sparse representations.

6144 Statistical Foundations of Data Science (15 credits)

An understanding of multivariate statistical. Hypothesis testing and confidence intervals. The ability to model data using well known statistical distributions as well as handle data that is both continuous and categorical. The ability to perform statistical modeling including multivariate linear regression and adjust for multiple hypothesis. Forecasting, extrapolation, prediction and modeling using statistical methods. Bayesian statistics. An understanding of bootstrapping and Monte Carlo simulation.

6145 Adaptive Computation and Machine Learning (15 credits)

The course offers mathematical and conceptual background, covering relevant concepts in linear algebra, probability theory and information theory, numerical computation, and machine learning.

6146 Data Visualisation and Exploration (15 credits)

This course introduces the field of data visualization which seeks to determine and present underlying correlated structures and relationships in data sets from a wide variety of application areas. The prime objective of the presentation is to communicate the information in a dataset so as to enhance understanding. The course is comprised of the following subjects: Data and image models; Visualisation attributes (colour) and design (layout); Exploratory data analysis; Interactive data visualisation; Multidimensional data; Graphical perception; Visualisation software (Python & R); and Types of visualisation (Animation, Networks & Text).

6241 Large Scale Computing Systems and Scientific Programming (15 credits)

Conducting e-research/e-science requires a good understanding of the computing principles, methods and tools that have been developed to support the analysis of large-scale and complex data. The course focuses on the software stack but addresses hardware issues as necessary. The will cover a selection of following topics: Introduction to programming environments for scientific computing (e.g. Pandas, Numpy, matplotlib); Principles of distributed systems, and overview of parallel architectures and environments (e.g. FPGA, GPU, multi-core, cluster, grid); Large scale data transfer and storage; Frameworks for large scale data analysis (relational databases, map-reduce, streaming); Scientific workflow management: provenance and replication; Introduction to cloud computing and virtualisation; and Project (e.g. Programming large-data applications on open-source infrastructures for data processing and storage systems).

6242 Large Scale Optimisation for Data Science (15 credits)

Advanced areas of data science require a deeper understanding of the large scale discrete optimisation methods pertaining to the field. In order to bridge this mathematical gap and provide a foundation for further learning this course will place more emphasis on topics such as convex optimisation, subgradient methods, localization methods, decomposition and distributed optimisation, proximal and operator splitting methods, conjugate gradients, and nonconvex problems.

6343 Special Topics in Data Science (15 credits)

This module deals with specialised and applied concepts and trends in the domain specific areas of data sciences such as finance, health sciences, bioinformatics, natural sciences, social sciences, smart cities, education, and energy.

Module description for specific modules in the MSc E-Science Programme presented by UniVen in the second year:**MNS 6000 : Mini Research Project [credits 90]**

The ability to do research is an essential skill for an individual pursuing a career in Data Science, and forms the basis for further post-graduate study. This module provides practical training for the development of research skills and bridges the gap between theory and practice, and established work and novel research. By working within established research structures in the Institution under the guidance of an expert, students will receive exposure to the methods, philosophy and ethos of research in the field of Data Science.

5 MASTER OF SCIENCE BY RESEARCH PROJECT:

- (a) The MSc programme is research based.
- (b) Prospective applicants should prior to making an application, enquire with the relevant faculty member about the suitability and feasibility of their proposed research interests.
- (c) Applicants should have obtained an overall mark of at least 60% at the BSc Honours level.
- (d) Applicants will undergo a selection interview.

6 MSC DEGREE BY PROJECT OFFERED IN SCHOOL [CREDITS FOR EACH = 180]:

• MSc in BIOCHEMISTRY	CODE: MNMMSB	Project: BCM 6300
• MSc in BIOLOGICAL SCIENCES: BOTANY	CODE: MNMBSB	Project: BOT 6300
• MSc in BIOLOGICAL SCIENCES: ZOOLOGY	CODE: MNMBSZ	Project: ZOO 6300
• MSc in MATHEMATICS	CODE: MNMMSM	Project: MAT 6300
• MSc in APPLIED MATHEMATICS	CODE: MNMSAM	Project: MAT 6300
• MSc in CHEMISTRY	CODE: MNMMSC	Project: CHE 6300
• MSc in PHYSICS	CODE: MNMMSP	Project: PHY 6300
• MSc in MICROBIOLOGY	CODE: MNMMMS	Project: MBY 6300
• MSc in STATISTICS	CODE: MNMMSS	Project: STA 6300

DOCTORAL DEGREE

1 ADMISSION REQUIREMENTS FOR DOCTORAL DEGREE (PhD)

- (a) To be admitted, candidates must have obtained a Master's degree or such other qualification as in the opinion of SENATE is of equivalent status, in the field where they wish to study, except if SENATE approves that it may be in another field, in which case they must satisfy SENATE as to their proficiency in the selected field.
- (b) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the

2 RULES FOR PROGRESSION:

- (a) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department and School's Higher Degrees Committee concerned for recommendation to the School of Postgraduate Studies and approval by SENATE. The Research proposal must be approved by the School's Higher Degrees Committee.
- (b) Unless otherwise decided by SENATE and subject to special provisions in the school:
 - The degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime.
 - The maximum period of study is FIVE years full time, subject to SENATE approval.
 - Extension may be granted only in exceptional cases and for only ONE year.
 - A student who desires an extension must submit a motivated application for consideration by SENATE.

3 ASSESSMENT FOR PhD PROGRAMME:

- (a) Procedures as per Postgraduate policy guidelines will be followed.
- (b) Viva Voce as per school postgraduate guidelines through the office of the Dean. If a student fails the Viva Voce, the degree will not be awarded.

4 RE-REGISTRATION AND DEFERMENT OF STUDIES:

- (a) For the duration of the degree Programme, a student must register each year by the stipulated date.
- (b) Registration each year is subject to the recommendation of the Head of Department and may be rejected in any year on grounds of unsatisfactory progress.
- (c) Students wishing to defer studies at any stage must submit a motivated application beforehand. If granted, such deferment **will be for a period of ONE year only**, after which a further application must be submitted. Deferment will, **at most, be granted twice**.

5 PhD DEGREES BY RESEARCH PROJECT OFFERED IN THE SCHOOL [CREDITS FOR EACH = 360]:

- | | | |
|---|--------------|-------------------|
| • PhD in BIOCHEMISTRY | CODE: MNPDPB | Project: BCM 7300 |
| • PhD in LIFE SCIENCES: BOTANY | CODE: MNPLSB | Project: BOT 7300 |
| • PhD in LIFE SCIENCES: ZOOLOGY | CODE: MNPLSZ | Project: ZOO 7300 |
| • PhD in LIFE SCIENCES: MICROBIOLOGY | CODE: MNPLSM | Project: MBY 7300 |
| • PhD in MATHEMATICAL SCIENCES: STATISTICS | CODE: MNPPST | Project: STA 7300 |
| • PhD in MATHEMATICAL SCIENCES: MATHEMATICS | CODE: MNPMSM | Project: MAT 7300 |
| • PhD in APPLIED MATHEMATICS | CODE: MNPPAM | Project: MAT 7300 |
| • PhD in CHEMISTRY | CODE: MNPDPB | Project: CHE 7300 |
| • PhD in PHYSICS | CODE: MNPDPB | Project: PHY 7300 |