CORRESPONDENCE

Please address all correspondence to:

The University Registrar
University of Venda
Private Bag X5050
THOHOYANDOU
LIMPOPO PROVINCE
0950

TELEPHONE NUMBER : (015) 9628000
FACSIMILE NUMBER : (015) 9624749
WEBSITE : www.univen.ac.za
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:

1. GENERAL INFORMATION
   - Academic Year Plan
   - Mission Statement
   - Officers of the University
   - Council of the University
   - Senate
   - Academic Staff and Departments
   - Administrative Staff
   - Colours and Hoods for Degrees
   - Admission and Registration
   - General Regulations
   - Library
   - General Rules for Degrees, Diplomas and Certificates

2. SCHOOL OF AGRICULTURE, RURAL DEVELOPMENT AND FORESTRY
3. SCHOOL OF EDUCATION
4. SCHOOL OF ENVIRONMENTAL SCIENCES
5. SCHOOL OF HEALTH SCIENCES
6. SCHOOL OF HUMAN AND SOCIAL SCIENCES
7. SCHOOL OF LAW
8. SCHOOL OF MANAGEMENT SCIENCES
9. SCHOOL OF MATHEMATICAL AND NATURAL SCIENCES
10. STUDENT FEES
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 Mantshimul
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)

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)
Junior Lecturer: A Burger, BSc (Hons) (UP), PhD (Rhodes)
Lab Technicians: DC Mmboyi, BSc (Hons) (Univen)

Botany Department
Associate Professor: *MP Tshisikhawhe, 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)
Lecturers: RT Tshivhandekano, BSc (Univen), BSc (Hons), MSc (UCT), M.Env.Man (PU for CHE)
Lab Technician: MP Legodi, BSc (Hons) (Univen), 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 (Brunei 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) (KZEN), MSc, DPhI (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), Ph.D.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 Mulauldi, BSc (Hons); MSc (Univen)
- GM Mokganya, MSc (Univen)
- MM Mdodla, 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 Mulauldi, BSc (Hons) (Univen), 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.**

<table>
<thead>
<tr>
<th>Qualification name</th>
<th>Total number of years</th>
<th>Credits (Actual number)</th>
<th>NQF level</th>
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<tbody>
<tr>
<td>Science Foundation Programme</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Diploma in fresh water technology</td>
<td>3</td>
<td>360</td>
<td>6</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>3</td>
<td>360</td>
<td>7</td>
</tr>
<tr>
<td>Honors</td>
<td>1</td>
<td>120</td>
<td>8</td>
</tr>
<tr>
<td>Masters</td>
<td>2</td>
<td>-</td>
<td>9</td>
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<tr>
<td>PhD</td>
<td>3</td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>
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 fulfill 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

<table>
<thead>
<tr>
<th>ONE YEAR DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester 1</strong></td>
</tr>
<tr>
<td>FGS 1540 (12)</td>
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<tr>
<td>Foundation Skills &amp; Study Skills 1</td>
</tr>
<tr>
<td>FIT 1540 (12)</td>
</tr>
<tr>
<td>Information Technology Fundamentals 1</td>
</tr>
<tr>
<td>FMT 1540 (12)</td>
</tr>
<tr>
<td>Foundation Mathematics 1</td>
</tr>
<tr>
<td>FPH 1540 (12)</td>
</tr>
<tr>
<td>Foundation Physics 1</td>
</tr>
<tr>
<td>FCH 1540 (12)</td>
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<tr>
<td>Foundation Chemistry 1</td>
</tr>
<tr>
<td>FBI 1540 (12)</td>
</tr>
<tr>
<td>Foundation Biology 1</td>
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</table>

Total credits = 72

Total credits = 72
## Year 1 - NQF Level 5

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 1543 (16) Diversity of Life for diploma students</td>
<td>FWT 1601 (28) An Introduction into Research Methodology and Project Planning and Project Management.</td>
</tr>
<tr>
<td>BIO 1544 (16) Cell Biology for diploma students</td>
<td>FWT 1641 (16) Introduction to Fluvial Geomorphology and the Physico-chemical Aspects of Water</td>
</tr>
</tbody>
</table>

**Core modules**

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>FWT 2531 (20) Basic Freshwater Ecology</td>
<td>FWT 2601 (30) Aquatic Habitat Delineation and Classification (Project)</td>
</tr>
<tr>
<td>FWT 2532 (20) Freshwater Biology</td>
<td>FWT 2602 (30) Collection and Identification of Freshwater Organisms (Project)</td>
</tr>
<tr>
<td>FWT 2533 (20) Identification of Freshwater Organisms</td>
<td>FWT 3533 (20) Biomonitoring Technology</td>
</tr>
</tbody>
</table>

**Fundamental modules**

<table>
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<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
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<tbody>
<tr>
<td>HWR 1541 (8) Hydrology</td>
<td>COM 0601 (4) Computer Literacy</td>
</tr>
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</table>

**Total credits = 120**

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## Year 2 - NQF Level 6

<table>
<thead>
<tr>
<th>Semester 1</th>
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</tr>
</thead>
<tbody>
<tr>
<td>FWT 1645 (16) Ecology, Adaptation and Evolution for diploma students</td>
<td>FWT 2531 (20) Basic Freshwater Ecology</td>
</tr>
<tr>
<td>FWT 1641 (16) Introduction to Fluvial Geomorphology and the Physico-chemical Aspects of Water</td>
<td>FWT 2601 (30) Aquatic Habitat Delineation and Classification (Project)</td>
</tr>
</tbody>
</table>

**Core modules**

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>FWT 2532 (20) Freshwater Biology</td>
<td>FWT 2602 (30) Collection and Identification of Freshwater Organisms (Project)</td>
</tr>
<tr>
<td>FWT 2533 (20) Identification of Freshwater Organisms</td>
<td>FWT 3533 (20) Biomonitoring Technology</td>
</tr>
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**Total credits = 120**

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## Year 3 - NQF Level 7

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<tr>
<th>Semester 1</th>
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<tbody>
<tr>
<td>FWT 1541 (16) Introductory Biometry</td>
<td>FWT 1601 (28) An Introduction into Research Methodology and Project Planning and Project Management.</td>
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**Core modules**

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<td>FWT 2531 (20) Basic Freshwater Ecology</td>
<td>FWT 2601 (30) Aquatic Habitat Delineation and Classification (Project)</td>
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<td>FWT 2532 (20) Freshwater Biology</td>
<td>FWT 2602 (30) Collection and Identification of Freshwater Organisms (Project)</td>
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**Fundamental modules**

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<tr>
<td>HWR 1541 (8) Hydrology</td>
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**Total credits = 120**
6.3. BACHELOR OF SCIENCE LEARNING PROGRAMMES

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

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<thead>
<tr>
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<th>Year 3 - NQF level 7</th>
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<tr>
<td>General Chemistry</td>
<td>Inorganic Chemistry I</td>
<td>Structural and Functional Biochemistry I</td>
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<td>CHE 1622 (8)</td>
<td>BCM 2522 (10)</td>
</tr>
<tr>
<td>Tree of Life</td>
<td>Organic Chemistry I</td>
<td>Biochemical and Molecular Techniques</td>
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<tr>
<td>BIO 1542 (16)</td>
<td>STA 1649 (8)</td>
<td>MBY 2521 (10)</td>
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<td>Cell Biology</td>
<td>Basic Statistical Inference</td>
<td>Bacteriology</td>
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<td>MBY 2522 (10)</td>
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## Bachelor of Science in Biochemistry and Biology: BSCBCB

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<td>and Morphology</td>
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<td>and Earth Sciences</td>
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**Total credits = 120**

**Total credits = 136**

**Total credits = 108**
## BACHELOR OF SCIENCE IN MICROBIOLOGY AND BOTANY: BSCMB

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<td>MBY 2521 (10) Bacteriology</td>
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<tr>
<td>BIO 1542 (16) Cell Biology</td>
<td>MBY 2522 (10) Immunology</td>
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<td>MAT 1543 (8) Math for Life and Earth Sciences</td>
<td>BOT 2544 (16) Plant Anatomy and Morphology</td>
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<td>STA 1549 (8) Basic Statistics</td>
<td>STA 1649 (8) Basic Statistical Inference</td>
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<td>ECS 1645 (10) English Communication Skills I</td>
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<td>ECS 1541 (10) English Com Skills</td>
<td>BIO 1643 (16) Ecology, Adaptation and Evolution</td>
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### Year 2 - NQF Level 6

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<th>Semester 1</th>
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<td>MBY 2623 (10) Environmental Microbiology</td>
<td>BOT 3543 (20) Plant Ecology</td>
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<td>MBY 2524 (10) Food Microbiology</td>
<td>MBY 3526 (14) Mycology and Phycolgy</td>
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<td>BIO 2625 (14) Virology</td>
<td>MBY 3629 (14) Parasitology</td>
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<td>BOT 3646 (14) Plant Physiology</td>
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### Year 3 - NQF Level 7

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<tbody>
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<td>BOT 3641 (20) Ethnobotany II</td>
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<td>PHY 1625 (8) Physics for Nat Sciences II</td>
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<td>CHE 2620 (10) Analytical Chemistry</td>
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<tr>
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<tr>
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<tr>
<td>PHY 1625 (8) Physics for Nat Sciences II</td>
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### Elective Modules - 20 credits taken from:

| 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                 |

### Elective Modules - 20 credits taken from:

| MBY 3527 (14) Industrial Microbiology           |
| MBY 3528 (14) Mycology and Phycolgy             |
| BOT 3527 (14) Industrial Microbiology           |
| BOT 3528 (14) Mycology and Phycolgy             |

**Total credits = 136**

**Total credits = 108**

**Total credits = 124**
# BACHELOR OF SCIENCE IN BIODIVERSITY AND CONSERVATION: BSCBDC

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| **Total credits = 114** | **Total credits = 114** | **Total credits = 114** |

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19
(E) BACHELOR OF SCIENCE IN BOTANY AND ZOOLOGY: BSCBZ

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<td><strong>Core Modules</strong></td>
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<td><strong>Semester 2</strong></td>
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<td>ECS 1645 (10) English Communication Skills</td>
<td>ZOO 2541 (16) Animal Physiology</td>
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<td>STA 1549 (8) Basic Statistics</td>
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### BACHELOR OF SCIENCE IN COMPUTER SCIENCES: BSCCSI

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<td>COM 3627 (14)</td>
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<tr>
<td>Systems Design and Implementation</td>
<td>Evaluation of Information Systems</td>
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#### Elective Modules – 32 credits taken from:

| PHY 1521 (8) | PHY 1623 (8) |
| Mechanics | Properties of Matter, Thermal Physics |
| PHY 1522 (8) | PHY 1624 (8) |
| Waves and Optics | Electricity and Magnetism |
| STA 1541 (8) | STA 1641 (8) |
| Introduction to Statistics | Elementary Statistical Method I - Introductory Interference |

Total credits = 124
Total credits = 120
Total credits = 126
## BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND MATHEMATICS: BSCCOM

### Core Modules

#### Year 1 - NQF Level 5

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<td>COM 2523 (10) Algorithms and Data Structures</td>
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#### Elective Modules – 32 credits taken from:

| PHY 1521 (8) Mechanics                         | MAT 1647 (8) Numerical Analysis I               | MAT 3548 (14) Mathematical Modelling II |
| PHY 1522 (8) Waves and Optics                  | PHY 1623 (8) Properties of Matter, Thermal Physics | MAT 3649 (14) Geometry |
| STA 1541 (8) Introduction to Statistics         | PHY 1624 (8) Electricity and Magnetism          | MAT 3642 (14) Rings and Fields |
|                                                | STA 1641 (8) Elementary Statistical Method I – Introductory Interference | MAT 3647 (14) Numerical Analysis III |
|                                                | COM 2520 (10) Digital Design Techniques         | MAT 3648 (14) Mathematical Modelling II |
|                                                | COM 2525 (10) Operating Systems                | MAT 3649 (14) Geometry |
|                                                | COM 2528 (10) Artificial Intelligence Fundamentals | MAT 3651 (14) Artificial Intelligence |
|                                                | STA 2541 (10) Probability Theory               | MAT 3652 (14) Evaluation of Information Systems |
|                                                | MAT 2647 (10) Numerical Analysis II             | MAT 3653 (14) Complex Analysis |
|                                                | MAT 3547 (14) Partial Differential Equations    | MAT 3654 (14) Graph Theory |
|                                                | MAT 3548 (14) Mathematical Modelling II         | MAT 3655 (14) Graph Theory |
|                                                | MAT 3649 (14) Geometry                          | MAT 3656 (14) Graph Theory |

#### Total credits = 132

### Elective Modules - 20 credits taken from:

| MAT 2520 (10) Digital Design Techniques         | COM 2528 (10) Contemporary Object-Oriented Concepts |
| COM 2628 (10) Contemporary Object-Oriented Concepts | COM 2529 (10) Systems Analysis |
| MAT 2641 (10) Statistical Computing              | STA 2541 (10) Probability Theory |
| MAT 2647 (10) Numerical Analysis II              | MAT 2648 (10) Systems Design and Implementation |
|                                                | MAT 3549 (14) Geometry |
|                                                | MAT 3642 (14) Rings and Fields |
|                                                | MAT 3647 (14) Numerical Analysis III            |
|                                                | MAT 3648 (14) Mathematical Modelling II         |
|                                                | MAT 3649 (14) Geometry                          |
|                                                | MAT 3651 (14) Artificial Intelligence           |
|                                                | MAT 3652 (14) Evaluation of Information Systems |

#### Total credits = 120

### Elective Modules - 14 credits taken from:

| MAT 2520 (10) Digital Design Techniques         | COM 2528 (10) Contemporary Object-Oriented Concepts |
| MAT 2628 (10) Contemporary Object-Oriented Concepts | COM 2529 (10) Systems Analysis |
| MAT 2641 (10) Statistical Computing              | STA 2541 (10) Probability Theory |
| MAT 2647 (10) Numerical Analysis II              | MAT 2648 (10) Systems Design and Implementation |
|                                                | MAT 3549 (14) Geometry |
|                                                | MAT 3642 (14) Rings and Fields |
|                                                | MAT 3647 (14) Numerical Analysis III            |
|                                                | MAT 3648 (14) Mathematical Modelling II         |
|                                                | MAT 3649 (14) Geometry                          |
|                                                | MAT 3651 (14) Artificial Intelligence           |
|                                                | MAT 3652 (14) Evaluation of Information Systems |

#### Total credits = 112
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<th>Total credits = 120</th>
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# BACHELOR OF SCIENCE IN FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS: BSCFMA

## Year 1 - NQF Level 5

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<td>MAT 1641 (8) Integral Calculus</td>
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<td>MAT 1646 (8) Mechanics I</td>
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<td>COM 1522 (8) Introduction to Computer Systems</td>
<td>MAT 1647 (8) Numerical Analysis I</td>
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<td>MAT 2642 (10) Ordinary Differential Equations I</td>
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<td>MAT 2548 (10) Mathematical Modelling I</td>
<td>MAT 2647 (10) Numerical Analysis II</td>
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## Year 3 - NQF Level 7

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## Elective Modules – 16 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 Macroeconomics
- STA 1642 (8) Elementary Statistical Methods II – Correlation and Regression
- COM 2523 (10) Imperative Programming
- COM 2528 (10) Artificial Intelligence Fundamentals
- STAT 2541 (10) Intermediate Multiple Regression
- COM 2616 (10) Reasoning about Programs
- STA 2642 (10) Sampling Techniques
- ECS 2641 (12) Intermediate Macroeconomics
- 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
**BACHELOR OF SCIENCE IN MATHEMATICS AND STATISTICS: BSCMST**

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# BACHELOR OF SCIENCE IN STATISTICS AND ECONOMICS: BSCSTE

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**Elective Modules – 24 credits taken from:**

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<td>Fundamentals of</td>
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<tr>
<td>Computer Architecture</td>
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<td>Money and Banking</td>
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<tr>
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**Elective Modules - 40 credits taken from:**

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<td>ECO 3544 (12)</td>
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<td>ECO 3543 (14)</td>
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<td>STA 3542 (14)</td>
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<td>STA 3643 (14)</td>
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**Total credits = 132**

**Total credits = 120**

**Total credits = 116**
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<th>Year 1 - NQF Level 5</th>
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<th>Year 3 - NQF Level 7</th>
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<tr>
<td><strong>Core Modules</strong></td>
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<td><strong>Semester 2</strong></td>
<td><strong>Semester 1</strong></td>
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<td>PHY 1623 (8)</td>
<td>PHY 2521 (10)</td>
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<td>Classical Mechanics</td>
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<td>PHY 1624 (8)</td>
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<td>Waves and Optics</td>
<td>Electricity and Magnetism</td>
<td>Waves and Optics</td>
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<td>MAT 1541 (8)</td>
<td>MAT 1641 (8)</td>
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<td>Differential Calculus</td>
<td>MAT 1642 (8)</td>
<td>Linear Algebra</td>
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<td>CHE 1540 (16)</td>
<td>MAT 1647 (8)</td>
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<td>Mathematics</td>
<td>MAT 1648 (8)</td>
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<td>Foundations I</td>
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<td>STA 1641 (8)</td>
<td>STA 1642 (8)</td>
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<td>Elementary Statistical Methods I – Introductory Interference</td>
<td>Elementary Statistical Methods II – Correlation and Regression</td>
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<td>Mathematical Modelling I</td>
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<td>STA 1642 (8)</td>
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<td>Fundamentals of Computer Architecture</td>
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<td>STA 1542 (8)</td>
<td>STA 2542 (10)</td>
</tr>
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<td>Introduction to Statistics</td>
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<td>Database Fundamentals</td>
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<td>STA 1541 (8)</td>
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## BACHELOR OF SCIENCE IN PHYSICS AND CHEMISTRY: BSCPC

### Core Modules

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 1</th>
<th>Semester 2</th>
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<tbody>
<tr>
<td>CHE 1540 (16)</td>
<td>General Chemistry</td>
<td>CHE 1621 (8)</td>
<td>Inorganic Chemistry I</td>
<td>CHE 2521 (10)</td>
<td>Inorganic Chemistry II</td>
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<td>MAT 1541 (8)</td>
<td>Inorganic Chemistry</td>
<td>MAT 1641 (8)</td>
<td>Electricity and Magnetism</td>
<td>PHY 2522 (10)</td>
<td>Waves and Optics</td>
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<td>ECS 1541 (10)</td>
<td>Mathematics Foundation I</td>
<td>MAT 1642 (8)</td>
<td>Integral Calculus</td>
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<td>Linear Algebra</td>
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<td>COM 0510 OR</td>
<td>Computer Literacy</td>
<td>ECS 1645 (10)</td>
<td>English Communication Skills</td>
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<td>Multivariable Calculus</td>
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<td>BIO 1541 (16)</td>
<td>Diversity of Life</td>
<td>BIO 1643 (16)</td>
<td>Ecology, Adaptation and Evolution</td>
<td>COM 2523 (10)</td>
<td>Imperative Programming</td>
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<td>BIO 1542 (16)</td>
<td>Cell Biology I</td>
<td>STA 1641 (8)</td>
<td>Statistical Method</td>
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<td>Artificial Intelligence Fundamentals</td>
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<td>COM 1721 (16)</td>
<td>Object Oriented Programming</td>
<td>STA 1541 (8)</td>
<td>Interference</td>
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<td>Database Fundamentals</td>
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<td>STA 1541 (8)</td>
<td>Introduction to Statistics</td>
<td>STA 1641 (8)</td>
<td>I – Introductory</td>
<td>COM 2620 (10)</td>
<td>Analytical Chemistry</td>
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<td>STA 1541 (8)</td>
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<td>STA 1642 (8)</td>
<td>Interference</td>
<td>CHE 2623 (10)</td>
<td>Physical Chemistry I</td>
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<td>STA 1541 (8)</td>
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<td>STA 1643 (8)</td>
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<td>STA 1644 (8)</td>
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<td>Interference</td>
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<td>CHE 3620 (14)</td>
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<td>STA 1648 (8)</td>
<td>Interference</td>
<td>CHE 3621 (14)</td>
<td>Quantum Mechanics</td>
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</table>

### Elective Modules – 16 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 |

### 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 |

Total credits = 136

Total credits = 120

Total credits = 112
<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Elective Modules – 16 credits taken from:</th>
<th>Elective Modules – 20 credits taken from:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1 - NQF Level 5</strong></td>
<td><strong>BIO 1643 (16)</strong> Ecology, Adaptation and Evolution</td>
<td><strong>COM 2523 (10)</strong> Imperative Programming</td>
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<td><strong>STA 1641 (8)</strong> Elementary Statistical Method I – Introductory Interference</td>
<td><strong>COM 2528 (10)</strong> Artificial Intelligence Fundamentals</td>
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<td><strong>COM 2529 (10)</strong> Database Fundamentals</td>
<td><strong>MAT 2641 (10)</strong> Systems Analysis</td>
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<td><strong>MAT 2541 (10)</strong> Linear Algebra</td>
<td><strong>MAT 2642 (10)</strong> Real Analysis</td>
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<td><strong>MAT 2542 (10)</strong> Multivariable Calculus</td>
<td><strong>MBY 2623 (10)</strong> Ordinary Differential Equations</td>
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<td><strong>MBY 2521 (10)</strong> Bacteriology</td>
<td><strong>PHY 2623 (10)</strong> Electrodyamics</td>
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<td><strong>PH Y2521 (10)</strong> Classical Mechanics</td>
<td><strong>Environmental Microbiology</strong></td>
</tr>
<tr>
<td><strong>Year 2 - NQF Level 6</strong></td>
<td><strong>CHE 1540 (16)</strong> General Chemistry</td>
<td><strong>CHE 2521 (10)</strong> Analytical Chemistry</td>
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<td><strong>CHE 1621 (8)</strong> Inorganic Chemistry</td>
<td><strong>CHE 2522 (10)</strong> Physical Chemistry I</td>
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<td><strong>CHE 1622 (8)</strong> Organic Chemistry</td>
<td><strong>CHE 2526 (10)</strong> Introductory Chemistry</td>
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<td><strong>CHE 1641 (8)</strong> Integral Calculus</td>
<td><strong>CHE 2527 (10)</strong> Chemometrics</td>
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<td><strong>CHE 1642 (8)</strong> Mathematics</td>
<td><strong>CHE 2529 (10)</strong> Environmental Chemistry</td>
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<td><strong>PHY 1623 (8)</strong> Properties of Matter, Thermal Physics</td>
<td><strong>CHE 2524 (10)</strong> Chemistry Fundamentals</td>
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<td><strong>PHY 1624 (8)</strong> Electricity and Magnetism</td>
<td><strong>CHE 2624 (10)</strong> Relativity and Quantum Physics</td>
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<tr>
<td><strong>Year 3 - NQF Level 7</strong></td>
<td><strong>ECS 1541 (10)</strong> English Communication Skills</td>
<td><strong>COM 0510 OR COM 0610 (4)</strong> Computer Literacy</td>
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<td><strong>COM 1721 (16)</strong> Object Oriented Programming</td>
<td><strong>BIO 1541 (16)</strong> Diversity of Life</td>
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<td><strong>BIO 1542 (16)</strong> Cell Biology I</td>
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<td><strong>COM 1645 (10)</strong> English Communication Skills</td>
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<td><strong>MBY 2521 (10)</strong> Bacteriology</td>
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<td><strong>PH Y2521 (10)</strong> Classical Mechanics</td>
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<td><strong>Total credits = 136</strong></td>
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<td></td>
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<td><strong>Total credits = 120</strong></td>
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</table>
# Bachelor of Science in Chemistry and Mathematics: BSCCM

## Year 1 - NQF Level 5

### Core Modules

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<th>Semester 1</th>
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<tr>
<td>CHE 1540 (16) General Chemistry</td>
<td>CHE 1621 (8) Inorganic Chemistry I</td>
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<tr>
<td>MAT 1541 (8) Differential Calculus</td>
<td>CHE 1622 (8) Organic Chemistry I</td>
</tr>
<tr>
<td>MAT 1542 (8) Mathematics Foundation I</td>
<td>CHE 1641 (8) Integral Calculus</td>
</tr>
<tr>
<td>PHY 1521 (8) Mechanics</td>
<td>PHY 1522 (8) Waves and Optics</td>
</tr>
<tr>
<td>EC S1541 (10) English Communication Skills</td>
<td>COM 0510 OR COM 0610 (4) Computer Literacy</td>
</tr>
</tbody>
</table>

### Elective Modules – 16 credits taken from:

| BIO 1541 (16) Diversity of Life | STA 1641 (8) Elementary Statistical Method Introduction to Statistics |
| BIO 1542 (16) Cell Biology I | MAT 1647 (8) Numerical Analysis I |
| COM 1721 (16) Object Oriented Programming | BIO 1643 (16) Ecology, Adaptation and Evolution |
| STA 1541 (8) Introduction to Statistics |  |

**Total credits = 126**

## Year 2 - NQF Level 6

### Core Modules

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<th>Semester 1</th>
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</thead>
<tbody>
<tr>
<td>CHE 1621 (8) Inorganic Chemistry I</td>
<td>CHE 2521 (10) Inorganic Chemistry II</td>
</tr>
<tr>
<td>CHE 1622 (8) Organic Chemistry I</td>
<td>CHE 2522 (10) Organic Chemistry II</td>
</tr>
<tr>
<td>CHE 1641 (8) Integral Calculus</td>
<td>MAT 2541 (10) Linear Algebra</td>
</tr>
<tr>
<td>PHY 1623 (8) Properties of Matter, Thermal Physics</td>
<td>PHY 1624 (8) Electricity and Magnetism</td>
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<tr>
<td>PHY 1625 (10) English Communication Skills</td>
<td>ECS 1645 (10) English Communication Skills</td>
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<tr>
<td>PHY 1626 (8) Waves and Optics</td>
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</table>

### Elective Modules – 40 credits taken from:

| COM 2523 (10) Imperative Programming | COM 2528 (10) Artificial Intelligence Fundamentals |
| COM 2529 (10) Database Fundamentals | PHY 2521 (10) Classical Mechanics |
| BIO 2620 (10) Analytical Chemistry | PHY 2622 (10) Modern Physics |
| CHE 2623 (10) Physical Chemistry | CHE 3520 (14) Analytical Chemistry: Instrumental Techniques |
| CHE 2623 (10) Physical Chemistry | CHE 3523 (14) Physical Chemistry II |
| MAT 2641 (10) Real Analysis I | MAT 3541 (14) Complex Analysis |
| MAT 2642 (10) Ordinary Differential Equations I | MAT 3542 (14) Mathematical Modelling II |

**Total credits = 120**

## Year 3 - NQF Level 7

### Core Modules

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<th>Semester 1</th>
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<td>CHE 2521 (10) Inorganic Chemistry II</td>
<td>CHE 2620 (10) Analytical Chemistry</td>
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<td>CHE 2522 (10) Organic Chemistry II</td>
<td>CHE 2623 (10) Physical Chemistry</td>
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<tr>
<td>MAT 2541 (10) Linear Algebra</td>
<td>MAT 2641 (10) Real Analysis I</td>
</tr>
<tr>
<td>MAT 2542 (10) Multivariable Calculus</td>
<td>MAT 2642 (10) Ordinary Differential Equations I</td>
</tr>
<tr>
<td>PHY 1623 (8) Properties of Matter, Thermal Physics</td>
<td>PHY 1624 (8) Electricity and Magnetism</td>
</tr>
<tr>
<td>PHY 1625 (10) English Communication Skills</td>
<td>PHY 2521 (10) Classical Mechanics</td>
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<td>PHY 2623 (10) Modern Physics</td>
<td>PHY 2624 (10) Electrodynamics</td>
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<td>ECS 1645 (10) English Communication Skills</td>
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<td>PHY 2625 (10) Modern Physics</td>
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<tr>
<td>PHY 2626 (8) Waves and Optics</td>
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<td>MAT 3541 (14) Complex Analysis</td>
<td>MAT 3542 (14) Mathematical Modelling II</td>
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<td>MAT 3543 (14) Group Theory</td>
<td>MAT 3642 (14) Rings and Fields</td>
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<tr>
<td>MAT 3544 (14) Numerical Analysis III</td>
<td>MAT 3647 (14) Numerical Analysis III</td>
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</table>

**Total credits = 126**
# BACHELOR OF SCIENCE IN CHEMISTRY AND BIOCHEMISTRY: BSCCHB

## Core Modules

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<tr>
<th>Year 1 - NQF Level 5</th>
<th>Year 2 - NQF Level 6</th>
<th>Year 3 - NQF Level 7</th>
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<tbody>
<tr>
<td><strong>Semester 1</strong></td>
<td><strong>Semester 2</strong></td>
<td><strong>Semester 1</strong></td>
</tr>
<tr>
<td>MAT 1541 (8) Differential Calculus</td>
<td>CHE 1622 (8) Organic Chemistry I</td>
<td>BCM 2522 (10) Biochemical and Molecular Techniques</td>
</tr>
<tr>
<td>MAT 1542 (8) Mathematics Foundation I</td>
<td>MAT 1541 (8) Integral Calculus</td>
<td>MAT 1642 (8) Mathematics Foundation II</td>
</tr>
<tr>
<td>BIO 1541 (16) Diversity of Life</td>
<td>BIO 1542 (16) Cell Biology I</td>
<td>PHY 1625 (8) Physics for Natural Sciences II</td>
</tr>
<tr>
<td>PHY 1525 (8) Physics for Natural Sciences I</td>
<td>ECS 1541 (10) English Communication Skills</td>
<td>MBY 2521 (10) Immunology</td>
</tr>
<tr>
<td>ECS 1541 (10) English Communication Skills</td>
<td>COM 0510 OR COM 0610 (4) Computer Literacy</td>
<td>Total credits = 136</td>
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</table>
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**  : CHE 1540, CHE 1621, CHE 1622, BIO 1542  
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.

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 CO₂ 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 monocotyledous and dicotyledous 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:

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOT 5501</td>
<td>Research Methodology</td>
<td>16</td>
<td>A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.</td>
</tr>
<tr>
<td>BOT 5702</td>
<td>Research Project</td>
<td>42</td>
<td>A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status.</td>
</tr>
<tr>
<td>BOT 5504</td>
<td>Applied Plant Ecology</td>
<td>16</td>
<td>BOT 3543</td>
</tr>
<tr>
<td>BOT 5505</td>
<td>Applied Plant Ecophysiology</td>
<td>16</td>
<td>BOT 3647</td>
</tr>
<tr>
<td>BOT 5606</td>
<td>Plant Physiology</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>BIO 5510</td>
<td>Freshwater Ecology</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>BOT 5612</td>
<td>Applied Ethnobotany</td>
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</tr>
<tr>
<td>BCM 5521</td>
<td>Research Methods and Seminars</td>
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</tr>
<tr>
<td>MBY 5604</td>
<td>The role of Microorganisms in Industrial Processes</td>
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<td></td>
</tr>
<tr>
<td>ZOO 5607</td>
<td>Molecular Ecology</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Candidates must select a minimum of four modules from the following selection which must include two Botany (BOT) modules:

- BOT 5504: Applied Plant Ecology
- BOT 5606: Plant Physiology
- BIO 5510: Freshwater Ecology
- BOT 5612: Applied Ethnobotany
- BCM 5521: Research Methods and Seminars
- MBY 5604: The role of Microorganisms in Industrial Processes
- ZOO 5607: 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, C4 photosynthesis and crassulacean acid metabolism, Respiration in plants, mycorrhiza, responses of plants to elevated atmospheric and rhizospheric CO2 concentration, salinity and water stress and photosynthesis, nutrient uptake and growth, seed physiology.

BOT 5608: Plant Systematics
Pre-requisites: A BSc degree in the biological sciences or a SENATE conferred equivalent qualification/status with BOT 3548.


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

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. Aromacity and nitration, sulfonation, halogenation, and alkylation of benzene.

(b) Mainstream Modules:

CHE 1540 : General Chemistry
Pre-requisites : As per admission requirement of the School

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 CHE 1545
Structure, bonding and geometry of organic compounds. Nomenclature, preparation and reactions of saturated and unsaturated hydrocarbons. Aromacity 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 (SN$_1$ and SN$_2$) 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 1540, CHE 1621, CHE 1622.*
*Co-requisites : CHE 2522, CHE 2524.*

**CHE 2620 : Analytical Chemistry: Classical techniques**
*Pre-requisite : CHE 1540.*
*Co-requisites : CHE 2521.*

**CHE 2623 : Physical Chemistry I**
*Pre-requisite : CHE 1540.*
*Co-requisites : MAT 1541, MAT 1641, PHY 1525, PHY 1625.*

**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.*

**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

CHE 3526: Chemical Analysis and Food Science
Pre-requisites: CHE 2620, CHE 2626
Co-requisites: CHE 3520
Surface analysis, thermal methods, chromatography, chemistry and technology of food.

CHE 3527: Process Technology
Pre-requisites: CHE 2623
Co-requisites: CHE 3523, CHE 3524

CHE 3528: 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

CHE 5531: Inorganic Chemistry
Pre-requisites: Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended: Second-year Mathematics.

CHE 5532: Organic Chemistry
Pre-requisites: Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

CHE 5533: Physical Chemistry
Pre-requisites: Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
Recommended: Second-year Mathematics.

CHE 5538: Analytical and Inorganic Chemistry of Natural Products
Pre-requisites: Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.

CHE 5630: Capita Selecta: Analytical Chemistry
Pre-requisites: Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
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.
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-requisites: 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.

CHE 5638: Natural Products Chemistry
Pre-requisites: Successfully completed BSc or equivalent tertiary qualification with Chemistry as a major.
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 worldwide 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  

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

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

**COM 5531** : Introduction to Grid Computing

**COM 5532** : Software Engineering Methodology

**COM 5533** : Information Systems Security

**COM 5534** : Scientific Research Method

**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

**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

**COM 5633 : Compiler Principles**

**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

**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 at least an E (HG) or D(SG) in Matric Mathematics

**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  

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  

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

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

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 \( \mathbb{R}^n \): neighborhoods, cluster points, open sets, Compact sets, bounded sets, connected sets, Cantor's intersection Theorem, Bolzano-Weierstrass theorem, Heine-Borel Theorem, Lebesque Covering Theorem. Functions in \( \mathbb{R}^n \): Limits of functions, Continuity, Globe continuity, bounded continuous functions, Continuity of the inverses, Lipschitz condition and contraction, continuity and compactness, continuity and connectedness, Brauer's Fixed point Theorem, Contraction of fixed points. Sequences in \( \mathbb{R}^n \): Limits, convergence, divergence, subsequences. Sequence of functions: Uniform convergence, Cauchy's Criterion. Differentiation in \( \mathbb{R}^n \).
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Course Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT 3643</td>
<td>Graph Theory</td>
<td>MAT 3542</td>
<td>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</td>
</tr>
<tr>
<td>MAT 3644</td>
<td>Continuum Mechanics</td>
<td>MAT 1646 or PHY 2521, MAT 3547</td>
<td>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</td>
</tr>
<tr>
<td>MAT 3646</td>
<td>Mechanics II</td>
<td>MAT 1646, MAT 3547</td>
<td>Dynamics and Statistics of a particle, moving coordinate systems, systems of particles and rigid bodies, Lagrange's equations and Hamiltonian theory</td>
</tr>
</tbody>
</table>
MAT 3647: Numerical Analysis III
Pre-requisites: MAT 2647

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

<table>
<thead>
<tr>
<th>Package 1 (Applied Mathematics) - NQF level 8</th>
<th>Package 2 (Pure Mathematics) - NQF level 8</th>
<th>Package 3 (Pure Mathematics) - NQF level 8</th>
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</thead>
<tbody>
<tr>
<td>Semester 1</td>
<td>Semester 2</td>
<td>Semester 1</td>
</tr>
<tr>
<td>MAT 5530 Numerical Solution of ODE</td>
<td>MAT 5630 Numerical Solution for Partial Differential Equations</td>
<td>MAT 5534 Algebra I</td>
</tr>
<tr>
<td>MAT 5549 Partial Differential Equations</td>
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<td>MAT 5537 Measure and Integration Theory</td>
</tr>
<tr>
<td>MAT 5533 Calculus of Variations</td>
<td>MAT 5646 Topics in stability and Optimization</td>
<td>MAT 5540 Matrix Analysis</td>
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<tr>
<td>MAT 5540 Matrix Analysis</td>
<td>MAT 5633 Integral Equations</td>
<td>MAT 5536 Complex Analysis</td>
</tr>
<tr>
<td>MAT 5537 Measure and Integration Theory</td>
<td>MAT 5641 Financial Mathematics</td>
<td>MAT 5532 Functional Analysis</td>
</tr>
<tr>
<td>MAT 5541 Stochastic Differential Equations</td>
<td>STA 5644 Stochastic processes</td>
<td>MAT 5538 Number Theory I</td>
</tr>
<tr>
<td>MAT 5543 Fluid Mechanics</td>
<td>MAT 5653 Control Theory</td>
<td>MAT 5533 Calculus Of Variations</td>
</tr>
<tr>
<td></td>
<td>MAT 5643 Graph Theory</td>
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</tbody>
</table>

Three of the following:
Two of the following:
Two of the following:

| MAT 5533 | MAT 5646 | MAT 5540 | MAT 5650 |
| Calculus of Variations | Topics in stability and Optimization | Matrix Analysis | Number Theory II |
| MAT 5540 | MAT 5633 | MAT 5536 | Complex Analysis |
| Matrix Analysis | Integral Equations | Complex Analysis | |
| MAT 5537 | MAT 5641 | MAT 5532 | Functional Analysis |
| Measure and Integration Theory | Financial Mathematics | Functional Analysis | |
| MAT 5541 | STA 5644 | MAT 5538 | Number Theory I |
| Stochastic Differential Equations | Stochastic processes | Number Theory I | |
| MAT 5543 | MAT 5653 | MAT 5533 | Calculus Of Variations |
| Fluid Mechanics | Control Theory | Calculus Of Variations | |
| | MAT 5643 | | Graph Theory |
| | | | | | |
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

MAT 5533 : Calculus of Variations
Pre-requisites : As per the departmental requirements subject to admission rules of the school

MAT 5534 : Algebra I
Pre-requisites : As per the departmental requirements subject to admission rules of the school

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

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

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 pigeon 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

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

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

MAT 5633        : Integral Equations  
Pre-requisites : As per the departmental requirements subject to admission rules of the school

MAT 5634        : Transformation Geometry  
Pre-requisites : As per the departmental requirements subject to admission rules of the school

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; Lie 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

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 pigeonhole 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  
MAT 6542: Functional Analysis I

MAT 6543: Ordinary Differential Equations I

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

MAT 6546: Computer Programming

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

MAT 6550: Partial Differential Equations II

MAT 6551: Operator Theory II

MAT 6552: Functional Analysis III

MAT 6553: Banach Algebra I.

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-Liouville problem, the Stieltjes inversion formula, the
non-self-adjoint differential operators of second order on the half-line.

MAT 6555 : Numerical Analysis II

MAT 6556 : Mathematical Modelling I

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

MAT 6559 : Operator Theory I.

MAT 6560 : Orthogonal Polynomials

MAT 6561 : Measure and Integration II

MAT 6642 : Functional Analysis II

MAT 6643 : Ordinary Differential Equations II

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 : Perturbation 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

MAT 6649 : Topological Vector Spaces.

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

MAT 6653 : Banach Algebra II.

MAT 6654 : Fluid Dynamics

MAT 6655 : C*- Algebra

MAT 6659 : Operator Theory III

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

**MBY 2522 : Immunology**
**Pre-requisites :** BIO 1541, CHE 1540, CHE 1621 or CHE 1622

**MBY 2623 : Environmental Microbiology**
**Pre-requisites :** MBY 2521

**MBY 2624 : Virology**
**Pre-requisites :** MBY 2521

**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

**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

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

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; immunosuppression; immunodeficiencies; autoimmunity, hypersensitivity reactions; blood transfusion and transplantation immunology; applications of agglutination, precipitation, complement system and human leucocyte antigen-MHC; enzyme immunonasasys; 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, trypanosomiasis, leishmaniasis, malaria, cryptosporidiosis, schistosomiasis, hookworm, ascariasis, taeniasis, enterobiasis, onchocerciasis/oilias, dracunculiasis, pneumocystis infection and other parasitic diseases, cryptococcosis, histoplasmosis, blastomycosis, candidiasis, aspergillosis, pityriasis 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

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  

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 Environmental & 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  

**PHY 1623**: Properties of Matter and Heat  
**Pre-requisites**: As per admission requirement of the School of Maths & Natural Science  
**Co-requisites**: MAT 1641  

**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  

**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  

**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  

**PHY 3522**: Solid State Physics  
**Pre-requisites**: PHY 2521 and PHY 2624  

**PHY 3525**: Energy Physics  
**Pre-requisites**: PHY 2522 and PHY 2623  

**PHY 3623**: Thermodynamics and Statistical Mechanics  
**Pre-requisites**: PHY 2521  
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

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

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

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
PHY 5622 : Statistical Mechanics (core)
Pre-requisites : As per the admission requirement of the school

PHY 5623 : Project (core)
Pre-requisites : As per the admission requirement of the school

PHY 5624 : Solid State Physics II
Pre-requisites : PHY 5523

PHY 5625 : Quantum Mechanics II
Pre-requisites : PHY 5522

PHY 5626 : 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:

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

STA 5649 : Experimental Design
Pre-requisites : STA 1648 or STA 1649

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) Mainstream Modules:

STA 1541 : Introduction to Statistics
Pre-requisites : At least 50% in Grade 12 Mathematics or MAT 0544/MAT 0644 (Service Mathematics)

STA 1542 : Introductory Probability
Pre-requisites : At least 50% in Grade 12 Mathematics or MAT 0544/MAT 0644 (Service Mathematics)
Co-requisite : 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

SECOND YEAR MODULES:

STA 2541 : Probability Theory
Pre-requisites : STA 1542, MAT 1541, MAT 1641
Co-requisite : MAT 2541

STA 2542 : Multiple Regression
Pre-requisites : STA 1641, STA 1642, MAT 1642
Co-requisite : MAT 2541
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

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

STA 3542: Industrial Statistics
Pre-requisites: STA 2541

STA 3543: Official Statistics and Introduction to Research
Pre-requisites: STA 1641, STA 1642, STA 2641

STA 3641: Time Series Analysis
Pre-requisites: STA 2541, STA 2641

STA 3642: Experimental Design
Pre-requisites: STA 1641, STA 2541

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

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

STA 5544 : Sampling Survey and Research Methods

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

STA 5642 : Time Series Analysis

STA 5643 : Analysis of Discrete Data

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

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

STA 6544: Sampling Survey and Research Methods

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 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 6641: Demographic Methods

STA 6642: Time Series Analysis

STA 6643: Analysis of Discrete Data

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.

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.

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


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 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, FWT 1541, FWT 1641, HWR 1541, FWT 2531, FWT 2532


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, FWT 2532, 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
Post-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
Post-requisites: FWT 2531, FWT 2532, FWT 2533, FWT 3531, FWT 3532


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
Post-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
Post-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 introductive 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  

**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

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.

<table>
<thead>
<tr>
<th>BSc (Honours) in Biodiversity and Conservation (BSCHCB)</th>
<th>BSc (Honours) in zoology (BSCHZO)</th>
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<td>ZOO 5501 (16)</td>
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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 ZOO 3649  
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 3541  
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 BIO 3544  
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.