COLLEGE OF SCIENCES

STUDENT HANDBOOK
ACADEMIC YEAR
2015 - 2016

Driving Change

BIUST
BOTSWANA INTERNATIONAL UNIVERSITY
OF SCIENCE & TECHNOLOGY

BIUST

Botswana International University
of Science and Technology

COLLEGE OF SCIENCES HANDBOOK

Academic Year
2014-2015

What is a handbook?

The handbook is an official publication and an essential guide for every student who studies at the University. You need to be aware of course structures and content, who your lecturers are, as well as assessment and examination procedures. You should also become familiar with course terminology and University and College regulations and rules. This handbook will supply a lot of this information.

Where to find other information

Other important information can be found in the University Calendar, the Student Guide and the guides for individual modules..

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COLLEGE OF SCIENCES

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	Mr Bokang Present	BSc, PGDE
	Mr. Mothusi Madiba	BSc

VISION, MISSION AND VALUES OF THE COLLEGE

Vision

To be a World Class Centre for Research, Education and Innovation in the Sciences.

Mission

To provide globally competitive and high quality academic programmes in Science, to produce employable graduates through excellence in teaching and research, to undertake national and international research in priority fields including through collaborative partnerships and industry linkages, and to promote the application of science for the benefit of society

Mission Statements

1. **Teaching and Knowledge Transfer:**
   - teaching basic sciences to underpin all science, engineering and technology programmes;
   - teaching undergraduate programmes relevant to national and regional needs;
   - teaching postgraduate programmes relevant to national, regional and international needs;
   - inward knowledge transfer through *inter alia,* industrial advisory boards and international scholar exchange programmes.

2. **Research and Knowledge Creation:**
   - research in the major science disciplines;
   - National and international Centres of Competence in research clusters which are multidisciplinary and focused on strategic research priorities;
   - collaborative partnerships and industry linkages
   - applied research for external clients including industry and government.

3. **Application of Science for the Benefit of Society:**
   - providing expert advice and work through consultancy, membership of national and regional committees, engagement with industry,

government, communities, and academic bodies;
- technology transfer from research via incubator facilities;
- partnerships in specific projects for strategic goals with external agencies both national, regional and international;
- community engagement through academic endeavours which are responsive to local community needs.

Values

The College will:

- Benchmark itself to international standards of scientific practice and critical thinking such that we produce world-class science;
- Actively encourage and respect the right of all scholars, staff and students to engage in critical inquiry, independent research, intellectual discourse and public debate in a spirit of responsibility and accountability, in accordance with the principles of academic freedom;
- Promote access to learning that will expand educational and employment opportunities for all;
- Embrace its responsibility to support and contribute to national and regional development, through the generation and dissemination of knowledge, the production of socially-responsible graduates and the application of science for the benefit of society;
- Conduct itself according to the highest ethical standards, and provide education that promotes an awareness of sound ethical practice and academic integrity;
- Foster a culture of responsible, ethical and sustainable use of natural resources;
- Ensure effective governance through broad and inclusive participation, representation, accountability, and transparency that serves as an example of true collegiality;
- Acknowledge the value of the individual by promoting the intellectual, social and personal well-being of staff and students through tolerance and respect and by fostering the realisation of each person's full potential;
- Aspire to the highest quality in all its endeavours.

INFORMATION FOR STUDENTS

The College of Sciences

The College of Sciences currently comprises five Departments:
Biological and Biotechnological Sciences;
Chemical and Forensic Sciences;
Earth and Environmental Sciences;
Mathematical and Statistical Sciences;
Physics and Astronomy;

The College offers four year undergraduate programmes leading to the degree of Bachelor of Science (BSc) in the following subjects: Biological Sciences; Chemical Sciences; Earth & Environmental Sciences; Environmental Sciences; Geology; Mathematics; Physics; and Statistics.

Two year Masters of Science (MSc) programmes are offered in Mathematical Sciences; and Geological Sciences which have a taught course component and a research dissertation.

The College also offers the degree of Master of Science (MSc) by research and the degree of Doctor of Philosophy PhD) by research only.

Designing an Undergraduate Curriculum

(a) Each programme has a specified combination of modules and there is a limitation on the distribution of modules in any semester.
(b) Modules may have pre- or co-requisite requirements.
(c) All combinations of modules are subject to the constraints of the time-table.
(d) All curriculum must be designed to lead to modules at the next Level and that are suitable for the completion of a particular programme and degree.

Semester System

The College follows the semester system of teaching for undergraduate programmes. An academic year consists of two academic teaching semesters and a shorter winter semester. Each of the two main teaching semesters has

15 weeks consisting of 13 teaching weeks, a study week and a week for final examinations. A limited number of specialist modules, field-based modules or internships may be offered during the winter semester period.

Credit System

Every Module for a qualification has a credit rating. Credit ratings are given for each module in the Module section of this Handbook. Unless specially exempted, students obtain the credit points indicated for a module by passing the assessments for that module with an average mark of not less than 50%. Such credits are also known as **Degree Credits** when they specifically accumulate towards the award of the Degree.

Each Programme is made up of a number of modules, and each module is given a credit rating based on the number of lectures, tutorials and practicals in the module. One credit is equivalent to one contact hour per week per semester or a series of 13 contact hours. One contact hour is equivalent to: one lecture hour; one 2 or 3 hours of practical work; or 1 hour tutorial; field work, industrial training or internship or similar activity outside the classroom will be awarded credit as specified in the description for a particular individual module.

Bachelor of Science Degree

A minimum number of credits is required for the completion of a degree, and a student normally has to take a minimum number of credits each year. A typical semester-long module is worth 3 or 4 credits, and students normally study five of these modules per semester. In their first year students take modules from the basic science disciplines, but at higher years students must select modules which are required for their particular programme of study. The rules of module combination for each programme and the number of credits for the award of a particular degree are given later in this Handbook.

Postgraduate Study: Masters and Doctoral Degrees

An applicant may be admitted to postgraduate study in any of the areas of specialisation in the College, provided that the applicant holds an acceptable primary degree, and provided also that the standard of proficiency previously

attained in the intended area is sufficiently high. It is also important that the University is able to provide supervision for a particular field of study within a discipline.

The College of Sciences currently offers the following postgraduate degrees:

- Master of Science (MSc) by coursework and dissertation, lasting a minimum of one and a half years;
- Master of Science (MSc) by thesis, lasting a minimum of one year;
- Doctor of Philosophy (PhD) by thesis, lasting a minimum of two years.

DEFINITIONS OF TERMS

"academic exclusion" means termination of a student's registration on academic grounds, resulting in exclusion from a particular programme of study or the university.

"admission" means the act by which the university admits a person to study, after acceptance by an applicant of an offer of a place at the university.

"assessment" means the evaluation and grading of work, supervised or unsupervised, carried out by a student in satisfying the requirements of a module, programme or degree. A module may be assessed through continuous assessment or a written examination or both.

"co-requisite module" means a module for which a student must register in the same semester as the proposed module.

"Council" means the Council of the BIUST

"coursework" means assessable work produced by the student (also may be called classwork or continuous assessment)

"**credit point or credits**" means a value assigned to module to indicate its weighing within a qualification.

"curriculum" means the combination of modules which together comprise the programme of study leading to a qualification. An individual student's curriculum refers to the specific selection of modules within the broad framework of the curriculum prescribed for a qualification, which enables the student to meet the requirements for the qualification.

"degree" a recognised qualification awarded by the University i.e. Bachelor, Masters, and Doctoral degrees.

"**dissertation**" means a work involving personal research, that is (a) capable of being recorded in any form or medium, and (b) capable of being evaluated, that is submitted for a degree and satisfies degree specific requirements (also see "thesis").

“duly performed (DP) requirements” means those College-determined requirements for a module which must be met to permit a student to be eligible for a final examination in that module.

“”**elective”** a module which the student may choose, this may be from a defined set of modules offered by the programme

“examination” means a formal assessment, conducted within an officially designated examination session, usually invigilated, and bound by time constraints.

“**exit level module**” is a module which forms part of the last year or level of a degree programme.

“external examination” means examination by a person, external to the university, who has not been involved with teaching including supervision at the University during the previous three (3) years.

“independent moderation” means examination by a person, internal or external to the university, who has not been involved with the teaching of the relevant module in that semester.

“internal examination” means examination by a person or persons involved with the teaching of the relevant module in that semester or, in the case of postgraduate qualifications, is a member of the University academic staff including persons who hold honorary appointments in the University other than the supervisor(s).

levels of study denote the levels within a university programme level 1 is equivalent to the full time first year of study, level 2 to the second and so forth. A part-time student will take longer to achieve each level of study.

”major” or “minor” is a required and defined number of credits (or modules) in a discipline at the exit-level

“module” means any separate course of study for which credits may be obtained.

“qualification” means a degree.

"pre-requisite module" means a module which must have been passed, with at least the minimum mark required by the relevant College, before registration for the proposed module is permitted.

"pre-requisite requirement" means that requirement, whether a prerequisite module, a specified mark in a module or any other condition, which must have been met before registration for the proposed module is permitted.

"programme" a prescribed set of modules and other work undertaken by a student which on satisfactory completion leads to the award of a qualification.

"project" means a substantial assignment, whether comprising a single module or part of a module, and which requires research or equivalent independent work by a student.

"registered student" means a student who is registered to study in one or more modules offered by the University. Such registration will lapse on the date of the following registration session or earlier should the student cease to be an admitted student.

"registration" means completion by a student, and acceptance by the University, of a registration form, and compliance with such other conditions as are required for entitlement to a current student card.

"Senate" means the Senate of the BIUST.

"special examination" means an examination awarded by the College to a student who has not been able to attempt or complete the original examination by reason of illness or any other reason deemed sufficient by the College. Only the component of the examination which has not been attempted or completed, shall be re-written.

"student" means a person who has been admitted to the University for the purpose of studying or who has registered for a qualification. A student remains a student until such time as that person graduates or otherwise completes studies, or withdraws from the University, or fails to attend or register in any semester, or is excluded and all appeal processes for readmission have been exhausted."

“supplementary examination” means an examination awarded by the Senate to a student, based on the student’s performance in the original module assessment. All final examination papers which constitute the module shall be re-written.

“suspended registration” means an agreement by which the University holds a student’s registration in abeyance for a specified period of time.

“tertiary institution” means any institution that provides post-school education on a full-time, part-time or distance basis.

“**thesis**” means a work involving personal research, that is (a) capable of being recorded in any form or medium, and (b) capable of being evaluated, that is submitted for a masters or doctoral degree and satisfies the requirements specified in the relevant rules

“the University” means the BIUST.

GENERAL UNIVERSITY ACADEMIC REGULATIONS

GR1. General Provisions

GR1.1 Senate reserves the right to alter, amend, replace or cancel any of the General Academic Regulations and shall be the final authority for the interpretation of these regulations.

GR1.2 Senate has the power to exempt any student from any of the General Academic Regulations.

GR1.3 In addition to these general academic regulations, specific College, Degree, Departmental and Institute regulations approved by Senate, may also apply.

GR1.4 General Academic Regulations shall take precedence over College, Degree, Departmental and Institute regulations unless Senate has otherwise or specifically provided

GR1.5 College regulations shall take precedence over Departmental regulations, unless Senate has otherwise provided.

GR1.6 The University may revise or add to its regulations and rules from time to time, and any such alteration or addition shall become binding upon the date of publication or upon such date as may be specified by the Senate, provided that such change shall not prejudice any currently registered student.

GR1.7 Should a regulation, according to which a programme has been compiled, be amended, a student who has started a programme under the one regulation and who has not interrupted studies, may complete such a programme in accordance with the original regulation on condition that a College Board may formulate transitional requirements in order to enable that student to complete studies in accordance with the new regulation.

GR1.8 A student who has been admitted to a programme and fails to register for such a programme in the ensuing two semesters; or is re-admitted to such a programme, is deemed to have interrupted studies and forfeits the right to continue studies under the old regulation.

GR2 Degrees, diplomas and certificates

GR2.1 The University may confer or award such degrees, diplomas and certificates as approved by the Senate and the Council.

GR2.2 The list of degrees, diplomas and certificates is published by the University and the regulations for specific qualifications, in each College Handbook.

GE2.3 The University may confer or award Honorary Qualifications as approved by the Senate and the Council.

GR3 Approval of curricula

GR3.1 The Senate, after consultation with the relevant Boards of the Colleges, shall approve the curricula for all qualifications of the University.

GR4 College Regulations

GR4.1 Subject to the provisions of current legislation, the Statutes of the University, and the following Rules, the Senate may make or amend rules for each College relating to:

GR4.1.1 The eligibility of a student as a candidate for any programme and/or module, which may include recognition of prior learning (RPL);

GR4.1.2 The selection process;

GR4.1.3 The period of attendance;

GR4.1.4 The curriculum, work and other requirements for each qualification;

GR4.1.5 Progression and academic exclusion; and

GR4.1.6 Any other matter relating to the academic functions of the University.

GR5 Application to study

GR5.1 Applications to study must be made in such manner as prescribed.

GR5.2 An applicant who has studied at any other tertiary education institution must, in addition, present an official academic record and a certificate of conduct, if requested, from that institution.

GR6 Selection requirements

GR6.1 All applicants shall produce evidence satisfactory to the Senate of their competence to work for the qualification sought.

GR6.2 The University may decline to admit as a candidate for the qualification, any person whose previous academic attainments are, in its opinion, not sufficiently adequate to warrant admission.

GR7 Selection for postgraduate studies

GR7.1 Graduates of any other recognised university (whether in the Republic of Botswana or elsewhere) may, for the purpose of proceeding to a postgraduate qualification in any College of the University, be admitted by the Senate to a status in the University equivalent to that which they possess in their own university by virtue of any degree held by them.

GR7.2 An applicant who has graduated from another tertiary institution or who has in any other manner attained a level of competence which, in the opinion of the Senate, is adequate for the purpose of postgraduate studies or research, may be admitted as a student in any College of the University.

GR8 Exemption from a module

GR8.1 Exemption from a module may be granted and credit may be awarded for a relevant module where an applicant has already obtained credit for an equivalent module or can demonstrate an equivalent level of competence through prior learning.

GR9 Registration

GR9.1 In order to pursue their studies in any semester or for any specified period of enrolment, all students of the University shall complete the applicable registration procedure, thereby affirming their acceptance of the regulations and rules of the University.

GR9.2 The Senate may impose conditions for the registration of any student.

GR9.3 Except as provided for hereunder, a student shall register in consecutive semesters.

GR 10 Suspension

GR10.1 On application in advance to the relevant College, and with the approval of the Senate, a student may apply for his/her registration to be suspended for a period of time not exceeding two (2) consecutive semesters.

GR10.2 Under exceptional circumstances, a further suspension of 2 semesters may subsequently be applied for and may be approved by Senate.

GR10.3 The Dean of a College may require that a student suspend his/her studies for a maximum of one (1) semester should the student be unable to register for a valid curriculum that will allow satisfactory progress to be made towards the attainment of the qualification.

GR10.4 A student with a suspended registration remains subject to the regulations of the University, and may return to register before or at expiry of the period of suspension.

GR10.5 The period during which registration is suspended shall not be included in and calculation towards the minimum and maximum periods prescribed for any qualification, nor for the evaluation of eligibility for the award of degrees *cum laude* or *summa cum laude*.

GR10.6 Rule GR1.7 shall apply to a student with a suspended registration.

GR11 Concurrent registration

GR11.1 Save by special permission of the Senate no student shall be registered for more than one qualification at the same time.

GR11.2 Unless approved by Senate prior to enrolment, no student shall be registered concurrently at the University while registered at any other tertiary institution.

GR12 Module registration

GR12.1 No student shall be registered for any module unless his or her curriculum has been approved by the College.

GR12.2 An approved curriculum may be modified only with the approval of the College.

GR12.3 Save by special permission of the appropriate College, no student may attend a module for which he or she is not registered.

GR13 Payment of fees

GR13.1 Save by special permission of the relevant Board of a College:

GR13.1.1 An applicant shall not be registered until all relevant prescribed fees are paid;

GR13.1.2 A student shall not be entitled to receipt of examination results, until all relevant prescribed fees are paid.

GR13.2 A student shall not be entitled to the conferral or award of a qualification until all monies due to the University have been paid.

GR14 Ancillary, pre-requisite and co-requisite requirements

GR14.1 A College may prescribe ancillary modules in any curriculum.

GR14.2 A College may specify the attainment of a minimum mark of more than 50% in a pre-requisite module, a specified mark in a module or any other requirement before registration for the proposed module is permitted.

GR14.3 Registration for a module will be conditional on meeting all co-requisite and pre-requisite requirements for that module.

GR15 Period of attendance

GR15.1 Every candidate for a qualification shall meet the relevant attendance and performance requirements for each module and qualification as prescribed by the relevant College and approved by the Senate, in order to obtain the requisite credit.

GR16 Duly performed (DP) certification

GR16.1 Students shall not present themselves for final examination in any module unless the Head of the Department in which they have studied that module has certified that they have met the DP requirements for the specified module.

GR16.2 Such DP certification shall be valid only for the examinations, including Supplementary examinations, of the semester in which it is issued.

GR16.3 With the consent of the Board of the College concerned, in exceptional circumstances, the DP certification may be extended to the relevant subsequent semester, in which case the Board may allow the student to retain any relevant class or continuous assessment mark.

GR16.4 The DP requirements for each module shall be published in the College Handbook and in any other manner deemed appropriate by the College.

GR16.5 Save as may otherwise be provided by the College, for each module a list of those students refused DP certification shall be published, in a manner deemed appropriate by the College, on or before the last day of teaching in each semester.

GR17 DP certification - right of appeal

GR17.1 Students have the right to appeal against the refusal of a DP certification in terms of Regulation GR16.

GR17.2 An appeal must be lodged to the relevant College, in the prescribed manner, within three (3) University working days of the last day of notification of DP refusals.

GR17.3 Such appeal shall be considered by an appropriate committee, the composition of which shall be approved by the Board of the relevant College.

GR17.4 The decision of the committee shall be final.

GR18 Examinations

GR18.1 An examination may be written and/or oral, and may include practical work.

GR18.2 On application and/or on the recommendation of the Head of Department, with the approval of the College, a written examination may, for a particular student, be replaced or supplemented by an oral examination.

GR19 Examination and moderation

GR19.1 Except with the permission of the Senate, all modules, other than exit-level modules, must be subject to internal examination and independent moderation.

GR19.2 Except with the permission of the Senate, all exit-level modules shall be subject to internal and external examination.

GR19.3 The portion of the total assessment subject to independent moderation or external examination, in terms of GR19.1 and GR19.2 above shall be at least 50%.

GR20 Examination scripts

GR20.1 Examination scripts shall be stored by the University for a maximum period of one (1) year or such longer period required by any contractual, professional or legal obligations.

GR21 Examination sessions

GR21.1 All examinations shall be held in the prescribed sessions approved by the Senate and given in the Academic Calendar.

GR22 Supplementary examinations

GR22.1 Supplementary examinations may be awarded in terms of these Regulations and the relevant College Regulations, as approved by the Senate.

GR22.2 Supplementary examinations shall not be awarded for any continuously assessed components of modules.

GR23 Special examinations

GR23.1 A student who has not been able to attempt or complete satisfactorily the original final examination by reason of illness or any other reason deemed sufficient by the College, may, on application, be granted permission to sit a special examination, during the next applicable supplementary examination session.

GR23.2 An application for a special examination shall be made on the prescribed form, accompanied by all relevant documentation, and lodged with the relevant College within three (3) working days of the date of the examination concerned. It is the responsibility of the student to ascertain whether or not the special examination has been granted.

GR23.3 If an application for a special examination is approved, the examination result, if any, from the original examination shall be regarded as null and void. If such an application is not approved the original examination result shall stand.

GR24 Standard of supplementary and special examinations

GR 24.1 To pass supplementary and special examinations, students must demonstrate a level of academic competence equivalent to that required in the original examination.

GR25 Limitation on awarding supplementary and special examinations

GR25.1 A supplementary or special examination shall not be granted in respect of any supplementary examination awarded in terms of Regulation GR22.

GR25.2 A supplementary or special examination shall not be granted in respect of any special examination awarded in terms of Regulation GR23.

GR26 Completion of modules

GR26.1 Every module shall be completed by passing the College approved assessment for that module.

GR27 Pass mark

GR27.1 The pass mark for all modules in the University shall be 50%, provided that any sub-minima required in certain components of the Senate-approved assessment have been met.

GR28 Completion requirements

GR28.1 Save upon the approval of the Senate, a qualification shall not be conferred or awarded until:

GR28.1.1 Credit has been obtained for all prescribed modules, including pre-requisite and co-requisite modules;

GR28.1.2 All other College requirements have been met; and

GR28.1.3 All monies due to the University have been paid.

GR29 Classification of results

GR29.1 A module may be passed with such distinctions as may be approved by the Senate on the recommendation of the Board of the College concerned.

GR29.2 A qualification may be conferred or awarded with such distinctions as may be approved by the Senate on the recommendation of the Board of the College concerned.

GR30 Overall Module Grade

GR30.1 Overall performance in a module shall be assessed on a percentage scale, a letter grade and a grade point as follows:

Marks %	Letter Grade	Grade point
90-100	A+	5.0
85-89.9	A	4.9
80-84.9	A-	4.7
75-79.9	B+	4.5
70-74.9	B	4.0
65-69.9	B-	3.5
60-64.9	C+	3.0
55-59.9	C	2.5
50-54.9	C-	2.0
45-49.9	D+	1.5
40-44.9	D	1.0
35-39.9	D-	0.5
0-34.9	E	0.0

GR31 Cumulative Grade Point Average (CGPA)

GR31.1 A student's weighted GP score is calculated for a module by multiplying the credits with the grade point achieved from the percentage mark awarded (see GR30). The cumulative GPA is given by the total weighted score (from the addition of the GP scores of all the modules) divided by the total number of credits. The GP score and CGPA are calculated to two decimal places.

GR32 Good Academic Standing

GR32.1 The CGPA will be calculated at the end of each semester or examination session and students who are in good academic standing will have a minimum CGPA of 2.0. Such students will be regarded as making satisfactory progress towards a qualification.

GR33 Academic Warning

GR33.1 A student who has a CGPA of less than 2.0 at the end of a semester will receive a warning that their academic progress is unsatisfactory.

GR34 Academic Probation

GR34.1 A student who fails to make satisfactory progress will be placed on academic probation.

GR34.2 A first year undergraduate student who has failed to achieve a CGPA of 2.0 in the first semester of study will be allowed to progress to semester two as long as they have passed at least two modules in the first semester.

GR34.3 A student, other than a first year student, who has a CGPA of less than 2.0 but greater than 1.7 will be placed on academic probation.

GR34.4

GR34.4.1 A student on academic probation must attain a minimum GP score of 2.0 for each of the modules taken during the probationary period, this probationary period will normally be two semesters,

GR34.4.2 A student should normally obtain an overall CGPA of 2.0 within the probationary period, but if not, and if the progress given in GR34.4.1 is achieved, the probationary period may be extended by a further semester to allow the CGPA of 2.0 to be achieved.

GR34.5

GR34.5.1 A student who fails more than two modules taken in a semester but has a CGPA of greater than 2.0 must retake and pass the modules or equivalent modules, if electives, at the next earliest opportunity.

GR34.5.2 A student with a CGPA of 2.0 or more but who fails a core, pre-requisite or co-requisite module must retake and pass the module at the next earliest opportunity.

GR34.6 A student may not re-take a module more than once and if passed the re-take mark will be used for calculating the CGPA.

GR34.7 A student may, on the authority of the College Board, be excluded from a particular programme of study.

GR35 Academic Progression Requirements for continued Registration

GR35.1 A first year student, who has a CGPA of less than 2.0 at the end of the first year of study, will be excluded from the university.

GR35.2 A student, other than a first year student, will be excluded if the overall CGPA is 1.7 or less, or the CGPA for their previous two semesters has been 1.7 or less.

GR35.3 A student who fails to meet the progression conditions and requirements as given in regulation 34 will be excluded.

GR36 Dean's Commendation

GR36.1 A student who achieves a CGPA of 4.0 or greater for any academic semester will receive a Dean's Commendation.

GR37 Academic exclusion

GR37.1 The Senate may exclude a student from a programme of study or from the University.

GR37.2 The Senate, after each examination session may exclude or refuse to renew or continue the registration of a student who has failed to meet the academic requirements for continued registration (see regulations 34 and 35).

GR37.3 A student who has been excluded from a programme may, at the discretion of Senate, and subject to College regulations, be allowed to register for a different programme in the same or a different College.

GR37,4 A student who has been excluded from two programmes will be excluded from the University.

GR37.5 The Senate may cancel the registration of a student in all or one or more of the modules for which the student is registered in a semester

if, in the opinion of the Senate, the academic achievement of the student is such that the student may not at the end of the semester obtain credit in such module or modules.

GR37.6 The Senate may refuse readmission to a student who fails to satisfy the minimum requirements for readmission.

GR37.7 Subject to Regulation GR37, students excluded from the university or refused re-registration may not be readmitted to the University until they are able to demonstrate that they have achieved a level of competence satisfactory to the relevant College and the Senate.

GR38 Academic exclusion – right of appeal

GR38.1 Students have the right to an appeal against an academic exclusion in terms of Regulation GR37.

GR38.2 Such appeal shall be lodged in the College of registration, in the prescribed manner, within seven (7) University working days of the release of final results.

GR38.3 The process for consideration of such an appeal shall be approved by the Senate.

GR39 Internal Programme Transfer

GR39.1 With the approval of Senate a student may transfer from one programme of study to another provided that:

GR 39.1.1 A student who wishes to transfer to a new programme must apply in writing to the Director of Registry; and

GR 39.1.2 All programme transfers and conditions for transfer are subject to the support of the Head of Department and the approval of the Dean in accordance with regulations established by the College into which the student wishes to transfer; and

GR39.1.3 All programme transfers are subject to advice from the Dean of the College from which the student wishes to be transferred from; and

GR39.1.4 A student must normally be in good academic standing (see rule GR32) and credit has been granted for all applicable modules which have been passed by the student and according to the rules of combination of the programme into which the student is transferring.

GR39.2 The College Examinations Board(s) may recommend the transfer of a student from one academic programme to another provided that:

GR39.2.1 The student meets the requirements for level of study for the programme being entered; and

GR39.2.2 That the Dean of the College into which the student wishes to transfer approves the transfer; and

GR39.2.3 That the student accepts the transfer recommendation.

GR40 Ethics

GR40.1 All academic activities and research, shall comply with the relevant University policies on ethics and any related requirements as determined by the Senate and the Council.

GR41 Reproduction of work

GR41.1 Subject to the provisions of the University's policy on intellectual property rights and any limitations imposed by official contractual obligations:

GR41.1.1 In presenting an assignment, prescribed project, dissertation, thesis or any such work for assessment, a student shall be deemed by so doing to have granted the University a perpetual, non-exclusive, royalty-free license to digitise, reproduce, share, disseminate and/or publicly distribute copies thereof for research and study purposes only, in whole or in part and in any format the University deems fit, provided that the University may waive its rights under this licence if the work in question has been or is being published in a manner satisfactory to the University.

GR41.1.2 Students shall forward master copies and electronic copies of all dissertations and theses to the University Libraries by the date, in the numbers and in the format stipulated by the Libraries in their policies existing at the time of creation of the dissertation or thesis concerned.

GR41.1.3 The work of students shall not be included in publications by academic staff without the student's express permission and acknowledgement; provided that such work may be included and acknowledged if all reasonable attempts to trace such students have been unsuccessful.

COLLEGE OF SCIENCES QUALIFICATION REGULATIONS

REGULATIONS FOR BACHELOR OF SCIENCE DEGREE IN THE COLLEGE OF SCIENCES

The following Regulations are additional to the preceding General Academic Regulations GR1 – GR41 and shall be applicable to every candidate for a Bachelor of Science Degree in the College of Sciences.

BR1 Periods of attendance

BR1.1 Every candidate for a Bachelor of Science degree shall be a registered student for the minimum period of attendance of four years full time study or as prescribed by the regulations and rules of the College.

BR2 Recognition of attendance

BR2.1 For the purpose of Regulation BR1, the College may accept as part of the attendance of a student for a degree of Bachelor, periods of attendance as a registered student at any other school, university or tertiary institution or in any other College in the University; provided that students shall not have the degree of Bachelor conferred and at least the last four semesters of the programme shall have been completed in the College of Sciences.

BR3 Level of Study

BR3.1 The Level of Study is the level at which undergraduate students are registered academically:

BR3.1.1 *Level 1*: applies to students who have not yet obtained **40 (degree) credits.**

BR3.1.2 *Level 2*: applies to students who have obtained at least **40 (degree) credits**

BR3.1.3 *Level 3*: applies to students who have obtained at least **72 (degree) credits**

BR3.1.4 *Level 4:* applies to students in four-year BSc programmes who have registered for such modules as will, if passed, lead to the completion of the degree.

BR4 Maximum Credits per Semester

BR4.1 The normal load per semester is 18-20 credits. Without the special permission of the College, a student shall not register for modules totalling more than 24 credits per semester.

BR5 Pass Mark

BR5.1 The pass mark for all modules in the College is 50%, the assessment being based on a weighted mean of marks obtained for one or more of the following: written, oral and/or practical examinations, practical work, field work, tests, essays, seminars, project reports and other classwork. A sub-minimum mark may be required in one or more parts of the assessment as specified in the syllabus entry for the module.

BR6 Internship

BR6.1 Students may be required, for specific programmes and as part of the requirements, to spend periods during the vacations in carrying out an internship in industry or other organisations.

BR7 Practical, Project or Field Work

BR7.1 Students may be required, for specific modules, to spend periods during the semester, vacations in carrying out practical work, project work or fieldwork related to a particular module of study.

BR8 Common Curriculum

BR8.1 All students enrolled in any Bachelor of Science programme in the College of Sciences at Level 1 will follow a common curriculum in their first year as given in the appropriate section of this Handbook.

BR9 Duly Performed (DP) Requirements

BR9.1 Students shall not be allowed to present themselves for the final examination in any module unless they have attained the College minimum requirements of 35% for the class mark and attendance at 90% of all practicals, tutorials and fieldwork required for the module; or as otherwise specified for the module in this Handbook. These should be taken to mean Minimum DP Requirements. In the module syllabus section individual modules may specify *additional* requirements.

Note: Students who do not satisfy the minimum attendance requirements will be liable to lose their duly performed certificate, ***no matter what the reason for their absence****.*

BR9.2 Students subject to the permission of the College, may be allowed to present themselves for the final examination in a module with less than 35% for the class mark provided that their attendance is at 90%.

BR 10 Supplementary examinations

BR10.1 Any student who fails a module with a mark of not less than 40% shall be permitted to write a supplementary examination in the module provided that the module assessment includes a formal written examination.

BR10.2 Under exceptional circumstances, and with the permission of the College Examination Board, a student who has failed a module with a mark of less than 40% may be awarded a supplementary examination.

BR10.3 Any student who passes a module overall, shall be permitted to write a supplementary examination in that module in order to fulfil a sub-minimum pre-requisite requirement for another module.

BR10.4 Students who have failed any modules with marks between 30% and 40%, and who, if they had passed all modules would have been able to graduate in that semester, shall be permitted to apply

to write supplementary examinations in those modules. Such examinations, up to a maximum of two such modules, will be granted on application to the College Office, provided the application is made to the College Office at least 3 working days before the supplementary exam is due to be written and the conditions above are met.

BR11 Degree Award and Classification

BR11.1 The student will be awarded the degree of Bachelor of Science when:

BR11.1.1 They have achieved the minimum of credits specified for the programme of which a specified number of credits will be at the exit-level of the qualification for a degree programme.

BR11.2 The degree will be classified as follows when the cumulative GPA for all the credits attempted in the last four semesters of the qualification:

Classification	Cumulative GPA
First Class	4.5-5.0
Second Class Upper Division	4.0-4.49
Second Class Lower Division	3.0-3.99
Third Class	2.0-2.99

BR12 Award of degree cum laude and summa cum laude

BR12.1 A degree of Bachelor may be conferred *cum laude* provided that, subject to exceptions as approved by the Senate, the student has:

BR12.1.1 Obtained a CGPA of at least 4.5 in all modules required for the qualification taken in the last four semesters; and

BR12.1.2 Successfully completed all modules in the curriculum at the first attempt and without recourse to supplementary examinations; and

BR12.1.3 Completed the degree in the prescribed minimum time.

BR12.2 A degree of Bachelor may be conferred *summa cum laude* provided that, subject to exceptions as approved by the Senate, the student has:

BR12.2.1 Obtained a CGPA of at least 4.7 in all modules required for the qualification taken in the last four semesters; and

BR12.2.2 Successfully completed all modules in the curriculum at the first attempt and without recourse to supplementary examinations; and

BR12.2.3 Completed the degree in the prescribed minimum time.

REGULATIONS FOR MASTERS OF SCIENCE DEGREE BY COURSEWORK

Note: The following Rules are additional to the preceding General Rules GR1 – GR41.

MCR1 Exemption from modules

MCR1.1 The College may accept examinations passed or certificates of proficiency completed in any module by a student in any College of the University or of any other university or institution recognised by the Senate for this purpose, or accept demonstration of an equivalent level of competence through prior learning, as exempting the student from a module(s) prescribed for a degree of Master of Science by coursework, provided that:

MCR1.1.1 no more than 40% of the required credits for the degree may be so exempted, and provided that such credits shall be awarded for coursework modules only; and

MCR1.1.2 students shall not have the degree of Master of Science by Coursework conferred unless the conditions laid down in Rule MCR2 is satisfied.

MCR2 Periods of registration

MCR2.1 A student registered for the degree of Master of Science by coursework shall be so registered for a minimum period of three consecutive semesters for full-time students or four consecutive semesters for part-time students before the degree may be conferred.

MCR3 Curriculum

MCR3.1 A student shall complete all prescribed modules, at least one of which shall be a dissertation module comprising individual research on a particular topic approved by the College, and comply with such other conditions as may be prescribed by the Senate.

MCR3.2 Except with the permission of Senate, the dissertation module shall comprise 50% of the total credits for the degree.

MCR4 Proposed research topic

MCR4.1 The College may, at its discretion, decline to approve a research topic if in its opinion:

MCR4.1.1 it is unsuitable in itself; or

MCR4.1.2 it cannot effectively be undertaken under the supervision of the University; or

MCR4.1.3 the conditions under which the student proposes to work are unsatisfactory.

MCR4.2 Ethical approval is required where applicable.

MCR5 Supervision

MCR5.1 The Board of the College shall, in terms of the policies of the Senate, appoint one or more appropriate supervisors, at least one of whom shall be a member of the University academic staff, to advise a student whose research topic is approved, and the student shall be required to work in such association with the supervisor or supervisors as the College may direct..

MCR6 Supplementary examinations

MCR6.1 A student who fails a module other than the dissertation with a mark of at least 40% shall be awarded a supplementary examination;

MCR6.2 under exceptional circumstances, and with the permission of the College Examinations Board, a student who has failed a module other than the dissertation with a mark of less than 40% may be awarded a supplementary examination.

MCR7 Failed coursework modules

MCR7.1 Failed coursework modules may not be repeated, except with the permission of the College and then not more than once.

MCR8 Progression

MCR8.1 A student who, after six semesters as a full-time student or ten semesters as a part-time student, has not completed the requirements for the degree shall be required to apply for reregistration, which will only be permitted on receipt of a satisfactory motivation.

MCR8.2 The student and supervisor must provide a progress report on the conduct of the research at the end of every semester in a manner prescribed by the College.

MCR9 Submission of dissertation

MCR9.1 At least two months before the dissertation is to be submitted for examination, a student shall give notice, in writing, to the College Office concerned of the intention to submit such dissertation and the title thereof, provided that, in the event of a student failing to submit the dissertation for examination within four months thereafter, the notice will lapse and a further notice of intention shall be submitted.

MCR10 Format of dissertation

MCR10.1 Every dissertation submitted shall include a declaration to the satisfaction of the Senate stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.

MCR10.2 Every dissertation submitted shall be in such format as prescribed by the College provided that each dissertation shall include an abstract in English not exceeding 350 words.

MCR10.3 A dissertation may comprise one or more papers of which the student is the prime author, published or in press in peer-

reviewed journals approved by the College Board accompanied by introductory and concluding material.

MCR10.4 A dissertation submitted under rule MCR10.3 shall include a detailed description of the student's own distinct contribution to the papers.

MCR10.5 All dissertations are subject to full examination in terms of these rules.

MCR11 Supervisor's report

MCR11.1 Upon submission of the dissertation, the supervisor or supervisors shall furnish a report on the conduct of the student's work; the report shall not include an evaluation of the quality of the dissertation.

MCR12 Examination of dissertation

MCR12.1 The Senate shall appoint for each dissertation one external examiner.

MCR12.2 A supervisor or co-supervisor shall not be appointed as an examiner.

MCR12.3 The name of the examiner shall not be known to the candidate.

MCR13 Re-examination of dissertation

MCR13.1 A failed dissertation may not be re-examined.

MCR14 Award of degree with Distinction

MCR14.1 The degree of Master of Science by Coursework may be awarded *with Distinction o*n the recommendation of the examiner of the dissertation provided that:

MCR14.1.1 the student has obtained an overall credit weighted average of at least 75% in the coursework component of the degree at the first attempt and without recourse to supplementary examinations; and

MCR14.1.2 the degree was completed in the prescribed minimum time plus two semesters.

REGULATIONS FOR THE DEGREE OF MASTER OF SCIENCE BY RESEARCH

The following Regulations are additional to the preceding General Academic Regulations GR1 – GR41 and shall be applicable to every candidate for a Masters Degree.

MR1 Periods of registration

MR1.1 A student registered for the degree of Master of Science by Research shall be so registered for a minimum period of two consecutive semesters for full-time students or four consecutive semesters for part-time students before the degree may be conferred.

MR2 Curriculum

MR2.1 A student for the degree of Master of Science by Research shall be required to pursue an approved programme of research on some subject falling within the scope of the studies represented in the College.

MR2.2 A student shall also comply with such other conditions as may be prescribed by the Senate and the rules of the College.

MR3 Proposed subject of study

MR3.1 Before undertaking the research, an applicant for the degree of Master of Science by Research shall submit for the approval of the College a statement of the proposed subject of study.

MR3.2 The College may, at its discretion, decline to approve such subject if, in its opinion:

MR3.2.1 It is unsuitable in itself, or

MR3.2.2 It cannot profitably be studied or pursued under the supervision of the College, or

MR3.2.3 The conditions under which the applicant proposes to work are unsatisfactory.

MR3.3 Ethical approval is required where applicable.

MR4 Supervision

MR4.1 The Board of the College shall, in terms of the policies of the College, appoint one or more appropriate supervisors, at least one of whom shall be a member of the University academic staff, to advise a student whose research topic is approved, and the student shall be required to work in such association with the supervisor or supervisors as the College may direct.

MR5 Progression

MR5.1 A student who, after six semesters as a full-time student, or ten semesters as a part-time student, has not completed the requirements for the degree shall be required to apply for re-admission, which will only be permitted with a satisfactory motivation, supported by the supervisor, and approved by the College Board.

MR5.2 The student and supervisor must provide a progress report on the conduct of the research at the end of every semester in a manner prescribed by the College.

MR6 Submission of thesis

MR6.1 Every student for the degree of Master of Science by Research shall be required to submit a thesis embodying the results of their research.

MR6.2 Every thesis submitted shall include a declaration to the satisfaction of the College stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.

MR6.3 At least three months before the thesis is to be submitted for examination, a student shall give notice, in writing, to the College

Office of the intention to submit such a thesis and the final title thereof, provided that, in the event of a student failing to submit the dissertation for examination within six months thereafter, the notice will lapse and a further notice of intention shall be submitted.

MR7 Format of thesis

MR7.1 Every dissertation submitted shall include a declaration to the satisfaction of the College stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.

MR7.2 Every thesis submitted shall be in such format as prescribed by the College; provided that each thesis shall include an abstract in English not exceeding 350 words.

MR7.3 A thesis may comprise one or more papers of which the student is the prime author, published or in press in a peer-reviewed journal approved by the Board of the College, accompanied by introductory and concluding material.

MR7.4 A thesis submitted under MR 7.3 above shall include a detailed description of the student's own distinct contribution to the paper(s).

MR7.5 All theses are subject to full examination in terms of these regulations.

MR8 Supervisor's report

MR8.1 Upon submission of the thesis, the supervisor or supervisors shall furnish a report on the conduct of the student's work to the College; the report shall not include an evaluation of the quality of the thesis.

MR9 Examination

MR9.1 The College shall appoint for each thesis two examiners, at least one of whom shall be responsible for external examination.

MR9.2 A supervisor or co-supervisor shall not be appointed as an examiner.

MR9.3 The names of the examiners shall not be disclosed to either the candidate or to one another.

MR10 Re-examination of dissertation

MR10.1 A failed thesis may not be re-examined.

MR11 Award of degree with Distinction

MR11.1 The degree of Master of Science by Research may be awarded *with Distinction* on the recommendation of the examiners provided that the degree was completed in the prescribed minimum time plus two semesters.

REGULATIONS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PhD) BY RESEARCH

These Regulations are additional to the General Academic Regulations (GR1 – GR41) and shall be applicable to every candidate for the Degree of PhD.

DR1 Criteria for admission to study

DR.1.1 Candidates for admission to the degree of Doctor of Philosophy (PhD) will normally have a Masters degree, subject to exceptions as agreed to by the relevant College Board.

DR1.2 Candidates, registered for a research Masters of Science degree, who have completed the requirements for the Masters degree, may apply to have their registration converted to a Doctor of Philosophy (PhD) registration *before* the Masters degree is awarded.

DR1.2.1 The time allowed for the PhD would be reduced by two semesters.

DR1.2.2 The material from the Masters dissertation may then be used towards the PhD.

DR1.2.3 If the PhD is not completed, the Masters degree may be awarded.

DR2 Periods of registration

A student registered for the degree of Doctor of Philosophy by research shall be so registered for a minimum period of four consecutive semesters for full-time students or eight consecutive semesters for part-time students before the degree may be conferred.

DR3 Proposed subject of study

DR3.1 Before undertaking the research, an applicant for the degree of Doctor of Philosophy shall submit for the approval of the College a statement of the proposed subject of study.

DR3.2 The College may, at its discretion, decline to approve such subject if, in its opinion:

DR3.2.1 it is unsuitable in itself, or

DR3.2.2 it cannot profitably be studied or pursued under the supervision of the University, or

DR3.2.3 the conditions under which the applicant proposes to work are unsatisfactory.

DR3.3 Ethical approval is required where applicable.

DR4 Supervision

DR4.1 The Board of the College shall appoint one or more appropriately qualified supervisors, at least one of whom shall be a member of the University academic staff, to advise a student whose research topic is approved, and the student shall be required to work in such association with the supervisor or supervisors as the College may direct.

DR5 Progression

DR5.1 A student who, after eight semesters as a full-time student or twelve semesters as a part-time student, has not submitted a thesis for examination shall be required to apply for re-registration, which will only be permitted on receipt of a satisfactory motivation.

DR5.2 The student and supervisor must provide a progress report on the conduct of the research at the end of every semester in a manner prescribed by the College.

DR6 Submission of thesis

DR6.1 Every student for the degree of Doctor of Philosophy shall be required to submit a thesis embodying the results of their research.

DR6.2 At least three months before the thesis is to be submitted for examination, a student shall give notice, in writing, to the College

Office of the intention to submit such thesis and the final title thereof, provided that, in the event of a student failing to submit the thesis for examination within six months thereafter, the notice will lapse and a further notice of intention shall be submitted.

DR7 Format of thesis

DR7.1 Every thesis submitted shall include a declaration to the satisfaction of the Senate stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.

DR7.2 Every thesis submitted shall be in such format as prescribed by the College; provided that each thesis shall include an abstract in English not exceeding 350 words.

DR7.3 A thesis may comprise one or more original papers of which the student is the prime author, published or in press in peer-reviewed journals approved by the College Board, accompanied by introductory and concluding integrative material.

DR7.4 A thesis submitted under DR7.3 above shall include a detailed description of the student's own distinct contribution to the papers.

DR8 Supervisor's report

DR8.1 Upon submission of the thesis, the supervisor or supervisors shall furnish a report on the conduct of the student's work; the report shall not include an evaluation of the quality of the thesis.

DR9 Examination

DR9.1 The Senate shall appoint for each thesis three examiners, at least two of whom shall be responsible for external examination.

DR9.2 Except with the permission of the College, at least one of the external examiners shall be based external to the country.

DR9.3 A supervisor or co-supervisor shall not be appointed as an examiner.

DR9.4 The names of the examiners shall not be disclosed to either the candidate or to one another.

DR10 Defense of thesis

DR10.1 As part of the examination process, a student may be required to defend a thesis. In this case rule DR9.4 may be waived.

DR11 Re-examination of thesis

DR11.1 A failed thesis may not be re-examined.

PROGRAMMES AND PROGRAMME REGULATIONS IN THE COLLEGE OF SCIENCES

The inclusion of any programme, course of study or module in this Handbook does not imply that the College of Sciences is compelled to offer it.

DEPARTMENT OF BIOLOGICAL AND BIOTECHNOLOGICAL SCIENCES

BSc Biological Sciences

The Biological Sciences cover a wide variety of specialist subjects all related to the study of life and the natural world. The core strands of modern biology include the fundamental understanding of cells and sub-cellular structures, biological molecules and biochemistry, physiology and the adaptation of organisms, ecology and evolution, and gene theory and molecular genetics. The degree in Biological Sciences is designed as a broad-based degree which covers all these fundamental areas.

Biology has been revolutionised by the recent development of powerful techniques in molecular and cellular biology, genomics and bioinformatics. These techniques are now being applied across all biological science disciplines and our programme is a reflection of this contemporary view. In addition, graduates should be able to appreciate the hierarchical nature of biological complexity, be abreast with emerging trends in molecular, cellular, organismal, populational and ecosystem level functions. Graduates should also be abreast with the history of scientific discovery in the biology, be conversant with logical and statistical procedures used to formulate, test and conclude on biological hypotheses, and technical acumen required to conduct contemporary research.

The degree programme provides a strong foundation for positions in a wide range of career options, including but not limited to research and development, regulation agencies, environmental consulting, research laboratories, medical, pharmaceutical or health related institutions, biotechnology firms, bioengineering, agriculture, not-for-profit organisations, food science and teaching. Furthermore, BSc graduates may opt to go on to postgraduate

study (either MSc or PhD) with specialty in any one of the above fields and join either private and government agencies or the academia.

RULES OF COMBINATION OF MODULES FOR THE BSc BIOLOGICAL SCIENCES

To obtain the degree the student must obtain a minimum of 160 credits with at least 34 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.

Specific details of the modules are in the Modules section of the Handbook.

NOTE: THE MODULES GIVEN FOR LEVELS TWO, THREE AND FOUR MAY BE CHANGED

	LEVEL 100	**LEVEL 200**	**LEVEL 300**	**LEVEL 400**
Semester 1	BIOL101 (4)	BIOL201 (4)	BIOL301	BIOL Elective
	CHEM101 (4)	BIOL202 (3)	BIOL303	BIOL Elective
	COMP101 (3)	BIOL203 (4)	BIOL305	BIOL Elective
	MATH101 (4)	CHEM201 (4)	Elective	BIOL Elective
	PHYS101 (4)	ENVS201 (3)	Elective	Elective
	TWAL101 (2)	TWAL202 (2)	TWAL301	BMEG401
Semester 2	BIOL102 (4)	BIOL204 (4)	BIOL302	BIOL Elective
	CHEM102 (4)	BIOL206 (3)	BIOL304	BIOL Elective
	MATH102 (4)	BIOL205 (4)	BIOL306	BIOL Elective
	PHYS102 (4)	CHEM202 (4)	Elective	BIOL Elective
	STAT101 (3)	STAT201 (3)	Elective	Elective
	TWAL102 (2)	TWAL202 (2)	TWAL302	BMEG401

DEPARTMENT OF CHEMICAL AND FORENSIC SCIENCES

Botswana International University of Science & Technology (BIUST), through its College of Science, offers programmes leading to four Bachelor of Science (BSc) degrees in the department of Chemical & Forensic Sciences being; i) BSc Chemistry, ii) BSc Applied Chemistry, iii) BSc Material Science and iv) BSc Forensic Science.

What is Chemistry? Chemistry is known as the central science that borrows from the fundamental principles of Mathematics, the laws of Physics and the concepts of Biology to describe the world around us. It is therefore crucial for a thorough understanding of many science, engineering and environmental studies. Modern Chemistry plays a pivotal role in our understanding of the structure & interactions of matter as well as achieving deeper insight in the formulation of new compounds, their identification, quantification and characterization. But Chemistry still retains the elements of magic and mystery that fuelled the *Alchemists* in the seventeenth century.

Everything around us (including us) is composed of the basic building blocks that constitute matter. Chemists refer to these building blocks as *Atoms*. There are only about 100 atoms known to exist. However, these building blocks can arrange themselves into an amazing number of different combinations that we call *Molecules*. There are thousands of known *molecules* and new ones are discovered on a regular basis. Everything that you can see (and can't see) is composed of *atoms* and *molecules*. So the question "*What is Chemistry*?" would be better posed as "*What isn't Chemistry*?"

The study of chemistry at university gives one broad education and prepares one for entry into many careers, from the invention of new products and materials, to the control of the processes that lead to their production, to the work that assures their quality & quantity. The following is a sample of areas of industry that would employ a graduate of chemistry; University Teaching and Research, Agricultural Research, Medical Research, Forestry Research, Science Publishing, Biotechnology, Forensic Science, Material & Chemical Manufacturing, Beverage Industry, Food Safety, Water Treatment and Analysis, Material & Chemical Manufacturing, Health and Safety

UNDERGRADUATE PROGRAMMES IN CHEMICAL AND FORENSIC SCIENCES

The department offers bachelor's degrees in the following areas:

- BSc (Chemistry)
- BSc (Applied Chemistry)
- BSc (Material Science)
- BSc (Forensic Science)

To obtain any of the above four degrees, the student must obtain a minimum of 160 credits with at least 40 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.
Specific details of the modules are in the Modules Section of this handbook.

NOTE: THE MODULES GIVEN FOR LEVELS TWO, THREE AND FOUR MAY BE CHANGED

One chemistry based lab session per week for each semester. The chemistry courses are based on the traditional divisions.

	LEVEL 100	**LEVEL 200**	**LEVEL 300**	**LEVEL 400**
Semester 1	BIOL101 (4)	CHEM201 (4)	CHEM301	CHEM Elective
	CHEM101 (4)	CHEM203 (4)	CHEM303	CHEM Elective
	COMP101 (3)	PHYS202 (4)	CHEM305	CHEM Elective
	MATH101 (4)	MATH202 (4)	Elective	CHEM Elective
	PHYS101 (4)		Elective	Elective
	TWAL101 (2)	TWAL201 (2)	TWAL301	BMEG401

Semester 2	BIOL102 (4)	CHEM202 (4)	CHEM302	CHEM Elective
	CHEM102 (4)	CHEM204 (4)	CHEM304	CHEM Elective
	MATH102 (4)	PHYS203 (4)	CHEM306	CHEM Elective
	PHYS102 (4)	MATH204 (4)	Elective	CHEM Elective
	STAT101 (3)	***STAT201 (3)***	Elective	Elective
	TWAL102 (2)	TWAL202 (2)	TWAL302	BMEG402

DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES

BSc Geology

The BSc in Geology includes the study of the continents, the oceans, the atmosphere, and the Earth's magnetic and gravitational fields. It encompasses the physical, chemical, and biological Sciences, and is concerned with the Earth's history and the processes operating in and on the Earth, including the formation of its surface features and the erosion and deformation of this surface. The more that is known about the Earth's materials, formation, and structure the better we can appreciate, use, and preserve our planet. This understanding is at the heart of many economic, social, and environmental issues--oil and mineral exploration; safe disposal of industrial and municipal wastes; preservation of groundwater supplies; the choice of sites for dams, nuclear power plants, and high-rise building issues that will become more complex as demands on the Earth and its resources increase.

Mineral resources dominate the national Botswana economy (diamonds, copper/nickel and coal) and this will continue. Indeed not only will the current activity be sustained but it will be increased by diversification in terms of types of rock minerals (e.g. gold, silver, uranium), gas production and geothermal capacity. It is very important that this 'bedrock' of the economy is maintained and enhanced through innovative and substantial downstream processing. This programme will produce graduates who have the expertise to join the resources sector in Botswana through the exploration and resource development of minerals (metallic and non-metallic), energy (coal and geothermal) and water (groundwater and surface water systems). The acquired knowledge and skills can be applied to better understand, model and manage natural earth resources.

The programme allows graduates to become Professional Geoscientists in a range of careers in mineral and petroleum exploration, mining and quarrying, geosciences information analysis, and engineering consultancy. Students may go on to postgraduate study, either at Master's level, usually with a particular specialised career path in mind, or at doctorate level for those wishing to pursue an academic career. The communication, numeric and IT skills you will gain also make you a good candidate for business or education-oriented careers.

RULES OF COMBINATION OF MODULES FOR THE BSc GEOLOGY DEGREE

To obtain the degree the student must obtain a minimum of 160 credits with at least 40 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.

Specific details of the modules are given in the Modules section of the Handbook.

BSC GEOLOGY CURRICULUM				
	LEVEL 100	**LEVEL 200**	**LEVEL 300**	**LEVEL 400**
Semester 1	BIOL101(4)	CHEM201(4)	GEOL301(4)	GEOL401(3)
	CHEM101(4)	MATH201(4)	GEOL303(4)	GEOL403(4)
	COMP101(3)	PHY201(4)	GEOL305(4)	GEOL405(3)
	MATH101(4)	GEOL201(3)	GEOL307(3)	BMEG401(2)
	PHYS101(4)	GEOL207(3)	ENVS305(3)	Elective (3)
	TWAL101(2)	TWAL201(2)	TWAL301(2)	Elective (3)
Semester 2	BIOL102(4)	CHEM202(4)	GEOL302(4)	GEOL402(3)
	CHEM102(4)	MATH211(4)	GEOL304(4)	GEOL404(4)
	MATH102(4)	STAT201(3)	GEOL306(3)	GEOL406(4)
	PHYS102(4)	GEOL204(3)	ENVS302(3)	GEOL408(4)
	STAT101(3)	GEOL208(4)	CHEM301(4)	BMEG402(2)
	TWAL102(2)	TWAL202(2)	TWAL302(2)	Elective (3)
Winter Semester		GEOL310(4)	GEOL410(4)	

BSc Environmental Sciences

It is inevitable that human nature and livelihoods as well as other ecosystems depend on the environment and its natural resources for survival. However unsustainable use and management of the natural resources impedes

human development and in developing countries it exacerbates inequalities in wealth distribution. Depletion of natural resources, pollution and the disintegration of ecological functions are increasingly becoming matters of concern at all scales. Environmental conservation, management of scarce water resources, sustainable development and poverty alleviation as well as dealing with the causes and impacts of climate change are high priority on the global agenda. To find sustainable solutions to environmental problems and to improve the quality of human life, we must first understand the processes that sustain environmental systems, how these systems function and interact with each other and with human society.

Environmental Sciences is an interdisciplinary field concerned with the interaction of processes that shape our natural environment and that deals with the impact of human activities on natural systems. Instruction is offered in the areas of Ecology, Earth sciences, Water, and Atmospheric Sciences. Various tools that are of use in addressing environmental problems, such as environmental modelling, GIS and Remote Sensing are applied to aid students' understanding of the physical set up of the environment.

The Environmental Sciences major starts off with developing grounding in the basic sciences of chemistry, biology, mathematics and physics in addition to the introductory courses. At the upper level of the programme students take core courses and electives which fall in the areas of earth/natural resources, environmental management and policy, climate change, water resources, pollution and atmospheric sciences. Students are also expected to design and conduct a research project of their choice in the fourth year. Fieldwork is also a major component of the training which is aimed at equipping students with essential hands-on skills and exposing them to the natural and manmade environments through site visits and fieldwork.

The BSc degree in Environmental Sciences programme is designed to prepare individuals for careers in environmental consulting, business, industry, government, NGO and education; or to pursue graduate studies in environmentally-related sciences, law and public health.

RULES OF COMBINATION OF MODULES FOR THE BSc ENVIRONMENTAL SCIENCE

To obtain the degree the student must obtain a minimum of 160 credits with at least 40 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.

BSC ENVIRONMENTAL SCIENCE CURRICULUM				
	LEVEL 100	**LEVEL 200**	**LEVEL 300**	**LEVEL 400**
Semester 1	BIOL101 (4)	CHEM 201 (4)	ENVS 301(3)	ENVS 401(4)
	CHEM 101 (4)	MATH 201 (4)	ENVS 303(3)	ENVS 403(4)
	COMP 101 (3)	PHY 201 (4)	ENVS 305(3)	ENVS 405(3)
	MATH 101 (4)	GEOL 201 (3)	ENVS 307(3)	ENVS 407(3)
	PHY 101 (4)	ENVS 201 (3)	ENVS 309 (3)	BMEG 402(2)
	TWAL101 (2)	TWAL201 (2)	GEOL 307(3)	Elective (4)
			TWAL 301 (2)	
Semester 2	BIOL102 (4)	CHEM 202 (4)	ENVS 302(3)	ENVS 402(3)
	CHEM 102 (4)	ENVS 202 (3)	ENVS 304(4)	ENVS 404(3)
	MATH 102 (4)	ENVS 204 (4)	ENVS 306(4)	ENVS406/GEOL408 (4)
	PHY 102 (4)	ENVS 203 (4)	CHEM 301 (4)	ENVS 408(4)
	STAT 101 (3)	STAT 201 (3)	GEOL 306(3)	BMEG 402(2)
	TWAL102 (2)	TWAL202 (2)	TWAL 301(2)	Elective (4)
Winter Semester			ENVS 413 (4)	

Specific details of the modules are in the Modules Section of this handbook

BSc Earth and Environmental Sciences

The Earth is a dynamic and active planet, as revealed by recent dramatic and sometimes catastrophic volcanic eruptions, earthquakes, tsunamis, fires and floods. To understand how our planet works, how it has evolved and what we know about its future, the ideas and principles of Physics, Chemistry, Geology, and Biology are integrated in the exciting and stimulating studies which make up the Earth and Environmental Sciences.

This understanding of the Earth is at the heart of many economic, social, and environmental issues—oil and mineral exploration; safe disposal of industrial and municipal wastes; preservation of groundwater supplies; the choice of sites for all kinds of development; the impact of climate change and many others—all these issues that will become more complex as demands on the Earth and its resources increase.

There has never been a better or more important time to study the Earth and Environmental Sciences. It is currently the UN Decade of Education for Sustainable Development (2005–2014) and increasing environmental legislation is forcing all businesses to account for their carbon footprints and environmental impact. With many Governments putting sustainability at the heart of all its policies, there is a growing shortage of skilled people who can translate scientific knowledge into actions that can manage resources sustainably for future generations.

This programme will cover the importance of understanding of earth systems (past, present and future); the integration of theoretical and practical investigation; a holistic and multidisciplinary scientific approach; the importance of spatial and temporal scale; the importance of the concepts of sustainability and sustainable development; and the examination of resource use and resource and environmental management.

This programme will equip you with the skills and knowledge necessary for a range of career opportunities within the Earth and Environmental Sciences in such wide ranging areas as: Environmental, engineering and ecological consultancies; Regulatory authorities and government agencies; Industry and private companies; Conservation and natural resource management; and research.

The communication, numeric and IT skills you will gain also make you a good candidate for business or education-oriented careers. Students may go on to postgraduate study, either at Master's level, usually with a particular specialised career path in mind, or at doctorate level for those wishing to pursue an academic career.

RULES OF COMBINATION OF MODULES FOR THE BSc EARTH AND ENVIRONMENTAL SCIENCE

To obtain the degree the student must obtain a minimum of 160 credits with at least 40 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.

BSC EARTH AND ENVIRONMENTAL SCIENCE CURRICULUM				
	YEAR 1	YEAR 2	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	CHEM 201 (4)	GEOL 303(4)	GEOL 401(3)
	CHEM 101 (4)	MATH 201 (4)	GEOL 307(3)	GEOL 405(3)
	COMP 101 (3)	PHY 201 (4)	ENVS 301(3)	ENVS 401 (4)
	MATH 101 (4)	GEOL 201 (3)	ENVS 303(3)	ENVS 407(3)
	PHY 101 (4)	ENVS 201 (3)	ENVS 305 (3)	BMEG 401(2)
	TWAL101 (2)	TWAL201 (2)	TWAL 301 (2)	ENVS 405 (3)
			Elective (3)	Elective (3)
Semester 2	BIOL102 (4)	CHEM 202 (4)	GEOL 302(4)	GEOL 402(3)
	CHEM 102 (4)	MATH 211 (4)	GEOL 306(3)	GEOL 404(4)
	MATH 102 (4)	GEOL 208 (4)	ENVS 302(3)	ENVS 408(4)
	PHY 102 (4)	ENVS 202 (3)	ENVS 304 (4)	ENVS406/GEOL408(4)
	STAT 101 (3)	STAT 201 (3)	CHEM 301 (4)	BMEG 402(2)
	TWAL102 (2)	TWAL202 (2)	TWAL 302 (2)	ENVS 402 (3)
Winter Semester			GEOL410/ ENVS413 (4)	

Specific details of the modules are in the Modules Section of this handbook.

DEPARTMENT OF MATHEMATICAL AND STATISTICAL SCIENCES

The aim of the programme in Mathematics and Statistics is to equip students with the skills necessary to succeed in professions that require quantitative skills, logical thinking and the ability to communicate complex technical information to a general audience. In the programme, students learn the basic material such as linear algebra, differential equations, probability and statistics which are needed to successfully solve real life of problems. In addition, they learn to think with rigor and to solve complex problems by studying simpler related problems.

BSc Applied Mathematics

Mathematics may appear to be an abstract subject but it has its roots many millennia ago in the systematic development of methods to solve practical problems. In the modern age the breadth of the applicability of mathematics is immense not just in the areas of Science, technology and engineering but in medicine, business, commerce and finance.

The applicability of mathematics is expanding as more areas of human work and endeavour require the analytical model building approach of modern mathematics. This programme will produce graduates who have the expertise to work as applied mathematicians in engineering, Science-based industry, and commerce, in the public and private sectors, in research and in education.

Employers greatly value the intellectual skills and rigour in reasoning, the familiarity with numerical and symbolic thinking, and the analytic approach to problem solving that well trained graduates in applied mathematics have. Employment can be obtained in areas such engineering, Science-based industry, and commerce, in the public and private sectors, in research and in education.

Students may go on to postgraduate study, either at Master's level, usually with a particular specialised career path in mind, or at doctorate level for those wishing to pursue an academic career.

BSc Statistics

Statistics is the science of learning from data, and of measuring, controlling, and communicating uncertainty. Statistical methods are applied in a variety disciplines such as astronomy, biology, engineering, genetics, medicine, psychology, public health, sports, education, commerce and economics. Statisticians work in government agencies, scientific research, industry, commerce, education and social sciences where they design methods for data collection, and ways of summarising the data to help understanding and drawing valid conclusions.

RULES OF COMBINATION OF MODULES FOR THE BSc APPLIED MATHEMATICS and BSc STATISTICS

To obtain the degree the student must obtain a minimum of 150 credits with at least 34 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.

Specific details of the modules are in the Modules section of the Handbook.

NOTE: THE MODULES GIVEN FOR LEVELS THREE AND FOUR MAY BE CHANGED

BSC APPLIED MATHEMATICS				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	MATH202 (4)	MATH301 (3)	MATH401 (3)
	CHEM 101 (4)	MATH206 (4)	MATH302 (3)	MATH *Elective* (3)
	COMP 101 (4)	PHYS202 (4)	MATH305 (3)	MATH *Elective* (3)
	MATH 101 (4)	COMP201 (4)	STAT301 (3)	MATH *Elective* (3)
	PHY 101 (4)	STAT202 (3)	TWAL301 (2)	BMEG 401 (2)
	TWAL 101 (2)	TWAL201 (2)	*Elective* (3)	*Elective* (3)

Semester 2	BIOL102 (4)	MATH204 (4)	MATH303 (3)	MATH400 (3)
	CHEM 102 (4)	MATH203 (4)	MATH304 (3)	MATH406 (3)
	MATH 102 (4)	PHYS203 (4)	MATH307 (3)	MATH *Elective* (3)
	PHY 102 (4)	COMP202 (4)	STAT302 (3)	MATH *Elective* (3)
	STAT 101 (2)	STAT203 (3)	TWAL302 (2)	BMEG402 (2)
	TWAL 102 (2)	TWAL202 (2)	*Elective* (3)	*Elective* (3)

BSC STATISTICS				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	MATH202 (4)	MATH301 (3)	STAT400 (6)
	CHEM 101 (4)	MATH206 (4)	MATH302 (3)	STAT401(3)
	COMP 101 (4)	PHYS202 (4)	STAT301 (3)	*Elective* (3)
	MATH 101 (4)	COMP201 (4)	STAT303 (3)	*Elective* (3)
	PHY 101 (4)	STAT202 (3)	*Elective* (3)	*Elective* (3)
	TWAL 101 (2)	TWAL201 (2)	TWAL301 (2)	BMEG 401 (2)
Semester 2	BIOL102 (4)	MATH204 (4)	STAT302 (3)	STAT400 (6)
	CHEM 102 (4)	MATH203 (4)	STAT304 (3)	*Elective* (3)
	MATH 102 (4)	PHYS203 (4)	STAT305 (3)	*Elective* (3)
	PHY 102 (4)	COMP202 (4)	STAT308 (3)	*Elective* (3)
	STAT 101 (2)	STAT203 (3)		*Elective* (3)
	TWAL 102 (2)	TWAL202 (2)	TWAL302 (2)	BMEG402 (2)

Note: STAT400 is a year-long module worth 6 credits

BSc Applied Sciences

Applied Sciences in this programme refers to Mathematics, Physics, Computer Science And Statistics and the application of these disciplines to practical problems. The disciplines of the Applied Sciences are integrated through their applications particularly in the fields of Engineering and Technology.

This Applied Science curriculum is designed to offer students flexibility and choice by allowing for a combination and integration of the disciplines of Applied Mathematics, Physics, Computer Science and Statistics. The

degree is designed so that one or two specialisations are taken in the final year.

You start this programme by studying the Basic Sciences. In subsequent years of the Applied Sciences degree, you will study a combination of relevant core and optional modules in Mathematics, Physics, Statistics and Computer Science.

Graduates of this programme will have the expertise to work as Applied Scientists in a wide range of engineering and Science-based industries and in commerce, in the public and private sectors, and in research and in education.

Students may go on to postgraduate study, at Master's level, usually with a particular specialised career path in mind, or exceptionally at doctorate level for those wishing to pursue an academic career.

RULES OF COMBINATION OF MODULES FOR THE BSc APPLIED SCIENCES

To obtain the degree the student must obtain a minimum of 150 credits with at least 34 credits at level 4. The compulsory modules and rules of combination for each level of the degree are given below.

At Level 3 students must choose EITHER two majors OR a double single major from the disciplines on offer: Applied Mathematics; Physics; Computer Science; or Statistics. For a two majors degree at both Level 3 and Level 4 students must take 4 modules of EACH of their majors. For a double single major students must take 8 modules in the major at Level 3 and Level 4.

In addition to their majors, students must take a further two modules at Level 3 and Level 4 as electives.

NOTE: it is essential that students make sure that they are able to meet any module pre-requisite requirements and that they are able to take any specific module in the semester in which it is offered.

Specific details of the modules are in the Modules section of this Handbook.

NOTE: THE MODULES GIVEN FOR LEVELS THREE AND FOUR IN ANY MAJOR MAY BE CHANGED

BSC APPLIED SCIENCES (Mathematics and Statistics)				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	MATH202 (4)	MATH301 (3)	MATH401 (3)
	CHEM 101 (4)	MATH206 (4)	MATH302 (3)	MATH *Elective* (3)
	COMP 101 (3)	PHYS202 (4)	MATH305 (3)	STAT401 (3)
	MATH 101 (4)	COMP201 (4)	STAT301 (3)	STAT *Elective* (3)
	PHY 101 (4)	STAT202 (4)	STAT303 (3)	BMEG 401 (2)
	TWAL 101 (2)	TWAL201 (2)	TWAL301 (2)	*Elective* (3)
Semester 2	BIOL102 (4)	MATH204 (4)	MATH303 (3)	MATH406 (3)
	CHEM 102 (4)	MATH203 (4)	MATH304 (3)	MATH *Elective* (3)
	MATH 102 (4)	PHYS203 (4)	STAT302 (3)	STAT *Elective* (3)
	PHY 102 (4)	COMP202 (4)	STAT308 (3)	STAT *Elective* (3)
	STAT 101 (3)	STAT203 (4)	TWAL302 (2)	BMEG402 (2)
	TWAL 102 (2)	TWAL202 (2)	*STAT Elective* (3)	*Elective* (3)

BSC APPLIED SCIENCES (Mathematics and Physics)				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	MATH202 (4)	MATH301 (3)	MATH401 (3)
	CHEM 101 (4)	MATH206 (4)	MATH302 (3)	MATH *Elective* (3)
	COMP 101 (3)	PHYS202 (4)	MATH305 (3)	PHYS403 (3)
	MATH 101 (4)	COMP201 (4)	PHYS301 (3)	PHYS *Elective* (3)
	PHY 101 (4)	STAT202 (4)	PHYS303 (3)	BMEG 401 (2)
	TWAL 101 (2)	TWAL201 (2)	TWAL301 (2)	*Elective* (3)
Semester 2	BIOL102 (4)	MATH204 (4)	MATH303 (3)	MATH406 (3)
	CHEM 102 (4)	MATH203 (4)	MATH304 (3)	MATH *Elective* (3)
	MATH 102 (4)	PHYS203 (4)	PHYS302 (3)	PHYS *Elective* (3)
	PHY 102 (4)	COMP202 (4)	PHYS306 (3)	PHYS *Elective* (3)
	STAT 101 (3)	STAT203 (4)	TWAL302 (2)	BMEG402 (2)
	TWAL 102 (2)	TWAL202 (2)	*PHYS Elective* (3)	*Elective* (3)

BSC APPLIED SCIENCES (Mathematics and Computer Science)				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	MATH202 (4)	MATH301 (3)	MATH401 (3)
	CHEM 101 (4)	MATH206 (4)	MATH302 (3)	MATH *Elective* (3)
	COMP 101 (3)	PHYS202 (4)	MATH305 (3)	COMP *Elective* (4)
	MATH 101 (4)	COMP201 (4)	COMP301 (4)	COMP *Elective* (4)
	PHY 101 (4)	STAT202 (4)	COMP303 (4)	BMEG 401 (2)
	TWAL 101 (2)	TWAL201 (2)	TWAL301 (2)	*Elective* (3)
Semester 2	BIOL102 (4)	MATH204 (4)	MATH303 (3)	MATH406 (3)
	CHEM 102 (4)	MATH203 (4)	MATH304 (3)	MATH *Elective* (3)
	MATH 102 (4)	PHYS203 (4)	COMP302 (4)	COMP *Elective* (4)
	PHY 102 (4)	COMP202 (4)	INFS201 (4)	COMP *Elective* (4)
	STAT 101 (3)	STAT203 (4)	TWAL302 (2)	BMEG402 (2)
	TWAL 102 (2)	TWAL202 (2)	*Elective* (3)	*Elective* (3)

POSTGRADUATE PROGRAMMES IN MATHEMATICS AND STATISTICS

The Department of Mathematics and Statistics offers the following postgraduate programmes

- MSc by Coursework and Dissertation
- MSc by Thesis
- PhD by Thesis

MSc by Coursework and Dissertation

The MSc by coursework and dissertation is offered over two years of full time study with specialisation in Pure Mathematics, Applied Mathematics or Statistics. In the first year, students must take a minimum of 15 credits per semester.

Rules for Combination of modules for the MSc by coursework and dissertation:

MSc Pure Mathematics

Year 1			
Semester 1		Semester 2	
MATH601	3 C	Elective 1	3 C
MATH611	3 C	Elective 2	3 C
MATH612	3 C	Elective 3	3 C
Elective 1	3 C	Elective 4	3 C
Elective 2	3 C	Elective 5	3 C

Year 2			
Semester 1		Semester 2	
MATH602	-		
MATH600			30 C

MSc Applied Mathematics

Year 1			
Semester 1		Semester 2	
MATH601	3 C	Elective 1	3 C
MATH611	3 C	Elective 2	3 C
MATH621	3 C	Elective 3	3 C
Elective 1	3 C	Elective 4	3 C
Elective 2	3 C	Elective 5	3 C

Year 2			
Semester 1		Semester 2	
MATH602	-		
MATH600			30 c

MSc Statistics

Year 1			
Semester 1		Semester 2	
MATH601	3 C	Elective 1	3 C
MATH611	3 C	Elective 2	3 C
STAT601	3 C	Elective 3	3 C
Elective 1	3 C	Elective 4	3 C
Elective 2	3 C	Elective 5	3 C

Year 2			
Semester 1		Semester 2	
MATH602	-		
STAT600			30

MSc by Thesis

A directed research on an approved topic in Mathematics or Statistics, under the guidance of a supervisor appointed by the Department. Students must register for one of the following:

MATH700 MSc Thesis Research in Mathematics
STAT700 MSc Thesis Research in Statistics

PhD

A directed research on an approved topic in Mathematics or Statistics, under the guidance of a supervisor appointed by the Department. Students must register for one of the following:

MATH800 PhD Thesis Research in Mathematics
STAT800 PhD Thesis Research in Statistics

DEPARTMENT OF PHYSICS AND ASTRONOMY

Physics seeks to discover and unravel the fundamental laws of nature. Physics also provides the underlying framework for applied science and engineering, which led to major technological developments such as the wheel, computer processor, supersonic jet, space travel and the World Wide Web. The physics programme will prepare students to develop their creativity, innovativeness, intellectual rigour and technical problem solving skills.

Many physics graduates pursue diverse career opportunities or continue their education at universities worldwide. A physics programme will allow graduates to land jobs in a wide range of careers such as environmentalists, medical physicists, quality controllers, materials scientists, exploration geophysicists, developers of renewable energy sources, astrophysicists, meteorologists, radiologists and oceanographers. Higher degrees can lead to careers in in academic or industrial research and university teaching. Other physics graduates have started their own businesses in electronics, telecommunications, computing and scientific/industrial instrument manufacture.

Students in many fields need a sound understanding of the physical world. Department of Physics and Astronomy is pleased to offer a number of basic and specialised service courses to students from other departments in science and engineering.

BSc Physics, BSc Applied Sciences

BSC PHYSICS				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**
Semester 1	BIOL101 (4)	MATH202 (4)	MATH301 (3)	PHYS *Elective* (3)
	CHEM 101 (4)	MATH206 (4)	PHYS301 (3)	PHYS *Elective* (3)
	COMP 101 (3)	PHYS202 (4)	PHYS303 (3)	PHYS *Elective* (3)
	MATH 101 (4)	COMP201 (4)	PHYS *Elective* (3)	PHYS *Elective* (3)
	PHY 101 (4)	STAT202 (4)	Elective	BMEG 401 (2)
	TWAL 101 (2)	TWAL201 (2)	TWAL301 (2)	*Elective* (3)

Semester 2	BIOL102 (4)	MATH204 (4)	PHYS302 (3)	PHYS *Elective* (3)
	CHEM 102 (4)	MATH203 (4)	PHYS306 (3)	PHYS *Elective* (3)
	MATH 102 (4)	PHYS203 (4)	PHYS *Elective* (3)	PHYS *Elective* (3)
	PHY 102 (4)	COMP202 (4)	Elective	PHYS *Elective* (3)
	STAT 101 (3)	STAT203 (4)	TWAL302 (2)	BMEG402 (2)
	TWAL 102 (2)	TWAL202 (2)	*PHYS Elective* (3)	*Elective* (3)

BSC APPLIED SCIENCES (Physics and Computer Science)				
Semester 1	**YEAR 1**	**YEAR 2**	**YEAR 3**	**YEAR 4**
	BIOL101 (4)	MATH202 (4)	MATH301 (3)	PHYS *Elective* (3)
	CHEM 101 (4)	MATH206 (4)	PHYS301 (3)	PHYS *Elective* (3)
	COMP 101 (3)	PHYS202 (4)	PHYS303 (3)	COMP *Elective* (4)
	MATH 101 (4)	COMP201 (4)	COMP301 (4)	COMP *Elective* (4)
	PHY 101 (4)	STAT202 (4)	COMP303 (4)	BMEG 401 (2)
	TWAL 101 (2)	TWAL201 (2)	TWAL301 (2)	*Elective* (3)
Semester 2	BIOL102 (4)	MATH204 (4)	PHYS302 (3)	PHYS *Elective* (3)
	CHEM 102 (4)	MATH203 (4)	PHYS306 (3)	PHYS *Elective* (3)
	MATH 102 (4)	PHYS203 (4)	COMP302 (4)	COMP *Elective* (4)
	PHY 102 (4)	COMP202 (4)	INFS201 (4)	*COMP Elective* (4)
	STAT 101 (3)	STAT203 (4)	TWAL302 (2)	BMEG402 (2)
	TWAL 102 (2)	TWAL202 (2)	*PHYS Elective* (3)	*Elective* (3)

For BSc Mathematics and Physics, see the Applied Sciences entry under the Department of Mathematics and Statistics.

UNDERGRADUATE MODULES IN THE COLLEGE OF SCIENCES BY DISCIPLINE

MODULE ABBREVIATIONS

BIOL	BIOLOGY
CHEM	CHEMISTRY
ENVS	ENVIRONMENTAL SCIENCE
GEOL	GEOLOGY
MATH	MATHEMATICS
PHYS	PHYSICS
SOC	SOCIAL SCIENCES AND HUMANITIES
STAT	STATISTICS

MODULES AT LEVEL ONE

Module	Outline Content
MATH101 MATHEMATICAL FOUNDATIONS **(4 credits)**	To provide a foundation of concepts in mathematics including introductory calculus **BASIC ALGEBRA:** Number system; Set theory; Exponents; Logarithms; Algebraic expressions; Equations; Inequalities; Absolute values **FUNCTIONS:** Function evaluation, domain and range; Combining functions; Properties of functions; Inverse functions; Exponential functions; Logarithmic functions **Graphs of Functions:** Quadratic function; Polynomial functions; Rational functions and Asymptotes; Transformations **POLYNOMILAS:** Dividing polynomials; Factor and remainder theorem **TRIGONOMETRY:** Radian measure; Trigonometric Ratios; Trigonometric functions of other angles; Trigonometric identities; Sine, cosine and tangent functions; Inverse sine, cosine and tangent functions; Trigonometric equations.
MATH 102 PRECALCULUS **(4 credits)**	**LIMITS:** Rate of change; Definition of a limit; Properties of limits; Limits of polynomial and rational functions; Limits of trigonometric functions; Limits at infinity; One sided limits; Continuity. **DIFFERENTIATION:** Tangents and Derivative at a point; The derivative as a function; Sum and difference rule for differentiation; Product rule; Quotient rule; Derivatives of trigonometric, exponential and logarithmic functions; Tangent and normal lines; Chain rule; L'Hopital's rule; Higher order derivatives; Minimum and maximum points; Monotone functions; Concavity and points of inflection; Curve sketching; Implicit differentiation. **INTEGRATION:** antiderivatives; indefinite integrals; definite integrals; Integration by trigonometric substitution; Integration of trigonometric functions; Integration by parts; Integration by partial fractions; Area under the graph; Improper Integrals. **Polar Coordinates**: Polar coordinate system; Graphing in Polar coordinates. **COMPLEX NUMBERS**

CHEM101 General Chemistry I (4 credits) and CHEM 102 General Chemistry II (4 credits)	To provide a foundation of knowledge and practical skills in chemistry and the role chemistry plays in society. Symbols and chemical numeracy; energy and matter; elements, compounds and mixtures; chemical reactions; solutions -solubility and concentration; separation of mixtures; atomic structure-electronic configuration and the Periodic table; compounds-bonding and nomenclature, molecular geometry; the mole; reactions in aqueous solution. Introductory principles in organic chemistry; organic functional group chemistry.
PHYS101 (4 credits) INTRODUCTORY PHYSICS I **PHYS 102 (4 credits) INTRODUCTORY PHYSICS II**	To provide a foundation of knowledge and practical skills in physics and the role physics plays in society Mechanics: Units and Dimensions; Vector algebra, Kinematics, Projectiles, Newton's laws of motion, Friction, Work, Energy and Power, Momentum, Rotational Motion, torque, Static Equilibrium, Gravitation. Vibrations and waves: Simple harmonic motion, Oscillations and Resonance, Wave motion; Geometrical Optics: Reflection and refraction, lenses, Optical Instruments. Electricity: electrostatics, electromagnetism, resistance, capacitance, inductance, Ohms law, dc and ac circuits, impedance, power calculations in dc and ac circuits, introduction to electrical energy sources, batteries, dc and ac generators. Magnetism; Introduction to Modern Physics: dual nature of matter, De-Broglie's wavelength, photoelectric effect, Bohr model of hydrogen atom, nucleus, radiation.
BIOL101 INTRODUCTION TO BIOLOGY I **(4 credits) and** **Biology 102 INTRODUCTION TO BIOLOGY II** **(4 credits)**	To provide a foundation of knowledge and practical skills in biology and the role biology plays in society. The structure and function of cells (prokaryote and eukaryote) and role of bio-molecules and basic metabolic processes in living organisms; introductory Genetics; Origin and Diversity of life: principles of classification; survey of bacteria, fungi, plants and animals; evolution and biogeography. Introduction of Ecology: Populations, community interactions, ecosystems, the biosphere; human evolution and human ecology including impact on the biosphere.

STAT101 INTRODUCTION TO STATISTICS **(2 credits)**	To introduce the basic concepts of probability and statistics. Summarising data: listing and grouping, graphical representations, measures of location and dispersion Elementary probability: counting, permutations and combinations, probability, sample space and events, addition and multiplication rules, conditional probability and Bayes' theorem. Expectation Probability distributions.

MODULES AT LEVELS TWO, THREE AND FOUR

NOTE: THE MODULES GIVEN FOR LEVELS FOUR MAY BE CHANGED

Biological Sciences

Offered by the Department of Biological and Biotechnological Sciences

BIOL201	4C	**Diversity of life (Biodiversity)** Comprehensive introduction to the biodiversity of plants, animals and microbes. Students are given a solid grounding in the vast diversity of multicellular and unicellular organisms and their evolutionary lineages.
BIOL202	4C	**General Microbiology** An introduction to the study of microorganisms (viruses, parasites, bacteria and fungi). This course will focus on the fundamentals of microbiology. These include introduction to, and history of microbiology, classification and identification of microorganisms, physiology (nutrition, metabolism, growth variability, etc.) and methods of handling microorganisms. The course will also examine the role of microorganisms in applications of biotechnology with reference to medicine, food science and agriculture.

BIOL203	4C	**Biochemistry** The study of the molecular basis of life. This is an introductory course that will focus on basic concepts in biochemistry and it will cover the four major classes of biological molecules: proteins, carbohydrates, lipids, and nucleic acids. The emphasis will be on the chemical properties and three-dimensional structure of these molecules in relationship to their biological function. The course will also provide an introduction to metabolic pathways and bioenergetics, including glycolysis, fermentation and respiration, oxidation of fatty acids, and photosynthesis.
BIOL204	4C	**Cell biology** This is an introductory course to cell biology and it will provide the students with a basic understanding of cell structure and the functional interactions of the cell with its environment. The students will learn the mechanisms of intracellular and transmembrane transport, cell control and intracellular signaling. Students will also learn current molecular biological techniques that are used to study these topics in the laboratory.
BIOL205	4C	**Genetics** This course will provide students with an understanding of the principles and concepts of genetics. The topics will include but not limited to structure and function of genes, genomes, chromosomal and molecular mechanism of replication, mutation, expression and transmission of inherited diseases.

BIOL206		**General Ecology** A study of the abiotic (non-living, including temperature, light, gases) and biotic (living organisms e.g. plants and animals) factors in ecosystems and how they interact and influence species distribution and abundance. Students will have an understanding on major areas including biogeography, population ecology, community ecology, energy flow/food webs, nutrient supply and cycling, conservation biology, landscape ecology, ecosystem management and global ecology.

Chemical Sciences

Offered by the Department of Chemical and Forensic Sciences

CHEM201	4C	**General Principles of Chemistry** Introduction to: quantitative chemistry, types of reaction, atomic spectroscopy, electronic configuration, bonding, gases, thermochemistry, kinetics, and gas and solution equilibria. Volumetric analysis, measurement of physical quantities, shapes of molecules.
CHEM202	4C	**Chemical Reactivity** Physical and descriptive inorganic and organic aspects of introductory chemistry. Phase equilibria and colligative properties, buffers, electrochemistry, nomenclature, reactions, main group elements, solid state structures, acid/base behaviour of oxides, and industrial chemistry of sulfur, phosphorus, nitrogen and the halogens.
CHEM301	4C	**Environmental Analytical Chemistry** To introduce students to instrumental methods of chemical analysis for rocks, soils and water. Sample collection, preparation and analysis. Errors. Atomic spectroscopy; chromatography; spectroscopic analysis, FTIR; electro-analytical methods; solid-state analysis, XRF and XRD.

Geology

Offered by the Department of Earth and Environmental Sciences

GEOL201	3 C	**Earth and its Materials** Structure of the Earth; Plate tectonics; Rock-forming Minerals and their properties; Plutonic and Volcanic Igneous rocks; Sedimentary cycle, Sedimentary rocks and basic principles of Stratigraphy; Metamorphism, deformation and Metamorphic rocks; Concept of geologic time; Mineral resources and their formation; Energy resources and their formation; Earth surface processes; General geological structure and stratigraphy of southern Africa
GEOL204	3 C	**Earth Surface Processes** This course examines processes which shape the surface of the earth. Emphasis will be on endogenic as well as exogenic processes. Major geomorphological concepts will be outlined as well as processes that form and modify the earth's surface. In particular, processes such as weathering, mass wasting, fluvial, aeolian and glacial will be examined. Transportation and deposition of earth material by various agents and the resultant landscapes will be examined and their morphology interpreted to understand the genesis and evolution of the landforms.
GEOL207	3 C	**Introduction to Structural Geology and Field Methods** Stress and Strain; Deformation; Brittle structures; Ductile structures; Tectonics; Structural mapping techniques and tools; Geologic field methods; Making, evaluating and interpreting geologic observations; Geologic maps and cross sections
GEOL208	4 C	**Mineralogy and Mineral Microscopy** Physical properties of minerals; Crystallography; Optical properties of minerals; Petrographic microscope; Chemical composition of minerals; Silicates; Oxides and hydroxides; Halides; Carbonates; Sulfides; Sulphates.

GEOL301	4 C	**Igneous and Metamorphic Petrology** Classification of igneous rocks; Igneous textures; Igneous phase diagrams; Igneous rock forming processes; Plutonism in different tectonic settings; Volcanism in different tectonic settings; Chemistry of igneous rocks; Classification of metamorphic rocks; Metamorphic textures; Metamorphic mineral assemblages and reactions; Metamorphic facies; Chemistry of metamorphic rocks; Metamorphic phase diagrams; Thermodynamic principles and pressure-temperature conditions of metamorphism; Fluids and metasomatism
GEOL302	4C	**Sedimentology and Stratigraphy** Sedimentary processes; Sedimentary environments and facies; Classification of sediments and sedimentary rocks; Textures and analysis of sedimentary rocks; Sedimentary structures; Sedimentary environments; Volcanic environments; Post-depositional structures and diagenesis; Stratigraphic concepts; Lithostratigraphy; Biostratigraphy; Sequence stratigraphy; Chronostratigraphy; Basin analysis and tectonics
GEOL303	4C	**Geochemistry and Exploration** Planet Earth in the Solar System; The geochemistry of the Earth; The Law of Mass Action; Chemical equilibrium; Carbonate equilibria; oxidation-reduction reactions; The kinetics of chemical reactions; stable and radioactive isotopes. The exploration part of the course includes: Analytical methods; geochemical characterization of rocks, sediments and water; introduction to environmental and biogeochemistry; geochemical exploration.
GEOL304	4C	**Geophysics and Exploration** Principles of geophysics; application and limitation of gravity, seismic, magnetic, electrical and electromagnetic methods. Exercises involving data acquisition, procession and interpretations. Principles of borehole logging, formation evaluation, resistivity, induction, Self-potential, radiometric, Case studies. Application of these methods in a variety of geologic exploration goals. Field work is an integral part of this course.

GEOL305	4C	**Structural Geology and Tectonics** Deformation mechanisms; Strain analysis; Stress measurements; Faults and faulting; Folds and folding; Shear zones and mylonites; Kinematic analysis; Microstructures; Deformation, metamorphism and time; Earth structure and Plate tectonics; Continental lithosphere; Contraction tectonics; Extensional tectonics; Fold-thrust belts; Strike-slip tectonics.
GEOL306	3C	**Research Methods in Earth and Environmental Sciences** Research methods and ethics, from design to data analysis and report writing.
GEOL307	3C	**Hydrogeology and Water Resources** Global cycling of water, Nature of groundwater & aquifers; Principles of groundwater flow (Darcy's experiment, Estimation of aquifer parameters, pumping test data analysis); The geology of groundwater occurrence; Hydro-geochemistry and introduction to isotope hydrology; analysis of hydrochemical and water isotope data, hydrogeological mapping, development of a conceptual hydrogeological and groundwater flow model; Groundwater exploration, development and management. Water resources component is focused on Freshwater Resources; demand for water; Water depletion and pollution and Water law and major treaties..
GEOL310	4C	**Geological Field Mapping and Reporting** General Principles and Techniques for Geological Mapping; Field equipment and their use for Geological Mapping; Sampling procedures; Field observation; Field interpretations, Organization of the field notebook Taking field notes; Field identification of rocks and structures Field description of geologic structures;. Geologic mapping and specific field techniques; Production of geological maps, Geologic report preparation. (Field Course)

EART401	3C	**Geology of Southern Africa and Botswana** Geologic evolution of Earth from Archean to Cenozoic; Evolution of life and landscape; Plate tectonics and its evolution with time; Supercratons and Supercontinents; Position of Africa and southern Africa in various paleogeographic reconstructions; Major geologic units of Africa; Geology of the Kaapvaal Craton; Geology of the Zimbabwe Craton; Geology of the Limpopo Complex; Geology of the Namaqua-Natal belt including Damaran orogeny; Archaean tonalite-trondhjemite-granodiorite granitoids in Botswana; Archaean volcano-sedimentary units as part of greenstone belts in Botswana; Gaborone igneous complex and related volcanics; Selebi-Phikwe Complex; Mahalapye Complex; Motloutse Complex; Transvaal Supergroup in Botswana; Paleoproterozoic syn-Bushveld units in Botswana including Molopo Farms Complex, Moshaneng Complex and Kubu island granitoids; Kheis, Magondi, and Okwa belts; Paleoproterozoic sedimentary basins in Botswana including Waterburg and Palapye groups; Mesoproterozoic Kibaran events in Botswana including the Umkondo large igneous province; Neoproterozoic Damaran units in Botswana; Pan-African events in Botswana and adjacent regions; Kimberlites in Botswana; Karoo igneous province and Supergroup in Botswana.
GEOL402	3C	**Petroleum Geology** Geological understanding of petroleum, including its origin, its migration, the reservoir rocks in which it is found, the mechanisms by which it is trapped in the subsurface, the techniques by which it is found and extracted, and its physical and geochemical properties.
GEOL403	4C	**Geology of Ore Deposits** Physical properties of ore minerals and their uses; Ore mineral assemblages and their textures; Ore petrography using reflected light microscope; Morphology of ore deposits; Ore forming processes; Magmatic ore deposits; Hydrothermal ore deposits – magmatic; Hydrothermal ore deposits – sedimentary; Ore deposits formed in sedimentary environments; Supergene ores; Distribution of mineral deposits in space and time; Metallogeny and tectonics.

GEOL404	4C	**Exploration and Evaluation of Mineral Deposits** Ore deposits; Exploration methods for mineral deposits; Sampling of mineralized material; Geochemical exploration; Geophysical exploration; Evaluation methods of mineral deposits; Mineral economics; Mining methods; Drilling methods and how geology affects them; Engineering properties of rocks; Geometallurgy; Mining in the stress field between society and environment; Mine reclamation.
GEOL405	3C	**Environmental Geology and Waste Management** The human environment; Minerals and rocks, geologic structures, introductory mechanics, hydraulics; Geomaterials and geohazards; case studies of interactions between geology and engineering; Waste management covers Landfill site selection, design, siting and operations; disposal of nuclear waste; Environmental pollution; mining and mineral processing, mining waste generation and disposal.
GEOL406	4C	**Engineering Geology** Minerals; Rocks; soils; weathering processes; Mechanics fundamentals; formulating an investigation; site investigation data collection and interpretation; Exploration using maps, Remote sensing; Susbsurface exploration; Engineering properties of soil, volume, mass, moisture, atterberg limits, gradation and classification systems; consolidation, compaction; shear strengths in cohesive and non-cohesive soils, triaxial tests, Mohr-Coulomb failure relation; Compressive, tensile and shear strength of rocks, test methods; Static and dynamic elastic moduli; Index tests; Rock mass deformation, Influence of discontinuities, weathering, in situ test methods: Rock mass quality; Control of susbsurface water, dams seepage, control of water table (temporary and permanent); Construction uses of rocks, aggregates, chemical degradation, degradation by weathering; Geological aspects of dam construction; natural hazards and mitigation of effects, earthquakes, volcanic processes, landslides and subsidence.
GEOL408	4C	**Final Year Project (Research Project)** Independent research project, from design to data analysis and presentation of results and report writing.

GEOL409	4C	**Mining and Evaluation of Geological Resources** Principal concepts of mine geology, mineral resource management, production and overall operational processes in the mining industry. Mining methods, mine mapping and sampling, reading mine plans, mineral reporting codes, mineral resource estimation and evaluation. Mine plan reading skills, identification of different mine layouts associated with a specific mining method. Ore reserve calculations, presentations. Mine visits
GEOL410	4C	**Internship** Internship/attachment in a relevant Industry/organization during the winter semester following the end of the 3rd year of study. Report to be produced at the end of the Internship Period

Environmental Sciences

Offered by the Department of Earth and Environmental Sciences

ENVS201	3C	**An introduction to Human Environments** Special topics in this course include: Fundamental issues and concepts in environmental sciences, The environment as an asset, The scientific process/methods of environmental analysis, Human geography, Human ecology, Human-cultural evolutions and their impacts, The changing global context, Urbanization, Human populations, Sustainability, Community ecology, Biogeochemical cycles, Adaptation and Cultural Ecology.
ENVS202	3C	**Introduction to the Biophysical Environment** This module covers the principles and processes governing climate, landforms, and vegetation systems and interrelationships between the atmosphere, hydrosphere, lithosphere and biosphere are also explored. Natural and human-induced changes to environmental systems form a considerable part of the module. Field and laboratory exercises are an essential component of this module.

ENVS203	4C	**ENVS 203: Environmental Microbiology** Microorganisms are important since they catalyse metabolic processes which in turn are associated with biogeochemical cycles, recycling and the degradation of organic contaminants as well as maintaining ecosystem health. Understanding the functions of microbial communities will enhance knowledge of ecosystem processes. This knowledge will help us to develop models that predict how an ecosystem will respond to changes in future environmental conditions. The course will introduce students to the diversity of microbial communities and the important roles they play in the various spheres of the Earth. Various ways are presented by which microbial activities sustain natural ecosystems and contribute to environmental integrity. The use of microorganisms in managed and artificial systems is also discussed. Techniques for characterizing microorganisms and investigating microbial processes are also explored. Topics covered include; cell structure, evolution and gene flow, population and community dynamics, water and soil microbiology, biogeochemical cycling and bioremediation
ENVS204	4C	**Ecology and Biodiversity** Topics include physical and biological processes in ecology concepts of evolution, biodiversity, and community ecology are introduced. Students will learn the fundamental principles of evolutionary theory, which they will use to explore the evolution of biodiversity on earth. Origins and diversity of life, from prokaryotes, to multi-cellular organisms are also discussed. The course also covers natural selection, speciation, and the phylogeny of evolutionary relationships in conjunction with changing conditions on earth
ENVS301	3C	**Soils** The importance of soils, soil formation, soil physical properties, soil chemical properties, soil biological properties, classification and survey, soil conservation and management.
ENVS302	4C	**Remote Sensing in Earth and Environmental Sciences** Remote Sensing processes, electromagnetism, interactions with the atmosphere, platforms and sensors, image pre-processing, image interpretation and/or image classification and analysis, applications including a group empirical project in which students will implement image analysis for a domain of their preference.

ENVS303	3C	**Atmospheric Science and Pollution** Basic concepts in physics and chemistry of the atmosphere as well as pollution science are explored in this course. Topics include the chemical composition of the atmosphere, atmospheric thermodynamics, atmospheric chemistry, radiative transfer, the production, transformation, transport, and removal of air pollutants. Special topics cover the photochemistry of ozone, smog formation, the greenhouse effect, acid rain and the health effects of air pollution.
ENVS304	4C	**Environmental Impact Assessment** The EIA process: various stages of the EIA process, such as screening, scoping, EIA document preparation, Public/ stakeholder involvement, Evaluating EIA: review and assessment, SEA Appeal rights and decision-making. Case studies in practice.
ENVS305	3C	**Geographic Information Systems and Databases** This course comprises of lectures and lab practicals. Opportunities are provided for students to apply these concepts to solve real-world problems. Topics covered are GIS principles and methods, databases and spatial data models, spatial data query and analysis, maps and visualisation.
ENVS306	4C	**Environmental Law and Policy** The course discusses the philosophical debates on issues such as market-oriented approaches to regulation, expert knowledge vis-a-vis indigenous knowledge and growth/ gain against ecology. Topics covered include sustainability and management, the politics surrounding ecosystem management, environmental governance, ethics and justice, the changing role of civil society, ecological economics, integrated environmental assessment, establishing facts and resolving environmental science- policy disputes and environmental justice in poor communities. Under the law component a set of laws designed to safeguard the environment against potential risks of pollution and other forms of damage are considered. Consideration is also given to the role of government and other responsible agencies in the management of environmental resources and policy processes

ENVS307	3C	**Energy and the Environment** Introduction to energy and the environment, principles of energy conversion, global energy use and supply, alternative energy sources (Renewable Energy), environmental effect of power generation including human-induced climate changes
ENVS309	3C	**Natural Resources Management** Topics include: Basic ecological principles and their application to natural resource management-Ecological Concepts, Human Population, Sustainability and Soil Conservation, Rangeland Management, Forest Management/National Parks, Wildlife Management/Biological Conservation, Aquatic Environments, Water Management and Conservation, Energy issues
ENVS401	4C	**Environmental Monitoring and Auditing** Introduction (Environmental Plans, Environmental Management Systems, Goal, Objectives, Activities), environmental management systems and ISO14001 as well as other standards; detailed examination of the standard (ISO 14001 structure); aspects, impacts and performance; auditing and consultancy skills; environmental legislation, application of audit skills through site visit..
ENVS402	3C	**Environmental Economics** Topics include: some basic concepts and principles of economics used in analyzing decisions on resource use and conservation, environmental valuation, externalities, market failures and environmental problems, cost -benefit analysis, the economics of renewable and non-renewable resources, ethics and economics. Environmental policy-Practical issues surrounding the feasibility of implementing economically efficient principles and policies are analyzed, and alternative policies aimed at achieving a sustainable environment are examined as well as case studies linking policies to environmental economics.
ENVS403	4C	**Environmental Hazards and Waste Management** Topics include: Introduction to hazardous wastes, characteristics of waste, identification of waste, management of waste (reduction and recycling), treatment and disposal technologies, refuse collection, storage and transport, waste minimization and recovery,.

ENVS404	3C	**Applied Geographic Information System and Remote Sensing** The course is delivered by a mix of lectures, labs and discussions (seminar style) of relevant peer-reviewed journal papers. Part I: Spatial analysis using raster and vector data, analyzing surfaces, 3D analysis, introduction to spatial modelling (spatial models, GIS tools for modelling). Part II: Advanced image classification techniques, image segmentation techniques, e.g. Object oriented analysis, image matching, introduction to imaging radar, use of scenarios with examples from different applications
ENVS405	3C	**Climate Change** The science of climate change, climate change – past, present and future, drivers of climate change, forcing and feedback, climate uncertainty and risk, climate change and policy, behavior change and climate change action
ENVS406	3C	**Research Project** Independent research project, from design to data analysis and presentation of results and report writing.
ENVS407	3C	**Hydrology** This course is structured around the hydrologic cycle. Individual components of the hydrologic cycle as well as interactions between these components are examined. Human impacts are also discussed. Components of the water balance , Watershed and its characteristics; theoretical and practical approaches to measurement and forecasting of components the water balance; human impacts on surface-water hydrology
ENVS408	4C	**Environmental Modelling and Decision Analysis** Topics include: The science of environmental decision making, An overview of environmental models (e.g., conceptual, mathematical and statistical, process, and spatial), Major steps involved in developing basic model structure, Explain how the models are used within a decision analysis framework (e.g on water quality and adaptation to climate change), Estimation of parameters, Model calibration and validation, Uncertainty, Practical application of models to solving environmental problems.

ENVS409	4C	**Economics of Climate Change** Overview, efficiency, public goods, externalities; environmental policy instruments; discounting; risk and uncertainty, integrated assessment, international cooperation and climate policy.
ENVS410	4C	**Synoptic Climatology** Overview of synoptic climatology, global climate and the general circulation, synoptic systems, methods and applications
ENVS411	4C	**Catchment Processes and Management** The characteristics of a catchment are largely determined by geology, soil type, land use, hydrology and water quality. Therefore catchment management addresses factors such as land use, vegetation, soils, wetlands, water quality and environmental flows. Topics include the impacts on catchment management of hydrological, watershed classification, ecological and geomorphic processes sustainable catchment management, community participation, law and policy as well as an analysis of catchment management systems.
ENVS412	4C	**Water Resources Management** Topics include: Introduction to IWRM, Institutions, Demand Management, River Basin Planning and Management, Sanitation and Health, Conflict Resolution, Stakeholder Participation/Involvement, Gender Mainstreaming in IWRM, Public-Private-Partnerships, Water Policy and Water Quality
ENVS413	4C	**Environmental field mapping and reporting/Internship** **I**nternship/attachment; practical field mapping and reporting

Mathematics

Offered by the Department of Mathematical and Statistical Sciences

MATH201	3C	**Calculus** Solution of algebraic equations, applications of trigonometry, vectors and matrices, Functions, Trigonometric functions, differentiation and integration of elementary functions. Taylor series.
MATH202	4C	**Differential Calculus** Functions, graphs and inverse functions, limits and continuity, the derivative, techniques of differentiation, applications of derivatives, antiderivatives
MATH203	4C	**Kinematics** Motion in a straight line: Equations of motion and their derivations, displacement, velocity, acceleration, variable acceleration, speed-time graphs. Motion in a plane: Use of polar coordinates; velocity and acceleration in terms of radial and transverse components. Projectile motion: path of projectile, range, maximum range, time of flight, maximum height, parabola of safety, projectile motion on an inclined surface, using non-standard axes on an inclined plane. Relative motion: shortest distance, relative displacement, relative velocity and relative acceleration, application of sine and cosine rules and vector algebra.
MATH204	3C	**Integral Calculus and Linear Algebra** Integral Calculus, definitive integral, techniques of integration, applications of integrals, Taylor series, complex numbers. Linear algebra , Vectors lines and planes in space matrices, systems of linear equations.
MATH205	4C	**Mechanics** Differential Equations, Newton's Laws of Motion, Resisted Motion Work, Energy and Power, Harmonic Oscillations, Momentum and Impulse, Statics of a Rigid Body.
MATH206	4C	**Vectors and Analytic Geometry** logic, sets, vectors, matrices and analytic geometry

MATH211	3C	**Applied Calculus** Polar coordinates, Calculus of Several variables, Differential equations; Applications to exponential, logarithmic and growth curves. Fourier series, Applications in the earth and environmental Sciences. Use of Matlab
MATH301	4C	**Advanced Calculus** Euclidean Spaces and Vectors; Sequences; Completeness; Compactness; Connectedness; Continuity. Differentiability in Several Variables; Higher Order Partial Derivatives; Taylor's Theorem; Critical Points and Extreme Value Problems **Application of Differentiation**; Integration on the Line; Integration in Higher Dimensions; Multiple Integrals and Iterated Integrals; Change of Variables for Multiple Integrals (Jacobian); Improper Integrals. Vector functions of a single variable; Line Integrals of vector fields, integrals over paths; Greens's theorem: Parametric representation of surfaces; Integrals over surfaces, the divergence theorem; Green and Stoke's theorem. Integrals and Derivatives of Sequences and Series; Power Series; The Complex Exponential and Trig Functions.
MATH302	3C	**Linear Algebra** Linear algebra: axioms for vector spaces. Linear independence, bases and dimension. Matrices and linear transformations. Change of basis. Eigenvectors and eigenvalues, diagonalization and its applications (including linear differential equations). Orthogonality, Gram-Schmidt process.

MATH303	4C	**Ordinary Differential Equations** differential equations and their solution; first-order differential equations; higher order differential equations; series solutions of linear differential equations; systems of linear differential equations; the laplace transform; Case studies from finance, population theory, mathematical biology, epidemiology, geometry and mechanics.

MATH304	3C	**Real Analysis I** The Real Number System; Continuity and Limits; Basic Properties of Functions on R: The Intermediate-Value Theorem, Least Upper Bound, Greatest Lower Bound, The Bolzano-Weierstrass Theorem, The Boundedness and Extreme-Value Theorems, The Cauchy Criterion, The Heine-Borel and Lebesgue Theorems; Elementary Theory of Differentiation
MATH305	3C	**Sets and Logic** Propositions and predicates, logical connectives. Quantifiers: existential and universal quantifiers. Elementary methods of proof. Sets: set operations, cardinality of a set, set partition, ordered pairs, Cartesian product. partially ordered sets (posets), Hasse diagram. Relations and functions. Real numbers: natural numbers, integers, rational numbers, irrational numbers. Intervals. Prime numbers.
MATH306	3C	**Discrete Mathematics** Basic set theory. Relations & functions, equivalence relations. Counting principles, inclusion-exclusion & pigeonhole principles, combinations, identities with binomial coefficients. Modular arithmetic, basic number theory: GCD, extended Euclidean algorithm, Euler's totient function, basic group theory, Fermat's Little Theorem, Euler's Theorem. Cryptology: encryption, decryption of well known private-key cryptosystems, cryptanalysis of shift, substitution & Vigenère ciphers, stream ciphers, Shannon theory, public key cryptography, product cryptosystems. Recursions & generating functions.
MATH307	3C	**Numerical Methods** Vector and Matrix norms: Orthogonal matrices; Singular value Decomposition. Systems of Linear Equations: Gauss Elimination; LU factorization; Pivoting; Cholesky factorization; QR factorization. Eigenvalues and Eigenvectors of a Matrix:; Eigenvalue problems; Reduction to Hessenberge and Tri-diagonal form; Power method Conditioning and Stability: Conditioning and condition number; Stability Iterative Methods; Conjugate Gradient method; Jacobi method; Successive Over- Relaxation method

MATH308	3C	**Fourier Methods** Fourier series, application to boundary value problems for ordinary differential equations (Sturm-Liouville problem). Series solution of ordinary differential equations, basic special functions. Separation of variables for one and two dimensional PDE's. Fourier transform, applications to PDE's. Further complex variable theory, Laurent's and Taylor's theorem, isolated singularities and residues, evaluation of integrals by residues. Applications.
MATH309	3C	**Elements of Set Theory** Ordered pairs and the product of two sets. Functions: definition of a function as a set of ordered pairs, images and preimages. Injective, surjective and bijective functions including their characterizations in terms of preimages, Cantor's theorem. Families of sets, Axiom of Choice. Binary relations: equivalence relations, equivalence classes, transversals, order relations, upper and lower bounds, greatest and least elements, maximal and minimal elements, Zorn's Lemma. Equipotent sets: countable sets, product of two countable sets, countability of Q, uncountability of R.
MATH310	3C	**Mathematical Programming and Game Theory** Systems of Linear Equations and Linear Inequalities; Convex Sets and Convex Cones; Convex and Concave Functions; Linear Programming Problems; Simplex Method: Initial Basic Feasible Solution; Degeneracy in Linear Programming; The Revised Simplex Method; Duality in Linear Programming; Variants of the Simplex Method; Post-Optimization Problems: Sensitivity Analysis and Parametric Programming; Bounded Variable Problems; Transportation Problems; Assignment Problems; The Decomposition Principle for Linear Programs; Polynominal Time Algorithms for Linear Programming; Nonlinear Programming; Quadratic Programming; Methods of Nonlinear Programming; Duality in Nonlinear Programming.

MATH400	3C	**Project in Mathematics**
MATH401	3C	**Real Analysis II** Upper and lower Riemann integrals, Riemann integrability, properties of the Riemann integral, the fundamental theorem of integral calculus, improper integrals, sequences and series of functions, uniform convergence, the interchange of limiting processes, power series, Taylor's theorem, sets, functions and countability, metric spaces, continuity and convergence, completions, fixed point theorems and applications, compactness.
MATH402	3C	**Algebra and Number Theory** Elementary number theory, Diophantine equations Law of Quadratic Reciprocity, abstract algebraic concepts rings, fields, irreducible and unique factorisation. Polynomial rings, algebraic numbers and constructible numbers .
MATH403	3C	**Topology** the basic ideas of topology Metric spaces, convergence, completeness and the contraction mapping theorem; Metric topology, open and closed subsets; Topological spaces, subspaces, product spaces; Continuous mappings and homeomorphisms; Compact spaces; Connected spaces; Hausdorff spaces and normal spaces, Applications include the implicit function theorem and chaotic dynamical systems
MATH404	3C	**Applied Discrete Mathematics** Recursion and induction, generating functions and recurrences, combinatorics, asymptotics and analysis of algorithms. Topics covered in the second part of the unit include Eulerian and Hamiltonian graphs, the theory of trees (used in the study of data structures), planar graphs, the study of chromatic polynomials (important in Scheduling problems), maximal flows in networks, matching theory. Applications in computer Science and engineering

MATH405	3C	**Computational Mathematics and Approximation Theory** The existence and uniqueness of best approximations in normed linear spaces and inner product spaces; the Lesbesgue inequality; polynomial interpolation: the Lagrange formula, Newton's divided differences formula, the Vandermonde matrix; Bernstein polynomials and the theorem of Weierstrass; best Chebyshev polynomial approximation; best approximation in an inner-product space: a characterisation theorem; orthogonal polynomials; interpolating quadrature: Newton-Cotes and Gauss formulae; Fourier series and their convergence; splines: the truncated powers basis, the B-spline basis, the Schoenberg-Whitney theorem, local spline approximation operators.
MATH406	3C	**Complex Analysis** Basic theories and techniques from Complex Analysis, including methods of solving classical problems relevant to Applied Sciences. Complex Plane and Riemann Sphere; elementary complex functions; complex differentiation; Cauchy-Riemann equations; contour integral and Cauchy Theorem for analytic functions; Cauchy Integral Formula; harmonic functions; Taylor's Theorem; Laurent Series; isolated singularities and residues; conformal mappings; linear fractional transformation; Riemann surfaces of elementary functions, application to Laplace equations.
MATH407	3C	**Information and Coding Theory** Introduction to the ideas and applications of information theory, entropy. data compression, storage and transmission. Data loss. Theory of error-correcting code. theory of linear and cyclic codes used in modern digital communication systems such as compact disk players and digital television.
MATH408	3C	**Financial Mathematics** Mathematical theory of modern finance. Topics include: notion of arbitrage, pricing riskless securities, risky securities, utility theory, fundamental theorems of asset pricing, complete markets, introduction to options, binomial option pricing model, discrete random walks, Brownian motion, derivation of the Black-Scholes option pricing model, extensions and introduction to pricing exotic options, credit derivatives.

MATH409	3C	**Abstract Algebra** Binary operations: semigroup, monoid. Groups: subgroup, subgroup generated by a subset, abelian group, cyclic group, permutation group, finitely generated group, cosets and Lagrange's theorem, Fermat's theorem and Euler's theorem, group homomorphism, normal subgroup, factor group, isomorphism, automorphism, homomorphism theorem, conjugacy classes of an element, conjugacy class of a subgroup. Rings: endomorphism ring of an abelian group, integral domain, subring, ring homomorphism, ideal, factor ring, isomomorphism, homomorphism theorem, principal ideal, prime ideal, maximal ideal; Euclidean domain, unique factorization domain, characteristic of a ring, polynomial ring.
MATH410	3C	**Undergraduate topics in Mathematics**

Physics

Offered by the Department of Physics and Astronomy

PHYS201	3C	**Physics for the Earth and Environmental Sciences** Mechanical properties of matter, earth's gravity, fluid flow, heat and heat flow, thermal physics, electricity and magnetism, vibrations and waves, sound, radioactivity. Applications in the Earth and Environmental Sciences.
PHYS202	4C	**Mechanics and Thermal Physics** Mechanics: vectors analysis including dot and cross product, particle dynamics in two dimensions, equilibrium of rigid bodies, rotational motion of rigid bodies, angular momentum, central force motion, hydrostatics, fluid flow. Thermal Physics: temperature, heat, calorimetry, thermal expansion, conduction, radiation, ideal gases, thermodynamics.
PHYS203	4C	**Electromagnetism and Optics** Electricity and magnetism: Electric field and electric potential due to any charge distribution. Application of Gauss's law in line surfaces and volume charges; Magnetic forces: The Lorentz force. Integral forms of Ampere's and Biot-Savart's laws in different geometries; Electromagnetic induction: Faraday's law, Lenz's law, Inductance, application in electromagnetic devices; Electromagnetic waves: Production, radiation fields, Physical optics: Interference, diffraction and polarization.
PHYS301	3C	**Classical Mechanics** Solution of dynamical problems. Energy, momentum, angular momentum of a system of particles. Harmonic oscillator. Special relativity. Langrange's formulation of mechanics, Principle of least action, Euler-Langrange equations and applications.
PHYS302	3C	**Electromagnetism and Waves** Electromagnetism, including Maxwell's equations in integral form. DC and AC circuit theory. Wave theory and waves in physical media. Waves, driven vibrations and coupled oscillators.

PHYS303	3C	**Theoretical and Computational Physics** Concepts in the physics of fluids and fields: Mathematical preliminaries; Elements of fluid dynamics and classical theory of fields; computational modelling of fluids and fields.
PHYS304	3C	**Applied Physics: introduction** Elementary semiconductor physics, diode and transistor circuits and digital electronics. Concepts in radiation physics, including coherent light sources, gamma ray, x-rays and ultrasonic waves. Energy sources and storage, including nuclear and renewable energy sources.
PHY305	3C	**Modern Physics** Einstein's theory of special relativity. Quantization of radiation, matter waves, black body radiation, Planck's hypothesis, Photoelectric effect, Compton effect, Schrödinger's wave mechanics, Franck-Hertz experiment, electron diffraction, atomic emission spectra, early atomic models, Millikan oil drop experiment, Bragg scattering, e/m ratio for the electron.

PHYS306	3C	**Physics Laboratory Project (I)** The purposes of Intermediate Lab are to give students hands-on experience with some of the experimental basis of modern physics and, in the process, to deepen their understanding of the relations between experiment and theory, mostly in atomic and nuclear physics. Each term, students choose a number of different experiments from a list of a given total of available labs stations. Methodology focuses on the theory of measurement and experimental design. Error analysis and advanced data fitting technique are included.
PHYS307	3C	**Thermal and Statistical Physics** Foundations of thermodynamics and statistical mechanics; Macroscopic properties of matter, Classical thermodynamics, Statistical mechanics. Statistical mechanics of gases; Classical ideal gas, Quantum indistinguishability, Ideal Fermi gas, Ideal Bose gas/condensation, Statistical mechanics of solids; Einstein theory of specific heats, Debye theory of specific heats and Blackbody radiation, Non-equilibrium systems. Phase transitions.

PHYS309	3C	**Introductory Circuit Analysis** Circuit laws and nomenclature, resistive circuits with DC sources, natural and complete response of simple RLC circuits, steady-state sinusoidal analysis and power calculations.
PHYS310	3C	**Physics of Energy** Introductory course in environmental physics that emphasizes the physical principles behind the production, transport and conversion of energy. The laws of thermodynamics and classical mechanics are applied to natural ecosystems and energy resources such as fossil fuels, nuclear energy, hydropower, wind, solar power, etc. These resources are analyzed in terms of the societal and environmental impacts of the associated technologies
PHYS401	3C	**Solid state Physics** Bonding in solids; Bravais Lattices, unit cells, lattice directions, Miller indices; the reciprocal lattice, Brillouin zones; lattice vibrations, phonons, Einstein & Debye Models, lattice specific heat acoustic & optic modes; Bragg, Von Laue & X-ray diffraction; free electron Fermi gas, energy bands.
PHYS402	3C	**Nuclear Physics and Applications** General Properties of Nuclei; Nuclear Models; Decay of unstable nuclei; Nuclear reactions; radioisotopes, nucleosynthesis; Sub-nuclear particle physics; the quark model. Applications and hazards.
PHYS403	3C	**Physics Laboratory Project (II)** The module aims include giving students hands-on experience with some of the experimental basis of modern physics and, in the process, to deepen their understanding of the relations between experiment and theory. Students are assigned a given number of different experiments to work on.
PHYS404	3C	**Quantum Mechanics** Wave functions, Schrödinger's equation, observables & operators, hermiticity, commutation relations, uncertainty. Hydrogen & many-electron atoms, central field approximation, configurations. Perturbation theories

PHY406	3C	**Special Topics** The module involves studying interesting topics in advanced Physics. The topics of study are to be determined by both the instructor and students. Topics courses in physics are offered to extend knowledge beyond foundation courses and to introduce students to more advanced topics in physics and their applications to many different areas of science and technology.
PHY407	3C	**Electromagnetism** Electrostatics and electric potential, the electric dipole, surface charge and boundary problems, Poisson and Laplace equations, boundary value problems and method of images. Magnetostatics: currents and charge conservation, surface currents and boundary problems, magnetization, H, linear and nonlinear media, Maxwell's equations: the displacement current; electromagnetic radiation, energy in electromagnetic fields, plane waves in media and across boundaries.
PHYS408	3C	**Analytical Mechanics** The course introduces students to classical mechanics. Topics covered include: space and time, straight-line kinematics, motion in a plane, forces and equilibrium, experimental basis of Newton's laws, particle dynamics, universal gravitation, collisions and conservation laws, work and potential energy, vibrational motion, conservative forces, inertial forces and non-inertial frames, central force motions, rigid bodies and rotational dynamics.
PHYS409	3C	**Instrumentation and Signal Processing** Instrumentation electronics, including operational amplifiers, passive and active filters A/D and D/A converters. Elementary signal processing, measurement sensors and measurement techniques.
PHYS410	3C	**Physics project** This is a supervised course that will introduce students to writing proposals, data collection and analysis, report writing and presentation.

Statistics

Offered by the Department of Mathematics and Statistics

STAT201	3C	**Statistics for the Non-Mathematical Sciences** Basic statistical concepts, sampling, variance, distributions, correlation, regression, estimation, precision, hypothesis testing. Use of statistical packages to problem solve and provide applicable statistics.
STAT202	3C	**Basic Statistical Theory 1** Set theory, probability, distribution functions, moments, multinomial distributions.
STAT203	3C	**Basic Statistical Theory 2** Covariance, correlation. Order statistics, convergence, central limit theory, practical applications, modelling, and analysis.
STAT301	3C	**Probability** The axioms of probability. Random variables, probability density functions and distribution functions. Expectation and moment generating functions. Transformation of variables. Limit theorems
STAT302	3C	**Statistical Inference** Point and interval estimation. Properties of estimators. Principles of Bayesian estimation. Hypothesis testing.
STAT303	3C	**Applied Linear Regression** Regression analysis with focus on applications; model formulation, checking, selection; interpretation and presentation results; simple and multiple linear regression; logistic regression; ANOVA; hands-on data analysis with computer software
STAT304	3C	**Experimental Design** Single- and multifactor experiments; analysis of variance; multiple comparisons; contrasts; diagnostics, fixed, random, and mixed effects models; designs with blocking and/or nesting; two-level factorials and fractions thereof; use of statistical computing packages

STAT305	3C	**Statistical Methods and Computing** Methods of data description and analysis using SAS, R, Stata or SPSS: Descriptive statistics, graphical presentation, estimation, hypothesis testing, sample size, power; emphasis on learning statistical methods and concepts through hands-on experience with real data.
STAT306	3C	**Bayesian Statistics and Decision theory** Bayesian statistical analysis, with focus on applications; Bayesian and frequentist methods compared; subjective probability and utility, Risk, Bayesian model specification, choice of priors, computational methods; hands-on Bayesian data analysis using appropriate software; presentation and interpretation of analysis results.
STAT307	3C	**Introduction to Biostatistics** Statistical concepts and methods for the biological sciences: descriptive statistics, elementary, probability, sampling distributions, confidence intervals, parametric and non-parametric methods, one way ANOVA, correlation and regression, categorical data.
STAT308	3C	**Sample Surveys** Basic ideas of Sampling and Estimation, Sampling and Non-sampling errors; Probability sampling methods: simple random sampling, stratified sampling determination of sample size, estimating the population mean, population total and proportions; Confidence interval for the population mean total and proportion, Systematic and cluster, Ratio and, regression estimators.
STAT400	6C	**Project in Statistics**
STAT401	3C	**Statistical Consulting** Supervised data analysis experiences, including statistical packages, statistical graphics, writing statistical reports, and dealing with complex or messy data
STAT402	3C	**Research Data Management** Overview of problems encountered in gathering and processing data from statistical investigations; data management techniques; introduction to databases; exporting and importing data from one system to another.

STAT403	3C	**Undergraduate Topics in Statistics**
STAT411	3C	**Time Series Analysis** General concepts, Descriptive techniques for time series. Probability models for time series. Concepts of AR, ARMA, and ARIMA models, Estimation in the time domain. Principles of forecasting. topics in time series analysis
STAT412	3C	**Linear Models** Topics from linear algebra. The Gauss-Markov Theorem. The general linear model of full rank and less than full rank. Regression analysis. Analysis of variance and covariance.
STAT413	3C	**Introduction to Generalised Linear Models** Distributions related to the Normal distribution; Quadratic forms; Principles of statistical modelling; Exponential Family and Generalized Linear Models; Maximum likelihood estimation; Sampling distribution for score statistics; Sampling distribution for maximum likelihood estimators; Log-likelihood ratio statistic; Sampling distribution for the deviance; Hypothesis testing; Normal Linear Models; Binary Variables and Logistic Regression; Nominal and Ordinal Logistic Regression;
STAT414	3C	**Analysis of categorical data** Models for discrete data, distribution theory, maximum likelihood and weighted least squares estimation for categorical data, tests of fit, models selection, log-linear models, logistic regression. Application using statistical packages.
STAT415	3C	**Statistical Process Control** Basic statistical concepts ; Types of Control Chart ; Calculating Control Limits; Variables Control Charts ; Uses of Control Charts; Process Capability; Process Control v Process Capability; Capability Indices: Cp/Cpk/Pp/Ppk; Attribute Control Charts; Example of SPC software (Minitab); Process Capability and Six Sigma
STAT416	3C	**Multivariate Distributions** Multivariate descriptive statistics, multivariate normal distribution, Hotelling's T-squared, MANOVA, multivariate regression.

STAT417	3C	**Multivariate Data Analysis** Principal components, discrimination and classification, cluster analysis.
STAT421	3C	**Random Processes** Conditional expectations; Markov chains, including random walks and gambler's ruin; classification of states; stationary distributions; branching processes; Poisson processes; Brownian motion.
STAT422	3C	**Applied Probability** Markov chains with continuous state space, Martingales, random walks, Brownian motion and other continuous-time Markov chains, simulation methods.
STAT431	3C	**Computing in statistics** R database management, graphical techniques, importing graphics into word-processing documents (LATEX), creating reports in LATEX; SAS, simulation methods (Monte Carlos studies)
STAT432	3C	**Data Mining** Supervised and unsupervised learning, data preparation and missing values, classification and decision trees, Attribute selection, predictive accuracy of classifiers, discretization of continuous attributes, overfitting, classification rules
STAT441	3C	**Biostatistical Methods in Categorical Data** Introduction to methods for allied categorical data analysis; estimation of proportions, rates, and risks; measures of relative risk and odds ratios, stratified analysis, case control studies, logistic regression
STAT442	3C	**Environmental and Spatial Statistics** Methods for sampling environmental populations, sampling design, trend detection and estimation, geostatistics, kriging, variogram estimation, lattice data analysis, analysis of spatial point patterns.
STAT443	3C	**Introductory Longitudinal Data Analysis** Statistical models and estimation methods used to analyze correlated data (.g., same subject measured repeatedly); emphasis on use of statistical software.

TWAL

Offered by the Centre for Business Management Entrepreneurship and General Education

TWAL101	2C	**English Composition and Fundamentals** Principles of composition are emphasized. A focus on basic writing skills, grammar, the development of thesis statements, topic sentences, and essay organization is included. The development of ideas in written work is emphasized. Fundamentals of research techniques are presented. Extensive readings and writing practice are required.
TWAL102	2C	**Technical and Professional Communication** Training in a systematic method for producing effective technical communications, written reports, letters, and memos as well as oral presentations are emphasized.
TWAL201	2C	**Technical Report Writing and Research Methods** Research report writing in technical fields is emphasized. Students will learn to write using standard report formats, analyze, use supporting data, and present research results. Methods of gathering information for technical and scientific research will be presented using print-based, electronic, and interview data. Accepted forms of bibliographic documentation will be introduced.
TWAL202	2C	**Introduction to Entrepreneurship** Students are introduced to the essential components of a practical business plan and they are presented with the challenge of starting an entrepreneurial venture. Students will be able to recognize the characteristics and practices of successful entrepreneurs. They will evaluate entrepreneurial ideas based upon product, customer, and competitive criteria. Students will demonstrate business-planning skills for venture start-up, marketing, financing, management, and ethical decision-making.

Postgraduate Modules in Mathematics and Statistics

(a) Mathematics.

Module Code	Title	Credits
MATH600	MSc Dissertation Research in Mathematics	30
MATH601	Mathematical Problem Solving	3
MATH610	Topics in Pure Mathematics	3
MATH611	Axiomatic Set Theory	3
MATH612	Advanced Mathematical Analysis	3
MATH613	Functional Analysis	3
MATH614	Advanced Algebra	3
MATH615	Measure Theory	3
MATH616	Advanced Topology	3
MATH617	Methods of Complex Analysis	3
MATH618	Dynamical Systems	3
MATH620	Topics in Applied Mathematics	3
MATH621	Differential Equations	3
MATH622	Numerical Linear Algebra	3
MATH623	Mathematical Modelling	3
MATH624	Biomathematics	3
MATH625	Financial Mathematics	3
MATH626	Epidemiology	3
MATH627	Game Theory	3
MATH628	Numerical Analysis	3
MATH629	Dynamical Systems	3
MATH630	SEED	-
MATH700	MSc Thesis Research in Mathematics	
MATH800	PhD Research in Mathematics	

(b) Statistics.

Module Code	Module Title	Credits
STAT600	MSc Dissertation Research in Statistics	30
STAT601	Advanced Probability	3
STAT602	Statistical Inference	3
STAT603	Advanced Stochastic Processes	3
STAT611	Multivariate Statistical Analysis	3
STAT612	Time Series	3
STAT613	Generalised Linear Models	3
STAT614	Bayesian Inference	3
STAT615	Categorical Data Analysis	3
STAT616	Sampling Techniques	3
STAT617	Experimental Design	3
STAT621	Bio-Statistical Methods	3
STAT622	Design and Analysis of Clinical Trials	3
STAT623	Statistical Methods in Epidemiology	3
STAT624	Longitudinal Data Analysis	3
STAT625	Survival Analysis	3
STAT631	Reliability	3
STAT632	Industrial Statistics	3
STAT633	Queuing Theory	3
STAT641	Computer Intensive Methods	3
STAT650	Topics in Statistics	3
STAT700	MSc Thesis Research in Statistics	
STAT800	PhD Thesis Research in Statistics	

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