CORRESPONDENCE

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VISION & MISSION STATEMENT

VISION

The University of Venda aspires to be at the centre of tertiary education for rural and regional development in Southern Africa.

MISSION

The University of Venda, anchored on the pillars of excellence in teaching, learning, research and community engagement, produces graduates imbued with knowledge, skills and qualifications which are locally relevant and globally competitive.

THE CALENDAR IS OBTAINABLE IN THE FOLLOWING SEPARATE PARTS:

OFFICERS OF THE SCHOOL OF MATHEMATICAL AND NATURAL SCIENCES

ADMINISTRATIVE STAFF MEMBERS:

Dean : N Potgieter, BSc (RAU), MSc (UP), PhD (UP)
Deputy Dean : Vacant
Executive Secretary : GC Mushiana
Typist/Clerk : MB Mantshimuli
School Administrator : LD Dongola, BA (Hons) (Univen)
Academic Administrator : Vacant

VUWANI SCIENCE RESEARCH CENTRE:

Coordinator : NE Maluta, BSc (Hons) (Unin), MSc (Univen), PhD (Bath University), (UK)
Lab Technicians : TT Khedzi, BSc (Hons) (Univen)
: S Mathebe BSc (Hons) (Univen)

NRF SARCHI CHAIR:

Coordinator : PJ Taylor, PhD (UKZN)

SPECIAL CATEGORY PROFESSORS:

Emeritus Professors : L Mammino, MSc (PISA, Italy), PhD (Moscow, USSR)
Adjunct Professors : T van Ree, DSc (Chemistry)
Research Professor : PO Bessong, PhD (Univen), Postdoc (Virginia, USA)
Research Prof Assistant : LG Mavhandu-Ramarumo, PhD (Univen)

ACADEMIC STAFF MEMBERS:
(Heads of Departments are indicated by means of an asterisk*)

Biochemistry Department

Professor :*****A Shonhai, BSc (Hons) (NUST), PhD (Rhodes)
Senior Lecturer : NE Madala, PhD (UJ)
Lecturers : B van Driessel, MSc (UFS), PhD (UFS)
: L Mathomu MSc (Unisa)
Junior Lecturer : A Burger, BSc (Hons) (UP), PhD (Rhodes)
Lab Technicians : DC Mmboyi, BSc (Hons) (Univen)
: C Ndou, BSc (Hons) (Univen)

Botany Department

Associate Professor : *MP Tshisikhawe, BSc (Hons) (Univen), MSc (Univen), PhD (UP), PGDipHE (Rhodes)
Senior Lecturers : MH Ligavha-Mbelengwa, BSc (Hons), BEd (Univen), MSc (UCT) UED, SABUFSEP (North Carolina A&T State University, USA)
: 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)
: LI Ramovha, BSc (Unin), BSc (Hons) (Univen), MSc (UP), HED (Postgrad) (Unisa) PhD (UP)
: N Swelankomo BSc (Hons) (Unitra), MSc (US)
Lab Technician : MP Legodi, BSc (Hons) (Unin), MSc (UL)

Computer Science and Information Systems Department

Senior Lecturer : C Chibaya BSc (Cuba), MSc (NUST, Zimbabwe), PG Dip (CHE) (RU), PhD (Rhodes)
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)
: K Madzima, BSc (Cuba), MSc (NUST, Zimbabwe), PG Dip (CHE) (RU)

Chemistry Department

Associate Professor	: IDI Ramaite, BSc (Hons) (Univen), PhD (Rhodes), PrChem SA
Senior Lecturers	: *SS Mnyakeni-Moleele, BSc (Hons), PhD (Wits), PrChem SA
	: MA Legodi, BSc (UCT), BSc (Hons) (Unin), PhD (UP), PrChem SA
Lecturers	: LR Puka, BSc, BSc (Hons) (Vista), MSc (RAU)
	: TE Ramurafhi, MSc (Medunsa)
	: LC Murulana, BSc (Univen), BSc (Hons), MSc, PhD (North West University), PrChem SA
	: E Batisai, BSc (Hons), MSc, PhD (SU)
	: N Tavengwa PhD (Wits), PrChem SA
Senior Lab Technician	: FB Mutshaeni, BSc Hons (Univen) PrChem SA
Lab Technician	: NR Maseko, BSc (Wits)
NMR Operator	: 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 (USSR), PhD (Brunel University, UK)
	: JC Ndogmo, PhD (University Of Montreal, Canada), DEA, (Louis Pasteur Of Strasbourg University, France)
Lecturers	: MA Luruli, BSc (Georgia State University, USA), Msc (Clar Atlanta), (USA)
	: FS Netshapala, BSc (Ed), BSc (Hons) (Univen), MSc (UP)
	: RM Mukhodobwane, BA (Hons) (Univen), HED, B.ED (Unisa), MSc (Univen)
	: D Mathebula, BSc (Hons) (Univen), MSc (US)
	: M Mohlala, BSc (Hons) (KZN), MSc, DPhil (Howard University)
	: AD Maphiri, BA, BSc (MSc) (Univen), PGDE
	: A Manthada, BSc, BSc (Hons) (Univen), PGDE, MSc (Univen)
	: NJ Netshiozwi, BSc (Hons) (Univen)
	: N Mphephu, BSc Hons (Univen) MSc (UP)
	: IR Makgatho, BSc (Hons)(Unisa), Business and Administration (Hons) (Stellenbosch), MSc, HED (Limpopo)
	: TL Kubjana, MSc (UWC)
	: VT Makhoshi BSc, (Hons), UED, MSc (Univen)
	: N Mukwevho BSc Hons (Univen)

Microbiology Department

Professor	: N Potgieter, BSc (RAU), MSc (UP), PhD (UP)
Associate Professors	: A Samie, BSc (Hons), MSc (Yaoundé), PhD (Univen)
	: *AN Traore, MSc (RAU), PhD (UJ)
Senior Lecturer	: ME Musie, BSc (Wits), BSc (Hons), MSc, PhD (Univen)
Lecturers	: J Kabue-Ngandu MSC (US)
	: MT Sigidi BSc (Hons) (UKZN) MSc, PhD (Univen)
Lab Technician	: M Magwalivha, BSc (Hons) (Univen), MSc (UP)

Physics Department

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

Science Foundation Department

Professor	: *S Shateyi, BSc (Hons) (NUST), MSc, DPhil (UZ)
Lecturers	: RS Pearce, MSc (UWC)
	: MS Mulaudzi, BSc (Hons); MSc (Univen)
	: GM Mokganya, MSc (Univen)
	: M Mbodila, BSc (Hons) (FHU), MSc (UNW), PGDip in HE T&L (SU)
	: VM Nekhubvi, BSc (Hons), MSc (Univen)
	: FR Mukiwa, BA (Hons) (MSU); MA (UKZN), DipEd (UZ).
Junior Lecturer	: O Matsilele, BSc, BSc (Hons) (Univen)

Statistics Department

Professor	: Vacant
Associate Professor	: 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 Professor	: *IEJ Barnhoorn PhD (UJ), Postdoc (UP)
Senior Lecturer	: LH Swanepoel, PhD (UP)
Lecturers	: CS Schoeman, MSc (US)
	: AJ Ramunasi, BSc (Hons) (Univen), MSc (UP)
	: GJ Madonsela, MSc (UDW)
	: H Roux, MSc (UJ)
	: HE Munzhelele, MSc (Univen)
Chief Lab Technician	: K Magwede, BA, UED, MSc (Univen)
Lab Technician	: MG Phaphana, BA, UED (Univen)

SECTION 2:

QUALIFICATIONS WITHIN THE SCHOOL AND THEIR TOTAL YEARS INCLUDING CREDITS AND NQF LEVELS.

Qualification name	Total number of years	Credits (Actual number)	NQF level
Science Foundation Programme	**1**	**-**	**-**
Diploma in fresh water technology	**3**	**360**	**6**
Bachelor's degree	**3**	**360**	**7**
Honors	**1**	**120**	**8**
Masters	**2**	**-**	**9**
PhD	**3**	**-**	**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 Ecophysiologist, 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 Physist and Lecture

Statistics Department
Lecturer, Statistician, Business analyst, Data analyst,

Zoology Department
Environmental writer, Statistian, Biodiversity Manager, Conservation Ecologist and Scientist, Environmental Planner, Zoologist, Geneticist and Ecologist

SECTION 4:

ADMISSION REQUIREMENTS FOR ALL THE OFFERED QUALIFICATIONS IN SCHOOL

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 enrol 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.

SECTION 5:

RULES FOR PROGRESSION

5.1 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.

5.2 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.

5.3 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.

5.4 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.

5.5 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.

5.6 BSc DEGREE:

(a) For a student to be promoted to the next level, the following criteria must be met:

- A student may only progress to the second year level when she/he has passed 60% of the 1st year modules and has no outstanding foundation modules.
- To progress to the third year level, a student must have passed **ALL** first and second year modules.
- A candidate may not enrol for any third year module unless **ALL** first-year modules have been passed.
- A second year 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.
- Students may not select modules that clash on the lecturing and practical timetables.

(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 are allowed to 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.

5.7 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 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.

5.8 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 submit an application 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.

5.9 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 least THREE years fulltime.
- The maximum period of study is THREE 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.

SECTION 6:

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

6.1. SCIENCE FOUNDATION PROGRAMME MODULES

Note: For all the modules the number of lectures/week is four

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**

6.2. 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**	

6.3. 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 taken from:		***Elective Modules – 16 credits taken from:***			
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** (20) 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** (28) Animal Ecophysiology	**BCM 3621** (16) Enzyme and Enzyme Biotechnology **BOT 3646** (10) Plant Physiology **ZOO 3649** (28) Evolutionary Genetics
Elective Modules – 8 credits taken from:					
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				
Total credits = 120		**Total credits = 136**		**Total credits = 108**	

(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	**MBY 2623** (10) Environmental Microbiology **MBY 2624** (10) Virology **BOT 2645** (16) Plant Taxonomy and Reproductive Biology **BOT 2649** (16) Ethnobotany I	**BOT 3543** (20) Plant Ecology **MBY 3526** (14) Food Microbiology **MBY 3527 (**14) Industrial Microbiology	**MBY 3628** (14) Mycology and Phycology **MBY 3629** (14) Parasitology **BOT 3646** (14) Plant Physiology **BOT 3647** (14) Plant Ecophysiology
Elective Modules – 8 credits taken from:		***Elective Modules - 20 credits taken from:***		***Elective Modules - 20 credits taken from:***	
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	**BIO 2542** (16) Population Ecology **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		**BOT 3641** (20) Ethnobotany II **BOT 3648** (20) Plant Systematics
Total credits = 136		**Total credits = 108**		**Total credits = 124**	

(D) BACHELOR OF SCIENCE IN BIODIVERSITY AND CONSERVATION: BSCBDC

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) Diversity of Life **BIO 1542** (16) Cell Biology I **CHE 1540** (16) 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 **GEO 1620** (16) Elements of Remote Sensing and Geomatics **STA 1649** (8) Basic Statistical Inference	**BIO 2542** (16) Ecology **BOT 2544** (16) Plant Anatomy and Morphology **ZOO 2544** (16) Principles of Genetics	**BIO 2646** (20) Conservation Biology I **BOT 2645** (16 Plant Taxonomy and Reproductive Biology **BOT 2649** (16) Ethnobotany **ZOO 2648** (16) Animal Phylogeny	**BIO 3544** (28) Basic Freshwater Ecology **BOT 3543** (10) Plant Ecology	**BIO 3646** (28) Conservation Biology II **ZOO 3649** (28) Evolutionary Genetics
				Elective Modules - 20 credits taken from	
				BOT 3548 (10) Plant Systematics	**BOT 3641** (10) Ethnobotany II **GEO 3641** (16) Remote Sensing and Geographic Information Systems A **STA 3648** (14) Biometry
Total credits = 144		**Total credits = 116**		**Total credits = 114**	

(E) 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** (16) 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	**BOT 2645** (16) Plant Taxonomy and Reproductive Biology **ZOO 2648** (16) Animal Phylogeny **BOT 2649** (16) Ethnobotany I	**BOT 3543** (10) Disturbance and Plant Ecology **BOT 3548** (10) Plant Systematics **ZOO 3541** (28) Animal Ecophysiology	**BOT 3646** (10) Plant Physiology **BOT 3647** (10) Plant Ecophysiology **ZOO 3649** (28) Evolutionary Genetics
Elective Modules – 8 credits taken from:				**Elective Modules – 14 credits taken from**	
	CHE 1621 (8) Inorganic Chemistry I **CHE 1622** (8) Organic Chemistry I				**BOT 3641** (10) Ethnobotany **STA 3648** (14) Biometry
Total credits = 144		**Total credits = 112**		**Total credits = 110**	

(F) 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 taken 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**	

(G) 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 taken from:		***Elective Modules - 20 credits taken from:***		***Elective Modules - 14 credits taken from***	
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**	

(H) 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 taken from:		***Elective Modules - 30 credits taken from:***		***Elective Modules - 42 credits taken from***	
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**	

(I) 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 taken from:		***Elective Modules - 40 credits taken from:***		***Elective Modules - 28 credits taken from***	
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**	

(J) 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 taken from:		***Elective Modules - 40 credits taken from:***		***Elective Modules – A total of 70 credits from either MAT or STA configured as: i) 28 credits from STA and 42 credits from MAT or ii) 28 credits from MAT and 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) Official Statistics and Introduction to Research **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**	

(K) 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 taken from:				***Elective Modules - 40 credits taken from:***	
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 **<u>Must take one of:</u>** **STA 3542** (14) Industrial Statistics **STA 3543** (14) Official Statistics and Introduction to Research	**ECO 3643** (12) Money and Banking **<u>Must take one of:</u>** **STA 3641** (14) Time Series Analysis **STA 3643** (14) Multivariate Methods
Total credits = 132		**Total credits = 120**		**Total credits = 116**	

(I) 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**	

(M) 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 Live **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**	

(N) 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 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 **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 **PH Y2521** (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**	

(O) 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 **EC S1541** (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 taken from:		***Elective Modules – 40 credits taken from:***		***Elective Modules - 14 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	**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**	

(P) 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**	

SECTION 7:

RULES FOR ASSESSMENT AND EXAMINATIONS

7.1 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.

7.2 ASSESSMENT FOR BSc HONS DEGREE:

(a) Candidates will only be assessed in a particular 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 learning programme, and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting.

(e) The minimum final pass mark in any module is 50%. Subject to department rules, a subminimum of 50% in the assessment is required.

(f) To obtain the degree cum laude, a candidate must attain an aggregate of 75%or higher.

(g) To be awarded an honours degree, the candidate must accumulate at least 120 credits at this level.

(h) Special examinations will not be offered to postgraduate students except with special permission of SENATE.

(i) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination:

  (i) 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

  (ii) 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.

7.3 ASSESSMENT FOR MSc PROGRAMME

(a) Procedures as per post-graduate policies and guidelines will be followed

7.4 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

7.5 RE-REGISTRATION AND DEFERMENT OF STUDIES:

(a) For the duration of the 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.

SECTION 8:

LIST OF ALL MODULES WITHIN THE SCHOOL AND THEIR DESCRIPTION

BIOCHEMISTRY DEPARTMENT

UNDERGRADUATE MODULES:

SECOND YEAR MODULES:

BCM 2521 : Structural and functional Biochemistry I
Pre-requisites : CHE 1540, CHE 1621, CHE 1622, BIO 1542
The chemistry of biomolecules (peptides, protein, vitamins, enzymes, co-enzymes), pH and buffers, bio-energetics

BCM 2522 : Biochemical and Molecular Techniques
Pre-requisites : CHE 1540, CHE 1621, CHE 1622, BIO 1542
Spectroscopy, Electrophoresis, Chromatography, Immunochemical techniques, Microscopy, cell Disruption Methods, Centrifugation, Protein Purification Methods and Introduction to Bioinformatics.

BCM 2621 : Structural and Functional Biochemistry II
Pre-requisites : CHE1540, CHE1621, CHE1622, BIO1542
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 2622 : Metabolism
Pre-requisites : BIO1542, CHE1540, CHE1621, CHE1622,
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 3521 : Protein Biochemistry
Pre-requisites : BCM2521, BCM2522, BCM2621, BCM2622
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 3522 : Advanced Molecular Techniques
Pre-requisites : BCM2521, BCM2522, BCM2621, BCM2622
LC-MS; biophysical techniques (ITC, circular dichroism, surface plasmon resonance, NMR, crystallography); flow cytometry; advanced electrophoresis; fluorescence; protein-protein interaction; advanced immunotechniques; microarrays; RNA-interference and DNA sequencing.

BCM 3621 : Enzymology and Enzyme Biotechnology
Pre-requisites : BCM2521, BCM2522, BCM2621, BCM2622
Structure and function of enzymes, enzyme kinetics and mechanisms of enzyme catalyzed reactions, applications of enzyme technology (including industrial enzyme biotechnology).

BCM 3622 : Gene expression, Protein Synthesis and Bioinformatics
Pre-requisites : BCM2521, BCM2522, BCM2621, BCM2622
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].

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 subjected to a final selection test which serves to assess their preparedness for the Honours course.

BCM 5701 : Research Methods and Seminars
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.

BCM 5523 : Genomics, Proteomics and Bioinformatics
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 5525 : Applied Biochemistry and Biotechnology
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 5622 : Research Techniques
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 5623 : Physiological Biochemistry and Cell Biology
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 5624 : Protein Folding and Advanced Enzyme Kinetics
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 5700 : Research Project and Report
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.

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.

BOTANY DEPARTMENT

UNDERGRADUATE MODULES:

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

FIRST YEAR MODULES:

BIO 1541 : Tree of Life
Pre-requisites(s) : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.
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 1542 : Cell Biology
Pre-requisites(s) : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.
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 1643 : Ecology, Adaptation and Evolution
Pre-requisites(s) : An achievement rating of 4 (NSC) OR E (HG) OR D (SG) in either matric Biology or Physical Science or Agricultural Science.
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 2542 : Ecology
Pre-requisites : BIO 1541, BIO 1643
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 2544 : Plant Anatomy and Morphology
Pre-requisites : BIO 1541, BIO 1542
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 2645 : Plant Taxonomy and Reproductive Biology
Pre-requisites : BIO 1541, BIO 1643
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 2649 : Ethnobotany I
Pre-requisites : BIO 1541, BIO 1643
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 3543 : Plant Ecology
Pre-requisites : BIO 2542 or BOT 2544
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 3641 : Ethnobotany II
Pre-requisites : BOT 2649
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 3646 : Plant Physiology
Pre-requisites : BOT 2544, BOT 2645
Uptake, transportation and metabolism of some important minerals and water, photosynthesis, responses of plants to elevated atmospheric CO_2 concentrations and salinity.

BOT 3647 : Plant Ecophysiology
Pre-requisites : BOT 2544, BOT 2645
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.

BOT 3648 : **Plant Systematics**
Pre-requisites : BOT 2645
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.

POSTGRADUATE MODULES:

HONOURS MODULES:

Pre-requisites:
In addition to section 4 candidates must have an average of at least 60% for the final-year modules relevant to the honours programme for which they want to register and must meet with the Pre-requisites for the individual honours modules. Candidates with average below 60% may be accepted subject to SENATE approval.

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.

Programmes:

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 **which must include** 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

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

BIO 5501/BOT 5501 : Research Methodology
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

BIO 5700/BOT 5700 : Research Project
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*".

BOT 5504 : Applied Plant Ecology
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3543
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 5505 : Applied Plant Ecophysiology
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3647
Plant distribution, function, response and performance with respect to drought, fire, cutting, grazing and so on; biochemical co-evolution.

BOT 5606 **: Plant Physiology**
Pre-requisites *: A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3646*
Plant mineral nutrition and ion uptake, nitrogen cycling in nature, metabolism of nitrogen, chemistry of photosynthesis, C_4 photosynthesis and crassulacean acid metabolism, Respiration in plants, mycorrhiza, responses of plants to elevated atmospheric and rhizospheric CO_2 concentration, salinity and water stress and photosynthesis, nutrient uptake and growth, seed physiology.

BOT 5608 **: Plant Systematics**
Pre-requisites *: A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT3548.*
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 5612 **: Applied Ethnobotany**
Pre-requisites *: A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BIO 3641*
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.

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.*

CHEMISTRY DEPARTMENT

UNDERGRADUATE MODULES:

FIRST YEAR MODULES:

(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.

CHE 1545 **: General Chemistry for the Applied Sciences**
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 1623 **: Inorganic Chemistry for the Applied Sciences**
Pre-requisites *: As per admission requirement of the School*
Co-requisites *: CHE 1540 or CHE 1545*
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 1624 : Organic Chemistry for the Applied Sciences
Pre-requisites : As per admission requirement of the School
Co-requisites : CHE 1540 or CHE 1545
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:

CHE 1540 : General Chemistry
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 1621 : Inorganic Chemistry I
Pre-requisites : As per admission requirement of the School
Co-requisites : CHE 1540 or CHE 1545
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 1622 : Organic Chemistry I
Pre-requisites : As per admission requirement of the School
Co-requisites : CHE 1540 or CHE1545
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.

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

SECOND YEAR MODULES:

CHE 2521 : Inorganic Chemistry II
Pre-requisites : CHE 1621
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 2522 : Organic Chemistry II
Pre-requisites : CHE 1622
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 UNIVEN-Visible spectroscopy in organic chemistry.

CHE 2524 : Industrial Chemistry
Pre-requisites : CHE 1540, CHE 1621, CHE 1622.
Co-requisites : CHE 2521, CHE 2522
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 2525 : Applied Organic Chemistry
Pre-requisites : CHE 1622.
Co-requisites : CHE 2522, CHE 2524.
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 2620 : Analytical Chemistry: Classical techniques
Pre-requisite : CHE 1540
Co-requisites : CHE 2521
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 2623 : Physical Chemistry I
Pre-requisite : CHE 1540
Co-requisites : MAT 1541, MAT 1641, PHY 1525, PHY 1625.
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 2626 : Introductory Chemometrics
Pre-requisites : MAT 1542, MAT 1642
Co-requisites : CHE 2620
Sampling and sample preparation, choice of analytical methods. Statistical treatment of chemical data, experimental design, quality assurance.

CHE 2629 : Environmental Chemistry Fundamentals
Pre-requisites : CHE 1540, CHE 1621, CHE 1622
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 3520 : Analytical Chemistry: Instrumental techniques
Pre-requisites : CHE 2620
Co-requisites : CHE 3523
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.

CHE3523 : Physical Chemistry II
Pre-requisites : CHE2623.
Topics selected from: Surface chemistry, electrochemistry, Chemical kinetics and reaction mechanisms.

CHE 3524 : Applied Chemical Analysis and Food Science
Pre-requisites : CHE 2522
Co-requisites : CHE 2620, CHE 3520
Surface analysis, thermal methods, chromatography, chemistry and technology of food.

CHE 3525 : *Capita Selecta* in Applied Chemistry
Pre-requisites : CHE 2626
Co-requisites : CHE 3520, CHE 3523, CHE 3524.
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 3621 : Inorganic Chemistry III
Pre-requisites : CHE 2521
Co-requisites : CHE 3520, CHE 3523, CHE 3622.
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 3622 : Organic Chemistry III
Pre-requisites : CHE 2522
Co-requisites : CHE 3520, CHE 3523, CHE 3621.
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 3626 : Process Technology
Pre-requisites : CHE 2623
Co-requisites : CHE 3523, CHE 3621, CHE 3622, CHE 3627
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 3627 : Chemistry of Materials
Pre-requisites : CHE 1540, CHE 2521, CHE 2522
Co-requisites : CHE 3621, CHE 3626
Chemistry and technology of: Metals and alloys; ceramics; polymers, paints and adhesives; glass; construction materials such as cement, concrete and bricks.

POSTGRADUATE MODULES:

HONOURS MODULES:

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.**

Pre-requisites:
An average of 60% in Chemistry third year modules. However, each application will be considered on merit.

CHE 5530 : Analytical Chemistry
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended: First-year Statistics or CHE 2626

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

CHE 5531 : Inorganic Chemistry
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended : Second-year Mathematics.
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 5532 : Organic Chemistry
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 5533 : Physical Chemistry
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended : Second-year Mathematics.
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 5538 : Analytical and Inorganic Chemistry of Natural Products
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 5630 : *Capita Selecta*: Analytical Chemistry
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended : First-year Statistics or CHE 2626.
Co-requisites : CHE 5530
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 5631 : *Capita Selecta*: Inorganic Chemistry
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended : Second-year Mathematics.
Co-requisites : CHE 5531. Additionally, an introductory module in Group Theory is highly recommended.
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 5632 : *Capita Selecta*: Organic Chemistry
Pre-requisite : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Co-requisites : CHE 5532
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 5633 : *Capita Selecta*: Physical Chemistry
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major;
Recommended : Second-year Mathematics.
Co-requisites : CHE 5533. Additionally, an introductory module in Group Theory is highly recommended.
The spectra of atoms. Molecular spectroscopy. Nuclear magnetic resonance. Statistical thermodynamics: the distribution of molecular states; relating molecular properties and thermodynamic quantities.

CHE 5638 : Natural Products Chemistry
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 5700 : Research project
Pre-requisites : Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major;
Recommended : First-year Statistics or Chemometrics (CHE 2626).
Co-requisites : 4 Core and 2 Elective modules in Chemistry at NQF Level 7
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.

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.

COMPUTER SCIENCE AND INFORMATION SYSTEMS DEPARTMENT

UNDERGRADUATE MODULES:

FIRST YEAR MODULES:

(a) Service Modules

COM 0510 OR COM 0610 : **Computer Literacy**
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 1522 : Introduction to Computer Systems
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 1524 : Fundamentals of Computer Architecture
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 1626 : Computer Technology
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 1721 : Object Oriented Programming
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 2520 : Digital Design Techniques
Pre-requisites : COM 1524
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 2523 : Imperative Programming
Pre-requisites : COM 1721
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 2525 : Operating Systems
Pre-requisites : COM 1522, COM 1524
Processes, Memory Systems, File Systems, Case studies: Windows 2000/XP, Unix, Linux.

COM 2526 : Human-Computer Interaction
Pre-requisites : COM 1522 or COM 1721
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 2528 : Artificial Intelligence Fundamentals
Pre-requisites : COM 1721
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 2529 : Database Fundamentals
Pre-requisites : COM 1721, COM 1524
Fundamental database concepts, Relational database model and normalization, Entity-relationship modeling, Transaction management and concurrency control, Distributed database management systems, Object-oriented databases, Client/server systems, Data warehousing, Databases in electronic commerce.

COM 2616 : Reasoning About Programs
Pre-requisites : MAT 1541, MAT 1542
Co-requisites : COM 1721
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 2624 : Algorithms and Data Structures
Pre-requisites : COM 1721
Co-requisites : COM 2523
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 2626 : Data Communication and Computer Networks
Pre-requisites : COM 1522, COM 1524, COM 1721, MAT 1541, MAT 1542
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 2628 : Contemporary Object-Oriented Concepts
Pre-requisites : COM 1721
Co-requisites : COM 2629
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 2629 : Systems Analysis
Pre-requisites : COM 1522 or COM 1524 or COM 1721
Co-requisites : COM 2529
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 2701 : Computer Science Laboratory
Pre-requisites : COM 1721
Co-requisites : COM 2523, COM 2624
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 3520 : Software Engineering 1
Pre-requisites : COM 1721
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 3521 : Distributed Operating Systems
Pre-requisites : COM 2525
Operating system structures, Distributed systems, Resource management, Protection and security, Distributed file systems, Example distributed systems.

COM 3528 : Systems Design and Implementation
Pre-requisites : COM 2629
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 3617 : Professional Issues in Computing and Information Technology
Pre-requisites : COM 3520
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 3620 : Software Engineering 2
Pre-requisites : COM 3520
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 3621 : Advanced Algorithms
Pre-requisites : COM 2624
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 3624 : Architectural Support for Languages and Operating Systems
Pre-requisites : COM 2523, COM 2525
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 3626 : Artificial Intelligence
Pre-requisites : MAT 1541, MAT 1642
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 3627 : Evaluation of Information Systems
Pre-requisites : COM 3520
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 3629 : Database design and implementation
Pre-requisites : COM 2529
The module develop 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

POSTGRADUATE MODULES:

HONOURS MODULES:

Pre-requisites:
A BSc degree with Computer Science or Information Systems as one of the majors or an equivalent degree

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	

COM 5531 : Introduction to Grid Computing
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 5532 : Software Engineering Methodology
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 5533 : Information Systems Security
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 5534 : Scientific Research Method
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 5535 : Guided Reading
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 5631 : Introduction to Wireless and Ad hoc Networking
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 5632 : Forensic Computing
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 5633 : Compiler Principles
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 5634 : Guided Reading
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 5700 : Honors Research Project
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. Assessment of the project shall be done by both the supervisor and an external examiner.

MATHEMATICS AND APPLIED MATHEMATICS DEPARTMENT

UNDERGRADUATE MODULES:

FIRST YEAR MODULES:

(a) Service Modules:

MAT 0543/0643 : Basic Service Mathematics
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 0544/0644 : Service Mathematics
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 1543 : Mathematics for Biological, Earth and life Sciences I
Pre-requisites : MAT 0544 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 1545 : Business Mathematics I
Pre-requisites : MAT 0554/0644 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 1643 : Mathematics for Biological, Earth and Life Sciences II
Pre-requisites : MAT 1543
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 1645 : Business Mathematics II
Pre-requisites : MAT 1545
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 1649 : Mathematics for Planners
Pre-requisites : MAT 0644 or MAT 0544
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 2649 : Quantitative Methods in Planning
Pre-requisites : MAT 1649
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) Main Stream Modules

MAT 1541 : Differential Calculus
Pre-requisites : FMT 1540, FMT 1640 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 1542 : Mathematics Foundation I
Pre-requisites(s) : FMT 1540, FMT 1640 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 1641 : Integral Calculus
Pre-requisites : MAT 1541
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 1642 : Mathematics Foundation II
Pre-requisites : MAT 1542
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 1646 : Mechanics I
Pre-requisites : PHY 1521
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 1647 : Numerical Analysis I
Pre-requisites : MAT 1541
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 2541 : Linear Algebra
Pre-requisites : MAT 1642
Vector spaces and subspaces, Linear Dependences, Basis and Dimensions, Linear Transformations, Eigenvalues and Eigenvectors, Inner Product Spaces and Cauchy Schwartz Inequality, Applications.

MAT 2542 : Multivariable Calculus
Pre-requisites : MAT 1641
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 2548 : Mathematical Modelling I
Pre-requisites : MAT 1641 or MAT 1646
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 2641 : Real Analysis I
Pre-requisites : MAT 1542
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-Weistrass theorem, Heine Borel Theorem, Functions: injective, surjective, inverses, compositions, limits of functions, continuity, Fixed Point Theorem. Differentiation in $\Re$ **:** Riemann sums, Reimann-Stiltjies integration

MAT 2642 : Ordinary Differential Equations I
Pre-requisites : MAT 1641
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, Ricatti 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 2647 : Numerical Analysis II
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-Siedel 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' rules, interpolatory and Gaussian quadratures. Using computer programming and packages.

MAT 2648 : Vector Analysis
Pre-requisites : MAT 2542
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 3541 : Real Analysis II
Pre-requisites : MAT 2641

Construction of the real number system: Dedekind cuts, Cantor Sets. Introduction to Metric space Topology in $\Re^n$ **:** neighborhoods, cluster points, open sets, Compact sets, bounded sets, connected sets, Cantor's intersection Theorem, Bolzano-Weierastrass theorem, Heiene-Borel Theorem, Lebesque Covering Theorem. Functions in $\Re^n$ **:** Limits of functions, Continuity, Globe continuity, bounded continuous functions, Continuity of the inverses, Lipschitz condition and contraction, continuity and compactness, continuity and connectedness, Brauwer's Fixed point Theorem, Contraction of fixed points. Sequences in $\Re^n$: Limits, convergence, divergence, subsequences. Sequence of functions: Uniform convergence, Cauchy's Criterion. Differentiation in $\Re^n$ **.**

MAT 3542 : Group Theory
Pre-requisites : MAT 2541
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 3546 : Finance Mathematics
Pre-requisites : MAT 2556, STA 2641
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 3547 : Partial Differential Equations
Pre-requisites : MAT 2642
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 3549 : Ordinary Differential Equations II
Pre-requisites : MAT 2642
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 3556 : Statistical Finance Mathematics
Pre-requisites : MAT 2556
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 3641 : Complex Analysis
Pre-requisites : MAT 2641
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 3642 : Rings and Fields
Pre-requisites : MAT 3542
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 3643 : Graph Theory
Pre-requisites : MAT 3542
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 3644 : Continuum Mechanics
Pre-requisites : MAT 1646 or PHY 2521, MAT 3547
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 3646 : Mechanics II
Pre-requisites : MAT 1646, MAT 3547
Dynamics and Statistics of a particle, moving coordinate systems, systems of particles and rigid bodies, Lagrange's equations and Hamiltonian theory

MAT 3647 : Numerical Analysis III
Pre-requisites : MAT 2647
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 3648 : Mathematical Modelling II
Pre-requisites(s) : MAT 2548, MAT 2642
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 3649 : Geometry
Pre-requisites : MAT 2542, MAT 2642
Topics in projective planes, Euclidean and non-Euclidean Geometry

MAT 3656 : Advanced Financial Mathematics
Pre-requisites : MAT 3546
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.

POSTGRADUATE MODULES:

HONOURS MODULES:

Pre-requisite : A BSc degree with mathematics or applied mathematics as one of the majors or an equivalent degree obtained elsewhere.

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 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

MAT 5532 Functional Analysis **STA 5541** Advanced Probability Theory					
Total credits = 150		**Total credits = 150**		**Total credits = 150**	

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 programme would require certain modules, like MAT 3647, which are electives in some undergraduate programmes.

MAT 5530 : Numerical Solution of ODEs
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 5532 : Functional Analysis
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 5533 : Calculus of Variations
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. Trasversalty condition. Extrema conditions. Jacobi condition. Legendre condition. Weierstrass condition. Canonical forms. Direct methods. Ritz method. Kantorovich method. Applications.

MAT 5534 : Algebra I
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 5536 : Complex Analysis
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 5537 : Measure and Integration Theory
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 5538 : Number Theory I
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 5540 : Matrix analysis
Pre-requisites : As per the departmental requirements subject to admission rules of the school
Eigenvalues, eigenvectors and similarity. Unitary equivalence and normal matrices. Canonial forms. Hermitian and symmetric matrices. Matrix norms. Location and perturbation of matrices. Positive definite Matrices

MAT 5541 : Stochastic Differential equations I
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 5543 : Fluid mechanics
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 5544 : Combinatorics I
Pre-requisites : As per the departmental requirements subject to admission rules of the school
Introduction to combinatorics and the pidgeon hole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5549 : Partial Differential Equations
Pre-requisites : As per the departmental requirements subject to admission rules of the school
Sturm-LioUnivenille 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 5551 : Theory of Computer Algebra
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 5552 : Partition Theory I
Pre-requisites : As per the departmental requirements subject to admission rules of the school
Elementary Theory of Patitions, Inversions in permutations and q – identities, Infinite series generating functions, Restricted partitions and permutaions.

MAT 5630 : Numerical Solution of Partial Differential Equations
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 5632 : General Topology
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. Urtsohn's Lemma. Tychonoff theorem. Stone-Cezh Compactification. Metrizable spaces.

MAT 5633 : Integral Equations
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 5634 : Transformation Geometry
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 5636 : Algebra II
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; Lei groups with applications to differential equations. Crystallographics groups with examples from Solid State Physics.

MAT 5641 : Financial Mathematics
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. Blackl-Scholes model. Black-Scholes action. Pricing market securities. Interest rates. Bigger models.

MAT 5643 : Graph Theory
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 5644 : Combinatorics II
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 5646 : Topics in stability and Optimization
Pre-requisites : As per the departmental requirements subject to admission rules of the school
Liapunov's Stability theory. Pontryagin's theorem.

MAT 5650 : Number Theory II
Pre-requisites : As per the departmental requirements subject to admission rules of the school
Introduction to combinatorics and the pidgeonhole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5652 : Partition Theory II
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 5653 : Control Theory
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 5654 : Stochastic Differential Equations II
Pre-requisites : As per the departmental requirements subject to admission rules of the school

MAT 5700 : Project
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.

MASTERS PROGRAMME:

Pre-requisites : Appropriate BSc Honours degree in Mathematics or Applied Mathematics or its equivalent obtained from elsewhere. 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 for the modules on offer, other than just a BSc Honours degree.

(a) MSc degree by research

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.

(b) MSc degree by course work and a mini-dissertation:

MAT 6656 : Mini dissertation
In order to be awarded the MSc degree in Mathematics or Applied Mathematics, a candidate must have passed six prescribed modules and completed satisfactorily the mini dissertation.

Taught MSc Modules

MAT 6541 : Measure and Integration I
Measure and measure spaces. Product measures, Tonnel Theorem. Fubini,s Theorem. Lebesgue space The Lebesgue spaces L_p, ($1 \leq p < \infty$). Convergence in measure. Vitali,s theorem. Riesz's Theorem. Egoroff's theorem. Decomposition of measure. Hahn's decomposition theorem. Jordan and Lebesgue Theorem. Riesz Representation Theorem. The extensions of measures, the Caratheodory and Hahn extension theorems. Lebesgue and Lebesgue Stieljies measures. Randon-Nikodym theorem. Integration of measure.

MAT 6542 : Functional Analysis I
Normed spaces. Banach spaces. Quotients and product of normed linear spaces. Linear functionals. Hahn-Banach extension theorem. Dual of normed linear spaces. Reflexive spaces. Open Mapping theorem, Closed Graph theorem. Uniform Boundedness Principle. Strong and weak convergence. Weak* convergence.

MAT 6543 : Ordinary Differential Equations I
A brief survey of first and second order linear ordinary differential equations; initial value problem. Existence and uniqueness. Pickard, Lindelof, Peano and Caratheodory theorems. Linear systems of differential equations; second order differential equations; singularities of first and second kind, series methods. Stability theory. Perturbation method, and its application

MAT 6544 : Complex Analysis I
Cauchy's integral theorem and consequences, Laurent series, calculus of residues, inverse and implicit functions, Rouche's theorem, harmonic and subharmonic functions, the poison integral, the mean-value property, positive harmonic functions Dirichlet's problem, the Poisson-Jensen formula and related properties, conformal mapping, normal families, the Riemann mapping theorem, Schwarz's lemma, the Phragemen-Lindelof and Hadamard theorems, entire functions with rational values, converse of the maximum modulus theorem.

MAT 6545 : Numerical Analysis I
Interpolation and approximation: Limitation on polynomial interpolation. The Fourier approximation. Interpolation in two variables. Rational approximation. Minimum – maximum error technique. Constructing minimax approximations. The calculation of eigenvalues and eigenvectors of matrices. The largest eigenvalue in magnitude by the power method. The eigenvalues and eigenvectors of symmetric matrices. Methods of non - symmetric matrices. The LR and QR algorithms. Errors in computed eigenvalues and eigenvectors. Deflation.

MAT 6546 : Computer Programming
Introduction to computer algebra systems MAPLE. Arithmetic operations. Fixed-point and floating-point calculations, using computer text editor. Basic MAPLE commands. Solving equations numerically. Calculus, convergence of sequence and series, Taylor series. Graphics, plotting in three dimensions. Approximation, programming in MAPLE, MAPLE procedures; if Statement, MAPLE loop. Numerical integration and Fourier series, MAPLE arrays, vectors, matrices. Introduction to MATHLAB, programming in MATHLAB, project.

MAT 6547 : Stochastic Differential Equations
Probability spaces, Random variables and stochastic processes, Ito integrals, Ito's formula and the martingale representation theorem, Stochastic differential equations, Diffusions, Boundary value problems, Optimal stopping, Stochastic control.

MAT 6548 : Dynamical Systems
Systems of ODE. 2-D linear and almost linear autonomous systems. Finite difference equations. Stability theory. Liapunov methods.Bifurcution, one and two-dimensional systems. Discrete systems. Self-similarity and fractal geometry. Chaos, detecting and route to chaos.

MAT 6550 : Partial Differential Equations II
Laplace's equation. Elliptic boundary value problems; Schauder estimates, and quasilinear symmetric hyperbolic systems. Heat equation, solutions and properties. Wave equations, solutions and properties, Duhamel's principle, energy methods. Sobolev spaces

MAT 6551 : Operator Theory II
Compact non self –adoint operators: Von-Neumann Schatten classes. Voltera operators. Triangular operators. Fredholm theory for trace-class operators. Superdiagonal representation of compact linear operators. Contractions, dilations, Naimark's theorem on dilations. Dissipative operators.

MAT 6552 : Functional Analysis III
Topological vector spaces. Product spaces and subspaces. Direct sum. Quotient spaces. Linear manifolds, hyperplanes. Locally convex spaces. Equicontinuity. Reflexive spaces. Conjugate spaces. Weak operators. Extreme points, extreme sets, Krein-Millman theorem.

MAT 6553 : Banach Algebra I.
Normed algebras. Adjunction of the identity. The radical in a normed algebra. Banach algebras with identity. Resolvent in a Banach algebra with identity. Regular representation of a normed algebra. Symmetric algebra.
Normed symmetric algebras. Commutative normed algebra. Homormophism and isomorphism of commutative algebras. Shilov boundary. Regular algebras. Primary ideals. Completely regular commutative algebras.

MAT 6554 : Differential Operators II
Spectral theory of self-adjoint operators, completely continuous operators, Extensions of symmetric operators, symmetric differential operators, spectral theory of differential operators, deficiency indices and applications and spectra of differential operators, the inverse of Sturm-LioUnivenille problem, the Stieltjes inversion formula, the

non-self-adjoint differential operators of second order on the half-line.

MAT 6555 : Numerical Analysis II
Numerical integration: Singular integrals, integration over a multidimensional hypercube. Error determination. Unequal intervals. Choosing a quadrature formula. Summation. Solution of ordinary differential equations. Methods based on higher derivatives. Extrapolation methods, stiff equations. Stability. Boundary value problems. Chebyshev methods. Error estimation. Solutions of partial differential equations. Hyperbolic equations. Parabolic and elliptic partial differential equations.

MAT 6556 : Mathematical Modelling I
Need, techniques, classification, examples. Modelling through: ordinary differential equations of first order, systems of ordinary differential equations, ordinary differential equations of second order, partial differential equations, graphs, functional-integral, delay-differential and differential-difference equations, calculus of variation and dynamic programming, mathematical programming, maximum principle and maximum entropy principle.

MAT 6558 : Distribution Theory and Fourier Analysis II
One-side Laplace transform, Titchmarsh's theorem, Mikusinski's operational calculus, differential operators with uniform strength, hypoellipticity.

MAT 6559 : Operator Theory I.
Calculus of projectors in Hilbert space, convergence for sequence of projectors. Square root of positive operators. Partial isometries. Polar decomposition. Spectral theory of operators. The Fredholm alternative. Applications to integral equations. Bounded integral operators. Hilbert-Schmidt operators. Carleman operators. Matrix operators.

MAT 6560 : Orthogonal Polynomials
Elementary theory of orthogonal polynomials. Representation theorem and distribution. Continued fractions and chain sequences. Recurrence relations and properties of orthogonal polynomials, Krein's theorem. Special functions. Classical orthogonal polynomials. Some specific systems of orthogonal polynomials: Bessel polynomials, q-polynomials, associated Legendre polynomials. Classical-type orthogonal polynomials, Bochner-Krall orthogonal polynomials.

MAT 6641 : Measure and Integration II
Decomposition of measures. The Hahn decomposition theorem. The Jordan and Lebesgue theorems. The Radon Nikodym theorem. The Riesz rep. Theorem. Generation of measures on algebras of sets. The extensions of measures, the Caratheodory and Hahn extension theorems. The Lebesgue and Lebegue's Stieltjes measures. The representation theorem for bounded positive linear functional on C[a , b]. Product measures. Tonneli's theorem. Fubini's theorem. Integration in locally compact spaces.

MAT 6642 : Functional Analysis II
Uniform boundedness. Closed linear transformations. Closed graph theorem, open mapping theorem. Inner product spaces. Projection theorem. Riesz representation theorem. Adjoint of linear transformation. Algebra B(X, Y) of bounded linear transformations. Banach theorem on inverse. Neumann series. Transpose of elements in B(X, Y). Spectra of linear operators. Spectral mapping theorem. Numerical range. Compact, self-adjoint, unitary and normal operators in Hilbert space.

MAT 6643 : Ordinary Differential Equations Ii
Floquet Theory, Regular and Singular Sturm-Liounivenille boundary value problems. Expansions in eigenfunctions, the regular and singular cases. The Titchmarsh-Weyl limit-point limit-circle theory. Green's functions. Asymptotic properties of solutions of linear and non-linear systems. Poincare-Bendixon theory.

MAT 6644 : Complex Analysis II
Entire and meromorphic functions, zeros of holomorphic functions, infinite products and partial fraction expansions, Weierstrass factorization theorem, functions of finite order, Mittag-Leffler theorem, Jensen's theorem, Blaschke products, the Muntz-Szasz theorem, elliptic functions, global analytic functions, analytic continuation, monodromy theorem, complete analytic functions, elementary theory of Riemann surfaces.

MAT 6646 : Numerical Solutions of PDEs
Topics to be selected from: Difference Methods for Elliptic, parabolic and hyperbolic equations. Finite element methods and variational techniques. Applications

MAT 6647 : Pertubation Methods
Elementary concepts, Equations containing a small parameter or a region slightly perturbed from a regular figure. Solutions in terms of small perturbation parameter. Methods of regular perturbation. Non-uniform expansions. Singular perturbation. Poincare-Lighthill-Kuo, matche asymptotic expansion, and multiple scales. Methods are illustrated by solving ODEs and PDE

MAT 6648 : Distribution Theory and Fourier Analysis I
Introduction to the theory of distribution. Convergence, generalized functions / tempered distributions, translations, multiplications and convolutions, Fourier transforms of rapidly decreasing / tempered distributions.

MAT 6649 : Topological Vector Spaces.
Operator theory on Hilbert and Banach space. Hahn-Banach theorem. Open mapping and closed graph theorems. Riesz representation theorem. Locally convex spaces. Weak topologies. Weak compactness. Anaoglu's theorem, Krein-Milman theorem. Krein-Smulian theorem. Banach-Stone theorem Compact and weakly compact operators. Spectral theory on Banach spaces. Ideals and Quotients. Riesz functional calculus. Spectrum of linear operators. Spectrum of compact operators. Abelian Banach algebra.

MAT 6650 : Partial Differential Equations I
Transport equations, first order equations, first order nonlinear partial differential equations, characteristics, conservation laws, shock and entropy conditions. Power series methods. The Cauchy-Darboux-Kowalevski theorem,

MAT 6651 : Differential Operators I
Fundamental concepts, eigenvalues and eigenfunctions of differential operators, Green's functions, Asymptotic properties of the eigenvalues and eigenfunctions, expansions in terms of eigenfunctions, differential operators in a space of vector functions, Hilbert space, theory of operators in a Hilbert space.

MAT 6652 : Operator Theory IV
Numerical ranges of operators in Hilbert space. Hypernormal operators. Subnormal operators. Shifts, models, invariant subspaces of simple shifts. Analytical representation of unilateral shifts.

MAT 6653 : Banach Algebra II.
Representation of symmetric algebras. Irreducible representations. Embedding in to an algebra of operators. Indecomposable functionals and irreducible representations. Application to commutative symmetric algebras. Generalized Schur lemma. Representations of the algebra of bounded linear operators in a Hilbert space. Completely regular algebras. Algebras of vector valued functions.

MAT 6654 : Fluid Dynamics
Equations of continuity and fluid motion. Dynamical similarity. Viscous flows. Inviscid flows. Boundary layers. Instability and turbulent flows. Flow in rotating fluids. Geostrophic flow, Ekman layer and Rossby waves. Stratified flow.

MAT 6655 : C*- Algebra
Elementary properties. Abelian C*-algebra. Functional calculus in C*-algebra. Positive elements, Ideals and Quotients. Spectral measure of C*-algebra. Spectral theorem on Hilbert spaces. Topologies on B(H). Commuting operators. Abelian von Neuman algebras. Multiplicity theory for normal operators.

MAT 6659 : Operator Theory III
Spectral theory of self -adjoint and normal operators. Spectral decomposition theorem. Spectral resolution for unitary operators. One-parameter unitary groups. Shifts, multiplication operators. Unilateral and bilateral shifts. Extensions of symmetric operators. Unbounded self-adjoint and normal operators.

DOCTORAL PROGRAMME:

MAT 7000 : Research Project
Pre-requisites: An appropriate MSc. Degree in Mathematics/Applied Mathematics or its equivalent.

MICROBIOLOGY DEPARTMENT

UNDERGRADUATE MODULES:

SECOND YEAR MODULES:

MBY 2521 : Bacteriology
Pre-requisites : BIO 1541, CHE 1540, CHE 1621 or CHE 1622
Historical perceptive 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 2522 : Immunology
Pre-requisites : BIO 1541, CHE 1540, CHE 1621 or CHE 1622
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. AdjUnivenants. 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 2623 : **Environmental Microbiology**
Pre-requisites : MBY 2521
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. Bioremedation. Biofilms. Microbial corrison/biofilms. Environental sample collection- specific methods for the isolation of pathogens from stools, food, water, air, soil. Introduction to molecular techniques. Pollution factors. Seminars/reports

MBY 2624 : **Virology**
Pre-requisites : MBY 2521
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 3526 : Food Microbiology
Pre-requisites : MBY 2521, MBY 2623, MBY 2624
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 extrinisic 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 3527 : **Industrial Microbiology**
Pre-requisites : MBY 2521, MBY 2623, MBY 2624
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

MBY3628 : **Mycology**
Pre-requisites : MBY 2521, MBY 2623, MBY 2624
Structure and features of fungi and algae. Classification of fungi: Zygomycetes, Basidomycetes, Ascomycetes, Deutromycetes, 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.

MBY3629 : Parasitology
Pre-requisites : MBY 2521, MBY 2623, MBY 2624
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.

POSTGRADUATE MODULES:

HONOURS MODULES:

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**
Pre-requisites : Successfully completed BSc degree with Microbiology as major
Overview of the vertebrate immune system; production and use of monoclonal antibodies; tolerance induction; immunosuppresion; 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 5503 : **The Role of Microorganisms in Disease**
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, entero- virus 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, trypanasomiasis, leishimaniasis, malaria, cryptosporidiosis, schistosomiasis, hookworm, ascariasis, taeniasis, enterobiasis, onchocerciasis/loasis, dracunculosis, pneumocystis infection and other parasitic diseases, cryptococcosis, histoplasmosis, blastomycosis, candidiasis, aspergillosis, ptyiriasis versicolor, scaly cutaneous mycosis, and cutaneous fungal infections. Prions

MBY 5604 : **The Role of Microorganisms in Industrial Processes**
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 5605 : **The Role of Microorganisms in the Environment**
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 5700 : **Research Project and Report**
Pre-requisites : Successfully completed BSc degree with Microbiology as major

MBY 5701 : **Advanced Research Methodology and Seminars**
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

MASTERS PROGRAMME:

The MSc programme is research based. Prospective applicants should prior to making an application, enquire with the relevant faculty member about the suitability and feasibility of their proposed research interests. Applicants should have obtained an overall mark of at least 60% at the BSc Honours level. Applicants will undergo a selection interview.

MBY 6000 : **Research Project and Seminars**
Pre-requisites : Appropriate BSc Honours degree

DOCTORAL PROGRAMME:

The doctoral programme is research based. Prospective applicants should prior to submitting an application inquire with the relevant faculty member about the suitability and feasibility of their proposed research interests. Applicants should have obtained an overall mark of 60% at the MSc level. Applicants will undergo a selection interview.

MBY 7000 : **Research Project and Seminars**
Pre-requisites : Appropriate MSc degree.

PHYSICS DEPARTMENT

UNDERGRADUATE MODULES:

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 1525 : Physics for Natural (Biological & Health) Sciences I
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 1625 : Physics for Natural (Biological & Health) Sciences II
Pre-requisites : As per admission requirement of the School of Maths & Natural Science
Co-requisite : PHY 1525
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 modules

PHY 1527 : Physics for Environmental & Agricultural Sciences I
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 1627 : Physics for Environment & Agricultural Sciences II
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 1521 : Mechanics
Pre-requisites : As per admission requirement of the School of Maths & Natural Science
Co-requisites : MAT 1541

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

PHY 1522 : Waves and Optics I
Pre-requisites : As per admission requirement of the School of Maths & Natural Science
Co-requisites : MAT 1541
Description and Properties of Waves, Properties of Sound Waves, Doppler Effect, Spherical Mirrors, Lenses and their Applications, Wave Properties of Light, Interference.

PHY 1623 : Properties of Matter and Heat
Pre-requisites : As per admission requirement of the School of Maths & Natural Science
Co-requisites : MAT 1641
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 1624 : Electricity and Magnetism
Pre-requisites : As per admission requirement of the School of Maths & Natural Science
Co-requisites : MAT 1641
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 2521 : Classical Mechanics
Pre-requisites : PHY 1521, MAT 1541, MAT 1641
Vector Algebra, Rigid Body Dynamics, Angular Momentum, Moment of Inertia, General Motion in Three-Dimensions, Fundamentals of Lagrangian and Hamiltonian Mechanics.

PHY 2522 : Waves and Optics II
Pre-requisites : PHY 1522, MAT 1541, MAT 1641
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 2623 : Electrodynamics
Pre-requisites : PHY 1624, MAT 1541, MAT 1641
Electrostatics, Electric Fields in Matter, Magnetostatics, Magnetic Fields in Matter, Electrodynamics, and AC Circuit Analysis.

PHY 2624 : Modern Physics
Pre-requisites : PHY 1521, MAT 1541, MAT 1641
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 3521 : Atomic and Nuclear Physics
Pre-requisites : PHY 2624
Rutherford Scattering, Bohr Atomic Model, Correspondence Principle, Atomic Spectra, Nuclear Properties, Nuclear Forces, Nuclear Models, Nuclear Decay and Radioactivity, Nuclear Reactions.

PHY 3522 : Solid State Physics
Pre-requisites : PHY 2521 and PHY2624
Crystallography, X-ray Diffraction, Crystal Defects, Lattice Vibrations, Heat Capacity, Metallic behaviour and Free Electron Gas, Energy Bands.

PHY 3525 : Energy Physics
Pre-requisites :PHY 2522 and PHY 2623
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 3623 : Thermodynamics and Statistical Mechanics
Pre-requisites : PHY 2521
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 3624 : Quantum Mechanics
Pre-requisites : PHY 2624
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 3626 : Electronics
Pre-requisites : PHY 2623
DC Circuit Theorems, Semiconductor Diodes, Diode Applications, Bipolar Junction Transistors, DC Biasing: BJT's, Field-Effect Transistors, FET Biasing, Operational Amplifiers.

PHY 3627 : Project
Pre-requisites : PHY 2521, PHY 2522, PHY 2623 and PHY 2624

POSTGRADUATE MODULES:

HONOURS MODULES:

Pre-requisites:
An average of 60% in Physics third year modules or its equivalent gained elsewhere with sufficient mathematics background. In marginal cases, additional criteria will be used to admit students into the BSc Honours 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)
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 5522 : Quantum Mechanics I (core)
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 5523 : Solid State Physics I (core)
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 5524 : Renewable Energy
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 5525 : Mathematical Methods of Physics
Pre-requisites : As per the admission requirement of the school
Vector Calculus, Matrices and Applications, Fourier Transforms, Special Functions and Polynomials, Integral Transforms.

PHY5526 : Laser Physics I
Pre-requisites : As per the admission requirements of the school
Will be offered in collaborations with National Laser Centre, CSIR
PHY 5527 : Electronics
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 5621 : Electrodynamics (core)
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 5622 : Statistical Mechanics (core)
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 5623 : Project (core)
Pre-requisites : As per the admission requirement of the school

PHY 5624 : Solid State Physics II
Pre-requisites : PHY 5523
Phonons I: Crystal vibrations, Phonon II: Thermal Properties, Thermal Conductivity, Imperfection in Crystals, Optical Properties and Physics of Semiconductors.

PHY 5625 : Quantum Mechanics II
Pre-requisites : PHY 5522
Angular Momentum, Spherically Symmetric Potentials, Scattering, Principles of Quantum Dynamics, Spin, Rotations and other Symmetry Operations, Perturbation Theory.

PHY5626 : Laser Physics II
Pre-requisites : PHY 5526
Will be offered in collaborations with National Laser Centre, CSIR

PHY 5627 : Nuclear and Particle Physics
Pre-requisites : PHY 5522
Nucleon Structure, Nuclear Forces, Bulk Properties of Nuclei, Nuclear Excitation and Decay, Elementary Particle Dynamics, Symmetries, Bound States, Feynman Calculus.

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.

STATISTICS DEPARTMENT

UNDERGRADUATE MODULES:

FIRST YEAR MODULES:

(a) Service Modules:

STA 1548 : **Basic Statistics (Business, Economics and the Social Sciences).**
Pre-requisites : MAT 0544 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 1549 : Basic Statistics (for the Natural and Applied Sciences).
Pre-requisites : MAT 0544 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 1648 : Basic Statistical Inference (Business, Economics and the Social Sciences).
Pre-requisites : STA 1548
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 1649 : Basic Statistical Inference (for the Natural and Applied Sciences).
Pre-requisites : STA1549
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 3648 : Biometry
Pre-requisites : STA 1648 or STA 1649
Biometrical Analysis of Agricultural Experiments, Statistical tests of hypotheses, Correlation and regression, ANOVA.

STA 3649 : **Fundamentals of Agronomic Experimentation**
Pre-requisites : STA 1649 or equivalent
Principles of field experimentation, Analysis of different experimental designs: completely randomized, randomized block designs, and Latin squares. Factorial Designs, missing plots.

STA 5649 : **Experimental Design**
Pre-requisites : STA 1648 or STA 1649
Topics: Principles of Experimental Design, Basic Experimental Designs: Completely randomized, Randomised Block, Latin Squares and Factorial Designs, Fixed and random effects.

STA 7649 : Experimental Design
Pre-requisites : STA 1648 or STA 1649, STA 3649, STA 5649.
Advanced experimental designs: Balanced incomplete block designs, 2^k factorial designs, missing plot techniques, Nested and Split-plot design. Analysis of covariance.

(b) <u>Mainstream Modules:</u>

STA 1541 : Introduction to Statistics
Pre-requisites : At least 50% in Grade 12 Mathematics or 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 1542 : Introductory Probability
Pre-requisites : At least 50% in Grade 12 Mathematics or MAT 0544/MAT 0644 (Service Mathematics)
Co-requisites : STA 1541
Counting techniques. Probability and Relative frequency, properties. Addition rule, mutually exclusive events. Conditional probability Baye's Theorem and Independence; Random variables and probability distributions. Binomial, Poisson and Normal distributions, Binomial and Normal tables.

STA 1641 : Elementary Statistical Methods I – Introductory Inference
Pre-requisites : STA 1541, STA 1542
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 1642 : Elementary Statistical Methods II – Correlation and Regression
Pre-requisites : STA 1541, STA 1542
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

<u>SECOND YEAR MODULES:</u>

STA 2541 : Probability Theory
Pre-requisites : STA 1542, MAT 1541, MAT 1641
Co-requisite : MAT 2541
Random experiments. Sample spaces and assignment of probabilities to events in the sample space. Random variables. Probability density functions and cumulative distribution functions. Joint, marginal and conditional distributions. Expectation and variance. Moment generating functions and moments. Functions of random variables and their properties. Special discrete probability distributions. Special continuous probability distributions. Sums of random variables. Characteristic functions and their properties. Covariance and correlation. Limit theorems (Law of large numbers and Central limit theorem). Approximations

STA 2542 : Multiple Regression
Pre-requisites : STA 1641, STA 1642, MAT 1642
Co-requisite : MAT 2541
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 2641 : Statistical Computing
Pre-requisites : STA 1542, MAT 1541, MAT 1641
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 2642 : Sampling Techniques
Pre-requisites : STA 1641, STA 1642
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 3541 : Statistical Inference
Pre-requisites : STA 2541
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 3542 : Industrial Statistics
Pre-requisites : STA 2541
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 3543 : Official Statistics and Introduction to Research
Pre-requisites : STA 1641, STA 1642, STA 2641
Rationale for research. Research design. Sources of data. Sampling procedures. Demographical population parameters. Basic projections of population parameters. Use of Statistical packages.

STA 3641 : Time Series Analysis
Pre-requisites : STA 2541, STA 2641
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 3642 : Experimental Design
Pre-requisites : STA 1641, STA 2541
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 3643 : Multivariate Methods
Pre-requisites : STA 2541, STA 2641, STA 2541, MAT 2647
Multivariate distributions. Sampling from the multivariate normal distribution. Transformations to near normality. Inferences about the mean vector. Comparison of several multivariate means.

STA 3644 : Non-Parametric and Categorical Statistics
Pre-requisites : STA 1641, STA 1642, STA 2641
Co-requisites : STA 3642

POSTGRADUATE MODULES:

HONOURS MODULES:

Pre-requisites:

- To be admitted to the BSc Honours programme, a candidate must have completed the Bachelor's Degree in Statistics with an average of 60% for the third year level and a pass in Mathematics at the second year level. In marginal cases, additional criteria will be used to admit students into the 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
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 5542 : Multivariate Statistical Analysis
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 5543 : Statistical Quality Control
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 5544 : Sampling Survey and Research Methods
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 5545 : Generalised Linear Models
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 5641 : Demographic Methods
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 5642 : Time Series Analysis
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 5643 : Analysis of Discrete Data
Cross-classified tables. Log-linear models. Hierarchical models. Model selection. Polytomous and multivariate response variables. Logistic regression

STA 5644 : Stochastic Processes
Elements of stochastic processes, Markov chains, Recurrence, Limit theorems of Markov Chains, Renewal processes, Martingales, Brownian motion

STA 5700 : BSc HONOURS PROJECT

MASTERS PROGRAMME:

For the MSc Degree in Statistics by coursework:

- A student must pass five modules and STA 6700
- STA 6541 and STA 6546 must be taken unless the student has passed equivalent modules at the BSc Honours level.

- A student cannot register for modules already passed at the BSc Honours level.
- MSc research to start only after successfully passing three modules in the first semester and student's proposal presented and accepted by Higher Degrees Committee of the school

STA 6541 : Probability Theory
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 6542 : Multivariate Statistical Analysis
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 6543 : Statistical Quality Control
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 6544 : Sampling Survey and Research Methods
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 6545 : Generalised Linear Models
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 6641 : Demographic Methods
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 6642 : Time Series Analysis
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 6643 : Analysis of Discrete Data
Cross-classified tables. Log-linear models. Hierarchical models. Model selection. Polytomous and multivariate response variables. Logistic regression

STA 6644 : Stochastic Processes
Elements of stochastic processes, Markov chains, Recurrence, Limit theorems of Markov Chains, Renewal processes, Martingales, Brownian Motion

STA 6546 : Advanced Statistical Inference
Point and interval estimation, Sufficiency, Unbiasedness, Invariance, Pivotal quantities, Bayesian methods of estimation. Hypothesis Testing, Methods of finding tests, Unbiased Tests, generalised likelihood tests and their properties, Sequential tests of hypotheses.

STA 6645 : Advanced Topics in Statistics II
Directed readings in selected topics in Statistics chosen to meet the needs of individual students.

STA 6700 : MSc MINI DISSERTATION

STA 6000 : MSc Research Project.
Pre-requisites : Appropriate BSc Honours degree.

DOCTORAL PROGRAMME:

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

ZOOLOGY DEPARTMENT

UNDERGRADUATE MODULES:

(a) Modules for the Diploma in Freshwater Technology (DIPFWT):

FIRST YEAR MODULES:

BIO 1543 : Diversity of Life for Diploma Students

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

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.

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.

BIO 1544 : **Cell Biology for Diploma Students**

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

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. Cytology: The history of cell biology, the cell theory, Membrane biology, the structure and feature of eukaryotic cells, Techniques used in cytology, Prokaryotic cells. 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.

BIO 1645 : **Ecology, Adaptation and Evolution for Diploma Students**

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

Ecosystems. Energy flow and nutrient cycling. Analysis of communities, ecological hierarchy and sampling methodology. Species area relationship. Latitudinal gradient. Common and rare species. Interactive networks and food webs. Niches and competition. Predation and disturbance. Demography. Dispersal. Darwinism. Microevolution. Macroevolution. Adaptation. 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 1641 : Fluvial Geomorphology and Water

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

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. 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.

HWR 1541 : **Introductory Hydrology and Meteorology**
*Pre-requisite : An achievement rating of 4 (NSC) **OR** E (HG) **OR** D (SG) in either matric Biology or Physical Science or Agricultural Science.*
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.

FWT 1601 : **Research Methodology, Project Planning and Management**
*Pre-requisites : An achievement rating of 4 (NSC) **OR** E (HG) **OR** D (SG) in either matric Biology or Physical Science or Agricultural Science.*
Students to be introduced to 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. 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. The theory will include case studies and this will be backed up by the students planning research projects regarding hypothetical problems.

FWT 1541 : **Introductory Biometry**
*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 descriptive statistics (average, mean, median and standard deviation), association statistics (correlation and regression), comparative statistics (t-test, chi-square) and frequency statistics. Use of graphics in reports.

COM 0601 : **Computer literacy**
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 2531 : **Basic Freshwater Ecology**
Pre-requisites : *FWT 1514, FWT 1641, BIO 1543, BIO 1544, BIO 1645, HWR 1541*
Defining limnology and introducing the relevant ecological concepts. Classification of water bodies. 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). The physico-chemical character of water bodies. Primary and secondary production and the cycling of nutrients and energy. 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 2532 : **Freshwater Biology**
Pre-requisites : BIO 1543, BIO 1544, BIO 1645, FWT1541, FWT 1641, HWR 1541, FWT 2531
Bacteria in freshwater. Freshwater algae and their role in the aquatic environment. The structure and function of plant and animal communities of rivers and wetlands, 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 2533 : **Identification of freshwater organisms**
Pre-requisites *BIO 1543, BIO 1544, BIO 1645, FWT1541, FWT 1641, HWR 1541, FWT 2531, FWT 2532*
The role played by morphological characteristics in the identification of organisms. The use of keys and identification guides. The identification of microscopic organisms (algae and diatoms). The identification of aquatic macroinvertebrates. The identification of aquatic macrophytes with an emphasis on aquatic weeds and alien invasive organisms. 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 2601 : **Aquatic habitat delineation and classification**
Prerequisites : *COM 0601, FWT 1601, FWT 2531, FWT2532, FWT 2533*
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 2602 : **Collection and Identification of Freshwater Organisms.**
Prerequisites : *COM 0601, FWT 1601, FWT 2531, FWT 2532, FWT 2533*
This module will focus on 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 clearing all first and second year modules.

FWT 3531 : **Sampling Technology**
Pre-requisites *: FWT 2531, FWT 2532, FWT 2533*
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), Sampling techniques of water sediment and fish for chemical analyses (major inorganic ions, heavy and trace metals, organic compounds) sampling techniques for biological and bacteriological analyses. Sampling techniques for toxicity testing. Early detection and eradication of alien invasives.
b) Introduction and practical use of relevant apparatus
c) Sampling and preservation techniques of biological samples. (algae/diatoms/plants/insects/fish) 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 3532 : **Introduction to Water Resource Management**
Pre-requisites : FWT 2531, FWT 2532, FWT 2533, FWT 3531
Basic principles of management and sustainable development. Sustainable development and management of water resources. The principles and application of water and sewage treatment. 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 (30%)
b) Examination: The examination for this module consists of 1 three hour paper.

FWT 3533 : **Biomonitoring Technology**
Pre-requisites : FWT 2531, FWT 2532, FWT 2533, FWT 3531, FWT 3532
Reasons for biomonitoring. The history and development of biomonitoring. EcoStatus and Ecological Reserve determination. Planning of a biomonitoring exercise. 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 3601 : **Sampling in Freshwater Ecosystems**
Pre-requisites : *FWT 2601, FWT 2602, FWT 3531, FWT 3532, FWT 3533*
In addition students who have not completed first and second year modules offered in the second semester (FWT 1601, FWT 1641, and BIO 1645) will not qualify for WIL programmes.
Students will be assigned a river/wetland for which they have to set up a sampling protocol (for repeated sampling for four weeks), do *in situ* physico-chemical determinations, collect samples for major inorganic ions analyses and write a report on their *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
   i) The portfolio which contains the project proposals (70%)
   ii) Evaluation of an oral presentation of project plan (10%)
   iii) 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 3602 : **Biomonitoring of Freshwater Ecosystems**
Pre-requisites : *FWT 2601, FWT 2602, FWT 3531, FWT 3532, FWT 3533*
In addition students who have not completed first and second year modules offered in the second semester (FWT 1601, FWT 1641, BIO 1645) will not qualify for WIL programmes.
With the use of currently applicable biomonitoring indices, such as IHI and SASS5, students will assess the EcoStatus of selected riverine ecosystems and prepare a report on the health of the ecosystem.

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
   (i) The portfolio which contains the project proposals (70%)
   (ii) Evaluation of an oral presentation of project results (10%)
   (iii) 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

(b) Degree modules presented jointly by the Botany and Zoology departments:

FIRST YEAR MODULES:

BIO 1541 : The Tree of Life
*Pre-requisites : An achievement rating of 4 (NSC) **OR** E (HG) **OR** D (SG) in either matric Biology or Physical Science or Agricultural Science.*
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 1542 : Cell Biology
*Pre-requisites : An achievement rating of 4 (NSC) **OR** E (HG) **OR** D (SG) in either matric Biology or Physical Science or Agricultural Science.*
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 1643 : Ecology, Adaptation and Evolution
*Pre-requisites : An achievement rating of 4 (NSC) **OR** E (HG) **OR** D (SG) in either matric Biology or Physical Science or Agricultural Science.*
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

(c) Degree modules presented by the Zoology department:

BIO 1644 : Introductory Human Anatomy and Physiology
*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 2542 : Population Ecology
Pre-requisites : BIO 1541, BIO 1643
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 2646 : Conservation Biology I
Pre-requisites : BIO 1541, BIO 1643
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 2541 : Animal Physiology
Pre-requisites : BIO 1542, BIO 1643
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 2544 : Principles of Genetics
Pre-requisites : BIO 1542, BIO 1643
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 2648 : Animal Phylogeny
Pre-requisites : BIO1541, BIO1643
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 3544 : Basic Freshwater Ecology
Pre-requisites : BIO 2542, BIO 2646
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 3646 : Conservation Biology II
Pre-requisites : BIO 2646, BIO 2542
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; protested areas; species conversation ‘’green’’economics; conserving the evolutionary process; conservation in forest-, savanna-, marine, drylands-, freshwater-, agricultural- and urban systems; conservation efforts, agreements and treaties.

ZOO 3541 : Animal Ecophysiology
Pre-requisites : ZOO 2541, ZOO 2544
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 3649 : Evolutionary Genetics
Pre-requisites : ZOO 2544, ZOO 2648
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.

POSTGRADUATE MODULES:

HONOURS MODULES:

Pre-requisites:
In addition to section 4 candidates must have an average of 60% for the final-year modules relevant to the honours programme for which they want to register and must meet with the pre-requisites for the individual honours modules. Candidates with average below 60% may be accepted subject to SENATE approval.

Programme curricula:
- Each programme consists of six modules with a minimum total credit value of 120.
- In order to qualify for the 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 department.
- Students are advised to consult the head of the department regarding the modules offered in a particular year.

BSc (Honours) in Biodiversity and Conservation (BSCHCB)	**BSc (Honours) in zoology (BSCHZO)**
Core Modules	
BIO 5501 or ZOO 5501 (16) Research Methodology **BIO 5700** (42) Research Project	**ZOO 5501** (16) Research Methodology **ZOO 5700** (42) Research Project

BIO 5511 (16) Conservation Biology **BIO 5510** (16) Freshwater Ecology	**ZOO 5606** (16) Invertebrate Diversity and Conservation **ZOO 5607** (16) Molecular Ecology **ZOO 5609** (16) Animal Ecophysiology
Elective Modules	
Candidate must select a minimum of two electives from the following modules: **BOT 5504** (16) Applied Plant Ecology **ZOO 5606** (16) Invertebrate Diversity and Conservation **ZOO 5607** (16) Molecular Ecology	Candidate must register one of the following: **BIO 5511** (16) Conservation Biology **BCM 5623** (15) Physiological Biochemistry **BCM5624** (15) Advanced enzyme Kinetics

Module description and Pre-requisites for specific modules in the Honours Programmes:

BIO/ZOO 5501 : Research Methodology
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.

BIO 5700/ZOO 5700: Research Project
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.

ZOO 5606 : Invertebrate Diversity and Conservation
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for BIO3646
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 5607 : Molecular Ecology
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher ZOO 3649
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 5609 : Applied Animal Ecophysiology
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for ZOO 3541
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

BIO 5510 : Freshwater Ecology
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for BIO 3544.
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 5511 : Conservation Biology
Pre-requisites : A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with 60% or higher for BIO 3646.
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.

MASTERS PROGRAMME:

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

DOCTORAL PROGRAMME:

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