NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

Yearbook

2018/19

FACULTY OF APPLIED SCIENCES

Dean
Dr D. J. Hlatywayo, PhD (Uppsala), BSc (Zambia), Dip (PRET), Cert. in Applied Meteorology

Senior Assistant Registrar
Mr W. D. Magagula, MSc in Disaster Management (UFS), Advanced Diploma Advanced Diploma in Disaster Management (UFS), Diploma in Development & Disaster Management (NUST), BSc in Education - Administration/Policy Making (UZ), Secondary School Teachers Certificate (GTC)

Administrative Assistant
Ms A. Daniel, MBA (NUST), Diploma (ICSA), Cert in Administration (Pitman), Postgrad Dip in Management (NUST)

Technicians
Tarusenga M, HND IT (HEXCO)

Moyo D, MSc. Computer Science (NUST), BSc (Hons) Computer Science (MSC)

FACULTY REGULATIONS FOR UNDERGRADUATE DEGREE PROGRAMMES

1.0 PREAMBLE

1.1 These regulations should be read in conjunction with the General Academic Regulations for Undergraduate Degrees hereinafter referred to as the General Regulations.

1.2 These regulations are in respect of programmes for the degrees offered in the Faculty of Applied Science listed in Section 4.2 below.

2.0 BACHELOR OF SCIENCE HONOURS DEGREE

The appropriate degree shall be awarded to a student who has successfully completed an approved Programme in accordance with these regulations.

3.0 DEFINITION OF TERMS

3.1 **Semester**

A semester shall normally comprise 15 weeks, 12 weeks of which shall be assigned to teaching, 1 week to revision and 2 weeks to examinations.

3.2 **Module**

A module is defined in the General Regulations as a separately examinable portion of a programme. In these Regulations the word 'module' without an adjective, shall refer to a portion consisting of four hours of formal instruction a week for a semester. Not more than three, but normally at least two, of those hours shall be lectures. This definition is extended by the introduction of the terms module, supporting module, co-requisite module, double module, half module, pre-requisite module and industrial training module. The Departmental Board responsible for a subject may designate, in the Special Regulations for that subject, certain modules as core modules and other modules as supporting modules. Core modules are modules which are considered to be essential for qualification in a particular subject while supporting modules are modules which are considered to give the student all the relevant interdisciplinary knowledge for studying the core modules.

3.2.1 A double module may consist of either eight hours of formal instruction a week for a semester or of four hours of formal instruction a week for the two consecutive semesters of an Academic Year. In the former case not more than six, and normally, at least four of those hours shall be lectures, while in the latter case, not more than three and, normally, at least two of those hours shall be lectures.

3.2.2 A half module shall consist of two hours of formal instruction a week for a semester.

3.2.3 A project module is a module in which a student is required to carry out, under the direction and supervision of a member of the academic staff, private studies or investigations related to a particular topic within a subject. In the Special Regulations for the subject of which it forms a portion, each project module shall be assigned a weighting based on the amount of time it occupies compared with a module. Weighting shall be in multiples of half modules.

3.2.4 An industrial training module is a module in which a student is required to work for a specified institution for a period of not less than four months and not more than ten months in one Academic Year. The student shall work under the direction and supervision of a member of the academic staff and delegated members of the specified institution for that period.

3.2.5 A pre-requisite module for a particular module is one that the relevant Departmental Board requires a student to pass prior to the start of the Academic Year in which he/she intends to study the particular module. A co-requisite module, for a particular module, is one which the relevant Departmental Board requires a student to take at the same time as, or at an earlier time than that module. Passing a co-requisite module cannot be made a condition for passing a module.

3.2.6 A practical module is a module in which a student is required to carry out, under the supervision of members of the academic staff, a set number of prescribed laboratory experiments.

(Through these regulations two half modules are equivalent to a module and a double module is equivalent to two modules).

3.3. **Part**

A Part is essentially a year of study. In the Special Regulations for each subject, each module shall be designated as a Part I, II, III or IV module, with the Part corresponding approximately to the level of maturity required for study of the module.

3.4 **Full time study**

In each year, other than the Industrial Attachment period, in order to be regarded as a full-time student, a student shall register for and attend a minimum of 12 modules.

In those years a full time student shall receive between 24 and 30 hours of formal instruction a week. During industrial attachment a student may register for failed modules which he/she is eligible to resist.

4.0 ENTRY REGULATIONS

4.1 In order to qualify for normal entry to a Bachelor of Science Honours Degree Programme in the Faculty of Applied Science, a prospective student must satisfy the Entry Regulations specified in the General Regulations and in so doing, must also meet the following Faculty Requirements:-

4.1.1 Have obtained a Pass at ‘A’ level in at least two of the following subjects or their recognized equivalents:-

Biology, Chemistry, Mathematics, Physics, Computer Science, Physical Science and:-

4.1.2 Have obtained a Pass at ‘O’ level or ‘A’ level in a third subject chosen from those listed in Section 3.1.1. and

4.1.3 Have obtained a Pass in at least five ‘O’ level subjects including Mathematics and English

NOTE: There are restrictions on the combinations of certain subjects. See 3.1.4 of the General Academic Regulations.

4.2 While the above requirements apply to entry to the Faculty as a whole, the following specific qualifications, or their recognized equivalents, are NORMALLY required by the indicated subjects for entry to first year studies in that subject:-

BSc Degree in Applied Biology & Biochemistry	-'A' level Biology and Chemistry plus any other science subject at "A" Level;
BSc Degree in Biotechnology	- at least two science subject passes at 'A' Level in Biology and Chemistry.
BSc Degree in Applied Chemistry	- 'A' Level Chemistry and either 'A' level Mathematics or 'A' level Physics
BSc Degree in Computer Science	- 'A' level Mathematics and Physics or 'A' level Mathematics and Computer Studies & any Science subject
BSc Degree in Informatics	- 'A' level Mathematics and any other Science or Commercial subject
BSc Degree in Applied Mathematics	- 'A' level Mathematics and any other 'A' level Science subject or Geography
BSc Degree in Applied Physics	- 'A' level Physics and 'A' level Mathematics
BSc Degree in Radiography	- 'A' level Physics and either 'A' level Biology or 'A' level Chemistry or Mathematics
BSc Degree in Earth Sciences	- 'A' level Physics and 'A' level Mathematics
BSc Degree in Sports Science and Coaching	- 'A' level Biology and either 'A' level Chemistry, Geography, Computer Science, Physics, or Mathematics;
BSc Degree in Environmental Science and Health	- 'A' level Biology and any other Science subject;
BSc Degree in Forest Resources Wildlife Management	- 'A' level Biology and either 'A' level Chemistry, and Mathematics, Physics, Agriculture or Geography
BSc Degree in Statistics and Operations	- 'A' level Pure Mathematics/ Statistics/ Mechanics and a pass in any other science or commercial subject.
BCs Degree in Business Analytics	- 'A' level Pure Mathematics/ Statistics/ Mechanics and a pass in any other science or

commercial subject.

4.3 Entry to all programmes in the Applied Sciences Faculty is competitive and in many cases the holding of the minimum requirements shall not ensure admission.
All applicants satisfying departmental requirements shall not ensure admission. All applicants satisfying departmental requirements compete on the basis of the overall points obtained from the 'A' level grades or points in the subjects listed.

4.4 In case of equal overall points preference shall be given to higher points in the core subjects.

4.5 **Special Entry**
In addition to the Special Entry requirements as provided in the general regulations, the following are the Faculty requirements:

4.5.1 **Special Entry Requirements into Part I**
Higher National Diploma (HND) holders in a subject related to the intended subject of study at NUST and with a minimum of Grade C at 'A' level or an equivalent qualification in the subject of intended study may be admitted into Part I of that intended subject.

This shall include diplomas from;

a) Teachers colleges;
b) Polytechnic colleges**;**
c) Technical colleges;
d) Any other equivalent institution.

4.5.2 Applicants who have obtained a first degree at NUST or any other recognised institutions in an appropriate science subject.

4.5.3 **Special Entry Requirements into Part II**

4.5.4 Holders of HND or equivalent in the subject of intended study, e.g. Computer Science, with at least 2 years work experience.

4.5.5 Holders of degrees with enough subject content to fulfil first year requirements of the subject of intended study from a registered institution (transcripts must be provided for the determination of content studied).
Examples are those who studied one of the following subject combinations and wish to do one of the other subjects in the combination;
Mathematics/Physics/Computer Science, Biology/Chemistry/Environmental Science

5.0 SPONSORED CANDIDATES

Applicants with HND diplomas related to their subject of intended study with teaching and/or technical experience at tertiary institutions who are sponsored (or Sponsorship supported or sourced) by their institutions may be admitted into Part I or Part II provided they meet the requirements as outlined in sections 1 and 2 above. Subject to interviews, their experience may also determine their admission into the appropriate part (Part I or Part II) of the intended subject of study.
Candidates applying for entry into Part I and Part II under sections 1, 2 and 3 may be subjected to an interview/test.

6.0 STRUCTURE OF DEGREE PROGRAMMES AND SELECTION OF MODULES

6.1 Except in the case of special entry when a lesser period may be allowed, the Bachelor of Science Honours Degree Programme requires full time study over a period of four years. Normally a student shall be required to complete the programme in not more than five years from the date of the first registration for the programme.

6.2 Bachelor of Science Honours Programmes in the Faculty of Applied Sciences are offered in the following subjects areas:-

Applied Biology and Biochemistry
Biotechnology
Applied Chemistry
Applied Mathematics
Applied Physics
Radiography
Earth Sciences
Operations Research and Statistics
Business Analytics
Computer Science Radiography
Informatics
Sports Science and Coaching
Environmental Science and Health
Public Health
Forest Resources and Wildlife Management

In Special Regulations for each of these Departments there shall be a list of modules available for a programme in that subject. This list shall include all supporting modules for the Programme, including those taught by other Departments. The list shall contain at least 12 Part I modules; at least 12 Part II modules; a Part III industrial training module lasting two semesters, or a Part III industrial training module lasting one semester and at least 6 Part III modules taught during the first semester; at least 12 Part IV modules.

At each of Parts I, II, III (if appropriate) and IV, at least 50% of those modules shall be core modules.

6.3 A Bachelor of Science Honours Programme in a particular subject shall consist of either an industrial training module of 2 Semesters and at least 36 other modules or an industrial training module of 1 semester duration and 42 other modules. The modules are to be chosen from those listed in the Special Regulations for that subject, including all core modules listed for that subject.

6.4 Normally, in any year of the Programme, a student shall study 12 modules at least 4 of which are core modules in his or her chosen subject.

6.5 In the second and subsequent years a student may study modules whose pre-requisites he/she has satisfied, subject to the conditions in Section 4.2.

6.6 A student shall study an industrial training module.

6.7 In Part IV of a Bachelor of Science Honours Degree Programme a student must take at least one project module examined by a dissertation, the weighting of that module being that of 2 modules but not more than 6 modules.

6.8 When a student needs no more than 6 modules to complete the Degree Programme and he/she has already completed four years of full time study he/she may study the remaining module in a further part-time year.

6.9 **Selection of Modules**

6.9.1 For each Part II or higher level module all pre-requisites and co-requisites that apply to that module shall be listed in the Special Regulations for the relevant subject. A student shall not be admitted to a module unless he/she has passed all pre-requisites for that module prior to the start of the Academic Year in which he/she intends to study that module.

6.9.2 Subject to the restrictions imposed by 4.9.3 a student may, in the second and subsequent years, study module(s) whose pre-requisites he/she has satisfied, including approved modules offered by other departments. These modules from other departments may be additional modules or may replace up to a total, during the entire programme, of at most six modules from the list of his/her chosen subject.

Note that it may be possible to allocate weightings different from one, half and two to a module from another Faculty. The weighting shall depend on the structure of the module, although normally a module shall only be approved if it is fully compatible with these regulations.

6.9.3 A student's selection of a module for a degree programme is subject to the approval of the Dean of Science and the Chairperson of all relevant departments and to the following conditions:-

6.9.3.1 The student must satisfy the entry requirements for the subjects from which other modules are taken.

6.9.3.2 The module combination is feasible in terms of the timetable.

6.9.3.3 The student must not be enrolled for more than eight modules at any time during a semester.

6.9.3.4 The chosen modules shall enable the student to complete the Programme in as close to the minimum period of four years as is possible.

6.9.3.5 Each module is taken in the year corresponding to the Part to which it is assigned or in a later year.

6.9.3.6 The total weighting of project modules in the Programme does not exceed six modules.

7.0 ASSESSMENT OF CANDIDATES

7.1 For modules other than Industrial Training Modules, Practical Modules and Project Modules:-

7.1.1. Each module shall be assessed by module-work assessment and a formal examination.

7.1.2 Each formal examination shall be held during an examination period at the end of a semester, normally that of the semester in which the module is completed.

7.1.3 The formal examination for a module shall have a duration of three hours while that for a half-module shall have a duration of two hours. A double module shall have a four hour formal examination.

7.1.4 Modules may contain a practical component. Where there is a practical component, that component shall be assessed by module-work assessment only and the practical assessment mark shall constitute between 15 and 25 per cent of the overall assessment for that module. The weighting of theory module-work assessment mark to formal examination mark shall conform to the bounds laid down in the General Regulations. However the total contribution from the practical assessment mark and the theory module work mark shall not exceed 40 per cent of the overall mark for that module.

7.2 **Project Modules**

The assessment of project modules shall be based on dissertation and oral presentation by the student. Normally a dissertation shall be submitted at the end of the revision period of the semester in which the module is completed.

7.3 **Industrial Training Modules**

Each Industrial Attachment Module shall be assessed by continuous assessment and by the assessment of a final report, written by the student. The continuous assessment mark shall constitute 50% and the final report mark shall constitute 50% of the overall assessment.

The module-work assessment shall be based on an assessment of the student's professional performance by his supervisors and on reports written by the student at the end of each phase of the Industrial Attachment Module.

The final report shall normally be submitted not later than the end of the month following completion of the industrial training module.

7.4 **Practical Modules**

The assessment of practical modules shall be based on the submission of laboratory reports. Students must write the reports in a prescribed manner on each laboratory experiment performed during the semester in which the module is being offered and present the reports to the academic supervisor for grading. Marks obtained from all the laboratory reports shall be used for compiling the final overall mark for the practical module.

8.0 DETERMINATION OF RESULTS OF MODULES

The weighting of modules shall be based on the notional study hours (NSH) credit system in which all learning activities of a student of average ability, taking place in and outside scheduled contact sessions, are taken into consideration (1 credit = 10 notional hours). A student must attain a prescribed minimum number of credits to qualify for the award of a degree.

8.1 For modules other than Industrial Training Modules, Practical Modules and Project Modules:

8.1.1 The appropriate Departmental Panel of Examiners shall determine for each module work and each student a theory assessment mark, a practical assessment mark (where appropriate), a formal examination mark, an overall theory mark and an overall mark for the module and shall determine whether the student has passed or failed the module. The Departmental Panel shall submit the overall theory mark, the practical assessment mark, the overall mark and the results to the Faculty Board of Examiners.

8.1.2 To pass a module that has both theory and a practical component a student must obtain an overall mark of at least 50%, and a practical assessment mark of at least 40%.

8.1.3 To pass a module a student must obtain at least 35% in the Final Examination and achieve an aggregate of at least 50%.

8.2 **Project Modules**

For each project module the appropriate Departmental Panel of Examiners shall determine, for each student, an overall mark and whether the student has passed or failed the module. The Departmental Panel shall submit the mark and the results to the Faculty Board of Examiners.

8.3 **Industrial Training Modules**

8.3.1 For each Industrial Attachment Module the appropriate Departmental Panel of Examiners shall determine, for each student, a module work assessment mark, a final report mark, an overall mark and whether the student has passed or failed the module. The Departmental Panel shall submit these marks and the result to the Faculty Board of Examiners.

8.3.2 To pass an Industrial Attachment Module a student must obtain an overall Mark of at least 50%, a continuous assessment mark of at least 50%, a mark of at least 50% in the assessment of the final report and oral assessment.

8.4 **Practical Modules**

To pass a practical module a student must obtain a final overall mark of at least 50%. The overall mark for the module shall be determined solely from the marks obtained for the written laboratory reports submitted during the period of the module.

9.0 REPEATING OF MODULES

9.1 A student may repeat only a module that he/she fails except that if a student is allowed to repeat Part I and is unable to register for sufficient modules to be regarded as a full-time student, he/she may repeat one or more of the Part I modules previously passed, provided that he/she is registered for all Part I modules that he/she failed. Normally a student shall only be allowed to repeat a module once.

9.2. If a student fails a module but passes the practical assessment for that module, he/she may, when repeating that module, be exempted by the relevant Departmental Board from attending the practical component of the module and allowed to rewrite the formal examinations at an appropriate time.

Where a student is so exempted, the practical assessment mark for the Module shall be carried forward to the assessment of the repeated module.

9.3 If a student fails a practical module of the Part, he/she shall be required to repeat the module at an appropriate time as recommended by the Departmental Board.

9.4 A student may be allowed to repeat the industrial training module if he/she has failed the module but has obtained at least 40% in the overall mark for that module. If he/she has passed the continuous assessment, then in repeating the module he/she shall only be required to submit a new version of his/her final report. In that case the module work assessment mark shall the assessment of the repeated module.

10.0 PROCEEDING AND DISCONTINUING

10.1 Each Degree Programme is divided into parts which are, essentially, years of study. In each Part, a student shall normally study at least 12 modules, at least 6 in each semester.

10.2 In order to proceed from Part I to Part II a student must have:

10.2.1 Passed all Part I registered modules and all practical modules as appropriate, and pass on aggregate, or

10.2.2 Passed at least all Part 1 modules including at least 4 Part II core Modules and all practical modules as appropriate, in his/her chosen subject and satisfied the pre-requisites for at least 6 Part II core modules.

10.3 A student who, in the first year, passes at least 50 % of the modules but is not permitted to proceed to Part II may be permitted to repeat Part I. In repeating Part I a student may, for each module that he/she failed, either repeat that module or an alternative Part I module and may study any Part II module whose pre-requisites he/she has satisfied.

10.4 A student who fails a practical module in his/her chosen subject (if appropriate) shall not be permitted to proceed to Part II. He/she shall be required to repeat any failed practical module during the long vacation.

10.4.1 A student who obtains less than 50% in the overall mark for the repeated practical module shall be required to discontinue.

10.5 In order to proceed from Part II to Part III a student must have:

10.5.1 Passed all Part II registered modules and all full practical modules in his/her chosen subject if appropriate, and pass on aggregate or;

10.5.2 Passed at least 17 modules including each Part I core module and at least 4 Part II core modules and full practical modules if appropriate, in his/her chosen subject.

10.5.3 Satisfied the pre-requisites for at least 4 Part III modules if appropriate, or at least 6 Part IV modules, in his/her chosen subject.

10.6 A student who, having been permitted to proceed to Part II, but not permitted to Industrial Attachment (Part III) module at the end of the following year may be permitted to repeat Part II.

10.7 A student who fails any practical module in his/her chosen subject if appropriate, in Part II shall not be permitted to proceed to Part III. He/she may be allowed to repeat the failed practical module during the long vacation.

10.7.1 A student who obtains less than 50% in the overall mark for the repeated practical module shall be required to discontinue.

10.8 In order to proceed from Part III to Part IV a student must have passed her continuous assessment component of his/her Industrial Attachment module and obtained an overall mark of at least 50% in the Industrial Attachment Module.

10.9 A student who obtains less than 40% in the overall mark for an Industrial Attachment Module shall be required to discontinue.

10.10 The required period for the completion of a programme should be 8 years.

10.11 A student whose progress is delayed by failure in pre-requisite modules may be permitted to repeat the pre-requisite modules as a part-time student. If the modules are passed at the next sitting the student shall be allowed to resume his/her full-time studies and the repeat year shall not count towards the five years. Otherwise he/she shall be required to discontinue.

11.0 AWARDING OF A DEGREE AND CLASSIFICATION OF THAT DEGREE

11.1 To be eligible for the award of a Bachelor of Science Honours Degree a student must:

11.1.1 Pass each module listed for his/her chosen subject.

11.1.2 Pass all Part I modules, all Part II modules, all practical modules if appropriate, the Part III Industrial Training Module and all Part IV modules, including a project module.

11.1.3 Pass the modules constituting his/her programme on aggregate. The modules constituting his/her programme shall be the core modules and such other modules which combine with them to make a total of 30 modules and a 1-year Industrial Training Module.

11.1.5 Each Departmental Board shall, having recommended that a student has passed his/her programme, recommend the division in which he/she has passed that Programme. In classifying the pass the Board shall consider the weighted aggregate mark for all Part II modules, the industrial attachment module and all Part III modules if appropriate, and all Part IV Modules.

11.2 Modules shall be weighted as follows :-

Part II - 30% of the weighted aggregate mark.

Part III - 20% of the weighted aggregate mark of the Industrial attachment module,

IV - 50% of the weighted aggregate mark.

11.3 The Bachelor of Science Honours Degree Certificate and the student's transcript shall record that the student has been awarded the Bachelor of Science Honours Degree, with the subject of specialization enclosed in parentheses, and the classification accorded to the Degree.

12.0 NOTIFICATION OF RESULTS

A list of results shall be published in accordance with Section 16 of the General Regulations.

13.0 SPECIAL REGULATIONS FOR EACH DEPARTMENT

(see Special Regulations)

MASTER OF SCIENCE DEGREES

Refer to the General Regulations of NUST

MASTER OF PHYLOSOPHY AND DOCTOR OF PHILOSOPHY DEGREE REGULATIONS

Refer to the General Regulations of NUST

GUIDELINES TO MASTER OF PHYLOSOPHY AND DOCTOR OF PHILOSOPHY DEGREE PROGRAMMES (HIGHER DEGREES BY RESEARCH)

Preamble

The following guidelines refer specifically to Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) degrees done through research that lead to a thesis supervised by one or more experienced academic(s). They set the procedure which a candidate who wishes to register for a higher degree (MPhil or PhD) in the Faculty of Applied Science is expected to follow. These guidelines should be read in conjunction with the regulations for higher degrees.

Research Project Proposal Guidelines

1.0 QUALIFICATIONS

A prospective candidate for an MPhil degree should be normally a holder of a B.Sc. (Hons) degree in the First or Upper Second Division whilst a prospective candidate for a PhD should be a holder of an MSc degree (Distinction or Merit) / MPhil in the broad field they are seeking admission into.

2.0 RESEARCH TOPIC IDENTIFICATION

2.1 The candidate should have an idea or a research topic and must identify a Department that is relevant to the subject matter.

2.2 The candidate must discuss the idea with the Department's Chairperson and Professor in the first instance. The candidate must then read widely in the area around the topic.

2.3 **Project Supervision**

2.3.1 The candidate's discussion with the Chairperson will lead to the development of the idea into a research proposal that has a title and (where possible) hypotheses.

2.3.2 The candidate may identify possible supervisors.

2.3.3 The Department will recommend a supervisor

2.3.4 Normally, there shall be two supervisors to each project, a main supervisor plus a co-supervisor. At least one of them must be on the academic staff list at NUST.

2.3.5 The candidate may elect to have one or two associate supervisors chosen by virtue of their expertise in specific areas that the candidate wishes to investigate.

3.0 THE RESEARCH PROPOSAL CONCEPT NOTE

3.1 Formulation of a Concept Note

3.1.1 A candidate is expected to produce a concept note of the proposal, which should be circulated to the Department through the Chairperson.

3.1.2 The Chairperson shall arrange for a seminar at which the candidate will explain to the Department the research proposal.

3.1.3 The Department will decide on the relevance of the topic and its acceptability to the Department and then advise on the prospective supervisors.

3.2 Contents of the Research Proposal Concept Note

3.2.1 The Research Proposal Concept Note should not be more than five pages long and comprise the following sections:

(i) Introduction to the topic and why it needs research,
(ii) Problem statement,
(iii) Objectives,
(iv) Hypotheses (where possible),
(v) Methods to be used in the data collection.
(vi) Likely scientific tests to be used in the analysis and
(vii) a list of the cited literature (Harvard referencing).

3.2.2 The brevity of this first proposal, is to enable members of the FHDC and the Academic Board (AB) to get the best chance to read it.

3.2.3 Sections (i) and (v) are expected to be the longest, and jargon should be kept to a minimum in an effort to broaden comprehension of the proposal.

4.0 REQUIREMENTS BY THE HIGHER DEGREES COMMITTEE

4.1 Assuming the Department accepts the candidate's research proposal, and that the candidate has presented a seminar, the following papers shall be forwarded to the Faculty Higher Degrees Committee through the FHDC Secretary:

(i) Completed Application Forms by the candidate:

a) Application for Admission to Full-Time/Part-Time MPhil/PhD Studies
b) Postgraduate Admission Application
c) Minutes from the Department relating to the application
d) Research Proposal Concept Note by the candidate
e) Names of supervisors and their curriculum vitae

5.0 FACULTY HIGHER DEGREES COMMITTEE EXPECTATIONS

5.1 In its deliberations the FHDC may return the proposal to the candidate, through the Department, for whatever amendments that may be necessary. Here the

Committee is especially concerned with the clarity of exposition of the topic, the precision of the proposed title, appropriateness of the data collection methods and the statistics to be used as well as the correctness of the referencing system.

5.2 The Committee shall also pay attention to the language, namely, spelling, grammar and punctuation. Candidates should use UK English spelling in their work.

6.0 THE ROLE OF THE ACADEMIC BOARD

6.1 When the FHDC is satisfied with the Research Proposal Concept Note and the proposed supervisors, it will recommend for provisional registration of the candidate to the Academic Board - a Committee of Senate.

6.2 The Academic Board will determine the suitability of the research topic in the proposal and decide on whether the applicant should be admitted as a student or not.

7.0 REGISTRATION: Provisional and Full Registration

7.1 The candidate shall be advised of the need to register as a student through an offer letter from the Senior Assistant Registrar, Admissions and Student Records Section.

7.2 The candidate will only be regarded as a student after successfully completing the registration procedures.

7.3 Registration shall be normally back-dated to the date when the proposal was approved by the Faculty Higher Degrees Committee.

8.0 SUBMISSION OF FULL PROJECT PROPOSAL

8.1 The student shall submit a full project proposal to the FHDC within six months of his/her provisional registration. This should be about 10-15 pages long, occasionally more.

8.2 The same sections as listed in 3.2 will be used, with the addition of sections on Literature review, and Justification of the research. This long project proposal must be read and corrected by the main supervisor before forwarding it to the FHDC.

8.3 After acceptance by the FHDC, the proposal will be forwarded to the Academic Board for full registration, together with a summary of 4-5 pages.

9.0 UPGRADING FROM MPHIL TO PHD

9.1 A candidate with a Bachelor's (Honours) Degree must first register for an MPhil .

9.2 A candidate may seek permission from the Department to upgrade to a PhD .

9.3 A candidate may apply to upgrade the MPhil to a PhD provided she/he broadens the scope of the research to show greater depth of scholarship, and to turn it into an original and substantial contribution to the chosen field. This should be done in consultation with the main supervisor.

9.4 The candidate shall demonstrate the ability to carry out PhD research work by publishing at least one paper in peer reviewed or recognized Journal.

9.5 A seminar by the candidate shall be delivered to the Faculty at which the Faculty Higher Degrees Committee shall decide whether or not to accept the new proposal for upgrade and if so to recommend it to the Academic Board

9.6 An MPhil normally takes 18 to 36 months to complete by full time study and as such candidate will be allowed to convert/upgrade to PhD if their period of study still falls within the 18 to 36 months' time.

10.0 STRUCTURE OF THE MPHIL/PHD THESIS FOR SUBMISSION

This section must be read in conjunction with General Academic Regulations for Master of Philosophy and Doctor of Philosophy degrees.

10.1 There are two acceptable ways of structuring a thesis for submission. The traditional way is to prepare it as one integrated, whole document, with one Introduction, one Literature Review, one Study Area and Methods, etc. The current way is to prepare the thesis as a series of chapters each of which may be a stand-alone portion of the thesis. NUST accepts both forms of thesis writing.

10.2 The greater portion of the work submitted must have been done after the registration for the MPhil or PhD degree and consist of the candidate's own account of research.

10.3 The thesis shall be written in English (UK spelling).

10.4 Work already published, including that published in joint names, may be included in the appendix of the thesis provided the main author was the candidate himself/herself and this has been certified by his/her Supervisor. A series of publications alone shall not be acceptable as a thesis regardless of their number.

11.0 GENERAL STRUCTURE AND LAYOUT

The report shall contain the following:

11.1 The Preliminaries:

11.1.1 Title page

The inner Title page shall bear the University logo in colour (no more than 25% of the page), the name of the University (font size-12 bold), the name of the Faculty (font size -12 bold), the approved title of the thesis (font size 14 bold), the candidate's full name (font size - 14 bold), and an inscription " A thesis submitted in fulfilment for the degree of ….." (font size-12 bold) followed by Department of …….., (font size- 12 bold) and year (font size - 12 bold).
The outer Title page shall duplicate the inner Title page except that it shall not bear the University logo.

11.1.2 Abstract

This should be short and informative. It shall cover what was done, what the results were and the conclusions or inferences that was reached. It shall be on one page only and shall be single spaced. There shall be no paragraphing in the abstract.

11.1.3 Table of contents

The table of contents appears soon after the abstract, it shall index these preliminaries in lower case Roman numerals. It shall index, titles of divisions e.g. Introduction, Literature review etc. and subdivisions of the thesis in Arabic numerals. Each heading shall be single spaced and double spacing used to separate the headings from each other.

11.1.4 Lists of Tables, Figures, Appendices and Abbreviations

These shall appear on separate pages following the Table of Contents. Each Table or Figure heading should be single spaced with double space separating each Table or Figure heading from the other. No terminal punctuation is used.

11.1.5 Declaration

Each thesis shall have a declaration of where the work was done. If parts of the work was not done by the candidate, the reasons why it was not done by the candidate must be stated as well as where that part was done. The declaration page follows immediately after the abstract page followed by an Acknowledgement page.

The declaration may be of the form:-

I, …….., declare that the work described in this thesis was carried out in the Department of ……., NUST, from (date) – (date). This work represents my own work and has not been reproduced from someone's work. Where use has been made of the work of others, it has been duly acknowledged in the text.

Signed: …………………………. Date:…………………

Student No:……………………...

11.1.6 Acknowledgements

This section shall due credit to persons who would have made significant contributions to the research e.g. supervisors, technical staff, financers, etc. No religious statements should be made in this section. Double spacing should be used for typing this section and should not be longer than one page.

11.1.7 Dedication

This section may come before the Title page. This may contain religious statements.

12.0 THE TEXT

The text should be printed on International A4 size paper in Times New Roman, size 12 fonts, double spaced and right justified. There shall be a margin of 40 mm on the left hand side of the page to allow for binding and 10 mm on the right hand side of the page. There shall also be a 20 mm margin on the top and bottom of the page.

12.1 Introduction

An introduction should describe the background of the project i.e. historical and theoretical background, the scope of the project, the objectives of the project defining the current problem to be investigated and the hypothesis of the project (where applicable).

12.2. Literature review

The literature review presents the relevant theory and up-to-date knowledge available in the literature related to the problem. Appropriate sections and sub-sections dealing different aspects of the work may be required here.

12.3 Materials and Methods

The methods used shall describe in sufficient detail such that another worker of similar competency could repeat the work. (In the Sciences, experimental methods detailing the analytical methods and laboratory techniques should be detailed. Do not list apparatus used but mention them in the text. It is useful to identify equipment used down to the model.). Statistical methods used in the study shall also be included here.

12.4 The results should be a factual description of experimental data generated through observation and measurement by the candidate. The results should not be cluttered by an attempt to interpret or discuss them. Tables and Figures should have headings which fully describe their contents and should not duplicate each other. The headings of Tables should be written at the top whilst that of the Figures should be written at the bottom. There is no limitation on the size of the figures/graph and tables but these should not spill over to the next page.

In quantitative work, it is important to show the degree of uncertainty and the methods used to calculate these should be mentioned here. Appropriate units for all quantities should be included here.

The Scale Rule that permits flexibility and rational convenience in stating quantities should be followed. When a quantity is quoted to two or more significant figures, the choice of unit should preferably allow its numerical component to fall between 1 and 100, but when only one significant figure is available, it should normally lie between

1 and 10. For example, 32.8 mg rather than 0.0328 g or 3280 µg; and 10-20 plants m^{-2} rather than 100 000-200 000 plants ha^{-1} should be written. The student should familiarize himself/herself with multiples and submultiples for SI units i.e. hecto, kilo, mega etc. or nano, micro, milli etc. Words should be used for numbers up to ten and numerals for larger numbers (eg six metals were chosen and 12 fish sacrificed).

12.5 Discussion

This is the most important part of the thesis and should be treated as such. The results obtained in the study should be related to existing knowledge and interpretation and deductions drawn in a critical, objective and logical manner. Results should be compared with published or other available values for similar work citing the references.

12.6 Conclusion

Often times, the study may not have conclusions as unsolved aspects of the study emerge. It is therefore pertinent to include concluding remarks in the discussion and also recommendations for further study. However, conclusions and recommendations can be stand-alone sections.

13.0 THE REFERENCES

Candidates must adhere strictly to the following guidelines in listing their references. **(List in alphabetical order; no numbering required)** Use **either** full journal name **or** accepted abbreviation of the journal but be consistent and not use both. Each reference is single spaced but double spaces separate references. Punctuation should be consistent and should follow the system shown below.

13.1 Citing in Reference list

13.1.1 From a journal:

Chuma, C., Orimoogunje, O.O.I., Hlatywayo, D.J. and Akinyede J.O. 2013. Application of remote sensing and geographical information systems in determining the groundwater potential in the crystalline basement of Bulawayo metropolitan area, Zimbabwe. Advances in Remote Sensing, 2, 149-161.

13.1.2 From a Conference/Workshop Proceedings:

Siwela, A.H. and Caley, A.D. 1989. Aflatoxin contamination of stored groundnuts in Zimbabwe. In Aflatoxin contamination of groundnuts: Proceedings of the International Workshop, Hall, SD. (Ed.). ICRISAT Centre, India. Patacheru, A.P. 502 324, India pp 59-63.

13.1.3 **From a book or book chapter**:

Dhlamini, Z. 2009. Agricultural Biotechnology. In : Biosafety of Genetically modified Organuisms: Basic concepts, methods and issues. Chowdhurry MKA, Hoque MI and Sonnino A (Eds). FAO , Rome pp 1-50. .

13.1.4 **From a book of Abstracts**:

Ngwenya, N.R. 1994. Physico-chemical, nutritional and microbiological changes during Marula (Slerocanya birrea) fruit juice fermentation. East, Central and Southern Africa Food Science and Technology Conference. 20-22 September. Victoria Falls, Zimbabwe. pp 5.

13.1.5 **From a Thesis/Project**:

Chiyaka, C. 2007. Development and analysis of mathematical models of the immunoepidemiology of malaria. PhD. thesis, National University of Science and Technology, Zimbabwe. 272 pp.

13.1.6 **From the world wide web/Internet page:**

Mackenzie, K.S., Kubena, L.F., Denvir, A.J. ,Rogers, T.D. , Hitchens, G.D., Bailey, R.H., Harvey, R.B., Buckley, S.A. and Philips, T.D. 2003. Aflatoxicosis in turkey poults is prevented by treatment of naturally contaminated corn with ozone generated by electrolysis [on line]. Available from: http//www.ozoneapplications.com [Accessed 17 April 2003]
NB. It is important to indicate the date of access.

13.1.7 **E-journal article**

Sturve, J., Stephensen, E. and Forlin, L. 2005. Effect of redox cycling compounds on DT-diaphorase actitivty in liver of rainbow trout (Oncorhynchus mykiss). Comparative Hepatology, [on line] **4**: Accessed 15 January 2007. Insert page numbers as usual, if known.

13.1.8 **E-book**

Dronke P. 1968. Medevial Latin and the rise of European love-lyric.[On line]. Oxford, Oxford University Press. Available from: netlibrary http:/ wwwnetlibrary.com [Accessed 6 March 2008]. Insert page numbers as usual, if known.

13.1.9 **Internet Blog**

Rotheram, B. 2008 Straws in the wind. Sounds Good 11 June [Internet blog]. Available from : < http://web.mac..com/simonft/Sounds Goog/Blog/Blog.html> [Accessed 24 June 2008].

13.1.10 **Newspaper article**

Although it is generally discouraged to quote newspapers, often times the newspaper may be the only source of information. Sunday News (or author if any) 2004. Government re-introduces DDT use for mosquito control. Sunday News (issue number or page if any) 10 January.

13.1.11 **References in text**

References in the text are cited as Black and White (1990) or (Black and White, 1990). A series of references in the text should appear in chronological order, e.g., (White and Black 1989; Black and White 1990; Black 1991). References having three or more authors are cited Black et al., 1990. References to papers by the same authors in the same year are distinguished by letters a, b, c, etc. (e.g., 1988a, or 1990 a,b,c).). Author's initials should only

be used when two or more authors being cited have the same surname and have published in the same year, in which case they should be identified by initials in order to avoid confusion. Publications having no obvious authors are cited as (Anon, 1990) in the text and bibliography. At the end of the manuscript, references are listed alphabetically. **No numbering is required**. References with three or more authors should be placed in chronological order after taking account of the names of the first and second authors. The candidate must ensure that references cited in the text agree with those listed in the bibliography.

Secondary citing or referencing is discouraged but may be used to a limited extent. This is when an author cites a piece of work mentioned or quoted within another author's work but has not actually seen the original source themselves. In the text cite both the original source and the secondary source where you actually read about it, using the words 'quoted in' or 'cited in'.

14.0 APPENDICES

The appendices contain material that would clutter the text such as forms used to collect data, raw data such as absorbencies, calculations, derivations, notes, published papers submitted in support of thesis, extensive computer output or other similar material.

15.0 LENGTH OF THE THESIS

15.1.1 The length of the thesis shall be determined in consultation with the supervisor but the following shall generally apply:

15.1.2 An MPhil thesis shall normally be between 80 and 100 pages long including the reference list but excluding the appendices.

15.1.3 A PhD thesis shall normally be between 100 and 200 pages long including the reference list but excluding the appendices.

16.0 SUBMISSION OF THESIS

Three spiral bound copies of the thesis (for easy handling) shall be submitted for examination.

17.0 BINDING FINAL COPIES OF THE THESIS.

17.1 The final thesis shall be bound in **sky-blue** hard cover, lettered boldly in gold down the back or spine indicating the degree (starting 20 cm from the top edge) name (centre of spine) and year (ending 20 cm from the bottom edge). The **sky-**blue front cover shall bear the title of the thesis at the top, name of candidate in the centre and year at the bottom.

17.2 Four hard copies of the thesis and a soft copy shall be submitted to the Department for distribution to various sections. It is usually polite for the candidate to bind extra copies for supervisor(s) not forgetting himself/herself.

GENERAL ACADEMIC REGULATIONS FOR HIGHER DOCTORAL DEGREES

(*EFFECTIVE FROM 2018*)

1.0 APPLICATION OF THESE REGULATIONS

1.1 The Senate shall be the final authority for the interpretation of these regulations.

1.2 The Senate reserves the right to alter, amend, cancel, suspend or replace any of these regulations.

1.3 The Senate has the power to exempt any candidate from any of the regulations.

2.0 DEFINITION OF TERMS

In these regulations, the following terms shall be used as described:

This University:	means the National University of Science and Technology and its predecessors and shall include an associated or affiliated institution to this University.
Published:	means material printed in a referred periodical or journal, or as a pamphlet or as a book.
Graduate of this University:	means a person who has been awarded a Bachelors or Masters or Doctoral degree of the University.

3.0 DEGREES OFFERED BY THE UNIVERSITY

3.1 The National University of Science and Technology awards the following higher doctorate degree:

Doctor of Science (D Sc)

3.2 This degree is the highest academic award of the National University of Science and Technology and is only awarded to persons who have published work of an exceptionally high standard, which would earn them authoritative standing in the field of research that forms the basis of the application for consideration.

4.0 ELIGIBILITY OF APPLICANT

4.1 An applicant must have published work of an exceptionally high standard that would confer authoritative standing in the discipline in which the application is located and the particular field or fields of research on which the application is based.

4.2 An applicant must be a graduate of this University or another university in the tenth or a subsequent year after the date of the award of the applicant's first degree or its equivalent.

4.3 An applicant who is not a graduate of this University shall, in addition to being a graduate of another university, have been employed by this University for a period of not less than five years and have been engaged in research, relevant to the application, in association with this University.

4.4 For ligibility for this specific degree the following is intended as a general guide:

An applicant for the D Sc degree would normally have conducted and published in the Sciences. Without derogating from the generality of the term Sciences, the D Sc degree would normally be awarded to successful applicants from the disciplines in Science, Agricultural Science, Engineering, Health Sciences and Veterinary Science.

5.0 APPLICATION FOR CONSIDERATION

5.1 An eligible applicant may make an application at any time for the appropriate Degree. Such an applicant shall submit with the application the following:

5.1.1 A full curriculum vitae;

5.1.2 An academic justification of the basis of their application; and

5.1.3 The academic evidence substantiating their application for the appropriate degree. Such evidence shall consist of published works, containing original contributions to the advancement of knowledge in the appropriate field or discipline.

5.2 Where work is submitted that is not in the applicant's sole name, the applicant shall indicate the extent of his/her contribution in terms of initiation, direction and conduct of the work.

5.3 An applicant shall indicate what part, if any, of the work including joint work submitted in support of the application has been submitted for the Award of a Degree in this or another university by the applicant or by a co-author.

5.4 The application shall be submitted to the office of the Registrar.

6.0 PROCESSING OF THE APPLICATION

6.1 Upon submitting the application the applicant shall be registered as a candidate for the award of the designated degree and shall pay the prescribed application fee.

6.2 Upon receipt of an application for the award of the degree, the application including all the supporting evidence shall be submitted to the Higher Degrees Committee of the Faculty responsible for the discipline in which the application is based. Such Higher Degrees Committee shall, having made a preliminary consideration of the application, transmit it for consideration to an appropriate Department of the Faculty.

6.3 The Departmental Board of the Department charged by the Faculty Higher Degrees Committee to consider the application shall make recommendations as to the merits of the application to the Faculty Higher Degrees Committee. The Departmental Board concerned shall submit with its recommendations, a list of persons it recommends as external and internal assessors.

6.4 Upon receipt of the resolution of the Departmental Board the Faculty Higher Degrees Committee shall consider the application and recommendations of the Departmental Board and shall make recommendations on the merits of the application and on the list of persons recommended as assessors. The Higher Degrees Committee may, at its discretion, make further recommendations on the list of assessors.

6.5 The resolution of the Department, the Department's list of persons recommended as assessors, the recommendations of the Faculty Higher Degrees Committee on the application and that Committee's recommendations on the list of assessors shall be transmitted via the Registrar to the Senate.

6.6 The Senate shall determine whether the application merits submission to assessors.

6.7 Having determined that an application merits submission to assessors Senate shall appoint the assessors.

6.8 In the event that the Higher Degrees Committee of the Faculty or the Departmental Board to which the matter is assigned do not consider that the application has been made to the appropriate Faculty or Department, they shall transmit the application and the supporting evidence with their reasons for declining to consider the application to the Registrar for re-assignment to an appropriate Faculty and Department, provided that Senate may determine that the matter shall be considered by a particular Faculty and/or Department.

7.0 REGISTRATION

If the application is approved by Senate, the candidate shall be informed of the acceptance of the application for consideration for the appropriate degree and shall be registered upon payment of the prescribed registration fee as a candidate for the award of the appropriate degree.

8.0 ASSESSMENT OF A CANDIDATE

8.1 After registration, as prescribed in Section 6, as a candidate for the appropriate degree, the assessment of the evidence submitted by the candidate shall be made by three (3) assessors, appointed in accordance with Section 5 of these regulations, provided that at least two (2) of the assessors shall be external assessors and, normally, at least one (1) shall be an internal assessor.

8.2 The assessors shall each submit a formal written report on the application and its merits to the Registrar. Such report shall contain a recommendation as to whether or not the candidate should be awarded the appropriate degree.

9.0 DETERMINATION OF THE RESULT

9.1 The Senate shall appoint a Board of Examiners, or delegate the responsibility to the Academic Committee, to consider the application in conjunction with the assessors' reports.

9.2 The Board of Examiners shall report to the Academic Committee its recommendations together with all the relevant documents availed to it.

9.3 The Senate shall determine whether or not the candidate should be awarded a higher doctorate degree.

10.0 AWARD OF THE DEGREE

A higher doctorate degree of the National University of Science and Technology shall be awarded without classification.

11.0 PUBLICATION OF THE RESULT

The Registrar shall notify the candidate of the result of the application as decided by Senate.

12.0 APPEAL AGAINST PUBLISHED RESULT

The decision of the Senate shall be final and no appeal against the published result shall be considered.

13.0 AWARD OF A DEGREE CERTIFICATE OF THE NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

13.1 The award of a degree Certificate of the National University of Science and Technology shall be subject to approval by the University Council.

13.2 A successful applicant for such an award will be entitled to receive a formal certificate of the University, bearing the seal of the University and signed by the Vice-Chancellor and the Registrar, confirming the award.

13.3 If, subsequent to the award of a degree to a candidate, it is discovered that there were gross irregularities and impropriety involved in the award the University Council, on the recommendation of the Senate, reserves the right to withdraw the award and cancel the certificate.

13.4 Once a Degree Certificate has been issued as the original, no duplicate of the same certificate shall be provided. Instead, the student shall be issued with a letter, signed by the Registrar, confirming that the candidate was awarded the degree of the National University of Science and Technology and was issued with an original and authentic degree certificate. A prescribed fee shall be levied for this service.

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

Lecturer and Chairperson
J. Mbanga, BSc (Hons), MSc (UZ), PGDHE (NUST)

Secretary

Associate Professor
A.H. Siwela, AssocDipAppBiol, BAppSc (RMIT Aus); MPhil (UZ); PhD (NUST)

S. Dube, BSc, MSc Benin, (Nigeria); Grad CE (UZ)

Senior Lecturers
Hilda Nyati, BSc (Hons) (UZ); MSc (WAGENINGEN), PhD (RMIT Aus), PGDE ZOU, Q.A. (Part I & II) City & Guilds, UK, PGDHE (NUST)

Z. Dhlamini, BSc (Hons), MSc, (UZ)

Thembekile Ncube, BSc (Hons) (NUST), MSc (Fort Hare), SA, PhD Limpopo,SA, PGDHE (NUST)

Norah Basopo, BSc (UZ); GradDipToxicol, MAppSc (RMIT Aus), PhD NUST, PGDHE (NUST)

Lecturers
E. Zumbika, BSc (Hons) (NUST); MSc,PhD (Zhejiang), CHINA

T. Sibanda, BSc (Hons) (NUST); MSc Fort Hare, SA, PhD (UP)

Nancy Nleya BSc (Hons) (NUST), MSc, NUST, PGDHE (NUST)

K. Mushonga, BSc (Hons) (NUST), MSc, NUST, PGDHE (NUST)

N. Mangoma, BSc (Hons) (NUST), MSc, (NUST)

Research Fellows
Madeline Sibula, BSc (Hons) (NUST), MSc, (NUST)

Anita Dube, BSc (Hons) (NUST), MSc, (NUST)

Linly Banda, BSc (Hons) (NUST), MSc, (NUST)

Sanele Mnkandla, BSc (Hons) (KZN) SA, MSc, (UKZN), SA

Chief Technician
A. Maunganidze, DipAppBioTech, BSc (Hons) (NUST)

Senior Technicians
J.M. Zakeo, Part II City & Guilds UK, BTechEd (Hons) (NUST)

N. Dube, BSc (Hons) (NUST)

Makhosazana Nyathi, BSc, UZ, MSc, (NUST)

UNDERGRADUATE PROGRAMME REGULATIONS

BSC (HONS) DEGREE IN APPLIED BIOLOGY & BIOCHEMISTRY

1.0 Degree Profile: **BSc (Hons) Degree in Applied Biology & Biochemistry**

INSTITUTION:	National University of Science and Technology
TYPE OF DEGREE:	Honours
CREDIT LOAD:	506 Credits
LEVEL:	SADC-QF - Level 8
ACCREDITATION ORGANISATION(S):	Zimbabwe Council For Higher Education
PERIOD OF REFERENCE:	From 2018

PURPOSE OF THE PROGRAMME:

To produce high quality graduates who are able to use their knowledge and practical skills to provide solutions to real problems and to contribute towards industrial development in the field of Applied Biology and Biochemistry.

PROGRAMME CHARACTERISTICS

Areas of Study:	The programme comprises but is not limited to the following areas in terms of teaching and research; cell biology, plant and animal physiology, Biochemistry, Food technology, Quality assurance, Process engineering Molecular genetics, Biotechnology and Nutrition, Food security.
Specialist Focus:	The programme provides a sound academic and practical foundation for future- and self- employment in the various fields of Applied Biology and Biochemistry.
Orientation:	Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects.

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Production Managers, Quality controllers, Laboratory technicians in the food industry (brewing, baking, dairy etc), Pharmaceutical, Agricultural (seed production houses, feed manufacturers, egg and chicken industries), Medical (Laboratories at diagnostic and medical centres). Research scientists in research institutions, lecturers at Universities and polytechnics, biology educators in the education sector. Some can proceed and pursue higher degrees. Some can become consultants or become entrepreneurs in biology related businesses.
Further Studies:	PhD, MPhil in Biology, Biochemistry, Microbiology, Biotechnology, MSc in Applied Microbiology and Biotechnology,

TEACHING AND LEARNING

Teaching and Learning Methods:	Lectures, tutorials, laboratory classes, seminars, group work, industrial visits, industrial attachment, research project, individual independent study.
Assessment Methods:	Written and oral examinations, tests, laboratory reports, seminar presentations, industrial attachment report, final year research project report, continuous assessments.

2.0 REGULATIONS

The Regulations for the Bachelor of Science Honours degree, hereinafter referred to as the BSc (Hons) in Applied Biology and Biochemistry complement and are subordinate to University General Regulations for undergraduate degrees and Faculty of Applied Science regulations.

2.1 Expected Learning outcomes

On successful completion of this degree programme, the graduates shall be expected to:

2.1.1 Be participants of the global community who understand and can contribute to the debate, research and experimentation on contemporary issues in the area of Applied Biology and Biochemistry.

2.1.2 Be able to design, conduct, analyze, and communicate (in writing and orally) their academic research.

2.1.3 Recognize and be able to apply basic ethical principles to basic and applied biological and biochemical practice and shall understand the role of biological/biochemical science, scientists, and practitioners in society.

2.1.4 Display sufficient practical skills and knowledge in Biology and Biochemistry to be sought-after practitioners in industries (brewing, dairy, baking, pharmaceutical),research institutions, tertiary education, manufacturing industries and in the medical sector in Zimbabwe, the region and the world at large.

2.1.5 Demonstrate a decisive approach in the evaluation of scientific data and information, including the capacity to apply relevant statistical analysis and use of statistical software.

2.1.6 Apply relevant Applied Biology and Biochemistry techniques to solve real problems in industry.

2.1.7 Provide the students with the knowledge and skills to create employment in varied areas of Applied Biology and Biochemistry.

2.2 ENTRY REQUIREMENTS

2.2.1 Normal Entry

In order to qualify for normal entry candidates must satisfy the Entry Regulations specified in the General Academic Regulations and in so doing must also meet the following requirements:-

The candidate must have obtained passes in A' Level Biology and "A" Level Chemistry or their equivalents plus any other science subject.

2.2.2 Special entry

Candidates who have successfully completed a National Diploma in Biological Sciences and Biotechnology or its recognized equivalent may apply for entry into Year I. Candidates shall normally have 2 years' post qualification working experience and shall normally undergo interviews.

2.3 Duration of the Programme and Mode of Study

2.3.1 Full time Study

When offered on a conventional basis the BSc (Hons) in Applied Biology and Biochemistry degree shall follow the normal academic year as outlined in the General University Regulations and the duration of study shall normally be four years.

2.3.2 Structure of the programme

The programme shall consist of 36 taught modules, plus 28 weeks industrial attachment. Year III of the programme shall consist of Industrial Attachment which shall culminate in the submission of an Industrial Attachment report in line with the General Regulations. In their final year students are expected to complete and pass a research project. All modules and research project are compulsory and students shall be required to pass them.

2.4 Assessment of candidates

2.4.1 Candidates shall be assessed through continuous assessment, practical assessment and a final written examination for each taught module. A student registered for the BSc (Hons) in Applied Biology and Biochemistry shall be required to pass all the modules for which they have registered.

2.4.2 Continuous assessment shall constitute 20%, practical assessment 20% and examination 60%of the overall mark.

2.4.3 During industrial attachment a student may register for failed modules he/she is eligible to re-sit. The industrial attachment module shall be assessed by continuous assessment, an oral examination and by the assessment of a final report written by the student. The continuous assessment mark shall constitute 50%, attachment report 40% and oral examination 10% of the overall assessment.

2.4.4 On submission of a satisfactory research project the student shall be required to defend his/her work before a panel of Departmental Examiners. The project module shall be assessed by oral presentation which shall constitute 10% and a dissertation which shall constitute 90% of the overall assessment.

PROGRAMME SUMMARY

YEAR I

Module Code	**Module Description**	**Credits**
SBB 1101	Man And The Environment	10
SBB 1103	Cell Biology	10
SBB 1105	Plant Physiology	10
SCS 1100	Introduction To Computers	10
SCH 1116	Organic Chemistry	10
SMA 1112	Preparatory Mathematics	10
SBB 1204	Genetics	10
SBB 1206	Animal Physiology	10
SBB 1207	General Microbiology I	10
CTL 1101	Conflict Transformation And Leadership	10

YEAR II

SBB 2101	Biochemistry: Chemistry Of Biomolecules	12
SBB 2102	Biochemistry : Metabolic Processes I	12
SBB2104	Introduction To Enzymology And Immunology	10
SBB 2105	General Microbiology II	10
SBB 2107	Food Chemistry	12
SBB 2109	Principles Of Fermentation Technology	10
SBB 2203	Analytical Biochemistry	12
SBB 2206	Food Microbiology	12
SBB2211	Principles Of Quality Control	10
SBB 2214	Molecular Genetics And Biotechnology	12
SCH 2108	Principles Of Process Engineering	10
SORS 2210	Applied Statistics For Biological Sciences	10

YEAR III

Module Code	Module Description	Credits
SBB 3001	Industrial Attachment	120

YEAR IV

SBB 4103	Principles Of Nutrition	12
SBB 4109	Advanced Applied Microbiology	12
SBB 4101	Advanced Biochemistry And Molecular Physiology	12
SBB 4111	Biochemistry: Metabolic Processes II	12
SBB 4106	Food Technology I: Non Alcoholic Fermentations	12
SBB 4202	Enzyme Biotechnology	12
SBB 4204	Advanced Cell Biology	12
SBB4207	Food Technology II: Alcoholic Fermentations	12
SSB 4208	Biotechnology Of Pharmaceutical Product	12

MODULE SYNOPSES

YEAR I

SBB 1101 Man And The Environment **10 Credits**

The module looks at layers of the atmosphere, air pollution, photochemical smog, biomes, ecosystems and habitats, food chains and webs, resource depletion, recycling and renewable energy, agrochemicals, portable water, sewage systems and effluent, differentiation, environmental impact assessment, oil spills s well as environmental ethics.

SBB 1103 Cell Biology **10 Credits**

The module explores the cell concept, structure and function of cell organelles , cell junctions, cell matrix, cytoskeleton, cell membrane structure and function, electron and light microscopy, microtomy, somatic and gamete cell division, cell culture, cell differentiation and specialization and cells in Biotechnology.

SBB 1105 Plant Physiology **10 Credits**

The module examines the plant Cell Structure function and regeneration, plant water relations, mineral nutrition and ion transport, respiration, photosynthesis, physiological principles of plant's growth and development, stress physiology and some new direction of plant physiology.

SCS 1100 Introduction To Computers **10 Credits**

Offered by Department of Computer Science

SCH 1116 Organic Chemistry **10 Credits**

Offered by Department of Applied Chemistry

SMA 1112 Preparatory Mathematics **10 Credits**

Offered by Department of Applied Mathematics

SBB 1204 Genetics **10 Credits**

The module is about the pre-Mendelian theories of genetics DNA and its genetic role. Mendelian genetics; monohybrid and dihybrid inheritance, allelic interations; multiple allelism, codominance and incomplete dominance, lethal alleles, gene interactions; epistasis, modifiers, suppressors, complementary genes, penetrance and expressivity, extranuclear inheritance, statistics and genetics; use of probability theories in genetics, the chi-square test, pedigree analysis, Bayes theorem and genetic counselling. It also looks at linkage analysis, Cytogenetics; variations in chromosome structure and number as well as population genetics; genetic variation, the Hardy-Weinberg equilibrium and quantitative genetics.

SBB 1206 Animal Physiology **10 Credits**

The module looks at energy changes in living cells, Respiration and gaseous exchange, digestion and nutrition, endocrine control and hormone action, homeostasis: Nervous system, excretion, animal cell culture, cardiovascular systems, circulation, hemodynamics, growth and aging as well as locomotion.

SBB 1207 General Microbiology I **10 Credits**
This introductory module deals with the study of different prokaryotic organisms, their morphology anatomy classifications, ecology, metabolism and control along with a brief survey of human diseases caused by them. Lab work would emphasize their identification and growth methods.

CTL 1101 Conflict Transformation And Leadership **10 Credits**
The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

YEAR II

SBB 2101 Biochemistry: Chemistry Of Biomolecules **12 Credits**
The module introduces the student to Macromolecular chemistry. The chemistry of water, carbohydrates, amino acids, proteins and nucleic acids are studied in preparation for studying metabolic processes.

SBB 2102 Biochemistry : Metabolic Processes I **12 Credits**
The module acquaints students with the modern concepts in Bioenergetics (biological oxidation and oxidative phosphorylation); coupling of biological reactions, Role of ATP in thermodynamically unfavourable reactions, mechanisms of oxidative phosphorylation; pathways for ATP formation in substrate and respiratory chain, carbohydrate metabolism and its regulation (glycolysis, citric acid cycle, pentose phosphate pathway, gluconeogenesis, irreversible steps and their bypass, regulation of gluconeogenesis, Cori cycle, glycogen degradation and synthesis) as well as lipid metabolism and its regulation (degradation and synthesis of glycerol and fatty acids).

SBB2104 Introduction To Enzymology And Immunology **10 Credits**
This module aims at giving the student an overview of the major characteristics and properties of enzymes and the mechanism of enzyme reactions and regulation of enzyme activity. The module introduces student also to the general processes of immune response, structure of immunoglobulins, mechanism of action of B- and T- cells.

. **SBB 2105 General Microbiology II** **10 Credits**
This module deals with detailed treatment of microbial growth, kinetics and environmental factors affecting growth, regulation of metabolism, solute transport, interaction of mixed cultures, antibiotics, sterilization and disinfection and enumeration of bacteria.

SBB 2107 Food Chemistry **12 Credits**

Food Chemistry is a major aspect of Food Science and is the science that deals with the composition and properties of food and chemical changes it undergoes under different environmental conditions and processing. Hence some of the components that shall be looked at in this module are the lipids, proteins, carbohydrates food colour pigments and other additives.

SBB 2109 Principles Of Fermentation Technology **10 Credits**

The scientific, technological and economic principles involved in selection and application of microbes, substrates and equipment to industrial fermentations are studied in this module.

SBB 2203 Analytical Biochemistry **12 Credits**

The module introduces students to practical techniques used in biochemical research as well as terms that are the language of the practicing biochemist. Topics covered include measurement of pH, extraction of biomolecules and techniques used in elucidating their structures (e.g. Centrifugation, Chromatography, Electrophoresis, Spectrophotometry, radioisotope techniques).

SBB 2206 Food Microbiology **12 Credits**

This module deals with microorganisms responsible for contamination, and spoilage of foods. Food preservation and Food processing. Food-borne infections and intoxication shall be examined as well as the microbiological analysis of foods including data interpretation.

SBB2211 Principles Of Quality Control **10 Credits**

The module deals with quality in food processing, probability and sampling methods, quality control plans for factories, sanitation (personal, storage and transport) and product principles.

SBB 2214 Molecular Genetics And Biotechnology **12 Credits**

The module deals with Advanced aspects of expression and transmission of genetic information; gene transfer in plants and animals, probes and their application; cutting and joining DNA molecules; recombination techniques; DNA libraries and basic cloning techniques.

SCH 2108 Principles Of Process Engineering **10 Credits**

Offered by Department of Applied Chemistry

SORS 2210 Applied Statistics For Biological Sciences **10 Credits**

Offered by Department of Applied Statistics and Operations Research

YEAR III

SBB 3001 Industrial Attachment **120 Credits**

YEAR IV

SBB 4103 Principles Of Nutrition **12 Credits**

The module explores the history of human nutrition; factors that influence food availability and consumption patterns; macro and micronutrients; sources, digestion and metabolism; nutrients with antioxidant functions; nutritional requirements in humans; role of age, sex and lifestyle on nutritional requirement, determining nutritional status in humans, dietary reference values (DRVs), diet planning, nutritional evaluation of food. It also looks at macro and micronutrient malnutrition; diet therapy; food fortification nutritional epidemiology and food labelling.

SBB 4109 Advanced Applied Microbiology **12 Credits**

The module examines the ecological and metabolic diversity of microorganisms and their Bio-geo chemical roles in nature and in artificial habitats such as sewage are taught. Metabolism of hydrocarbons and aromatic compounds as well as growth on reduced C-1 compounds shall be included in the module.

SBB 4101 Advanced Biochemistry And Molecular Physiology

12 Credits

This module deals with advanced aspects of mechanisms of enzyme action; blood clotting, metabolism of liver and biotransformation reactions, biochemistry and Molecular, physiology of muscle contraction, neurotransmission and hormone action.

SBB 4111 Biochemistry: Metabolic Processes II **12 Credits**

The module deals with ketone body formation, metabolism of cholesterol and steroids, Amino acid metabolism and their conversion to specialized products, Nucleic acid metabolism, Protein synthesis, regulation and integration of metabolism shall also be covered.

SBB 4106 Food Technology I: Non Alcoholic Fermentations **12 Credits**

The module covers the principles of processing , preservation, packaging and storage of various categories of foods of plant and animal origin as well as non-alcoholic fermented foods are studied. Major food processing sectors that include the dairy, meat, canning, cereals, fruit, vegetable, oils and fats industries are explored.

SBB 4202 Enzyme Biotechnology **12 Credits**

The module gives the student an overview of applications of Biotechnology, introduction to enzyme biotechnology, the production and purification of enzymes and methods of enzyme and cell immobilization, the use of immobilized enzymes analytical chemistry, medicine on the synthesis of fine chemicals and food production.

SBB 4204 Advanced Cell Biology **12 Credits**

Following from SBB 1103, mitotic and meiotic cell divisions are also studied in this module. Molecular anatomy of genes and chromosomes Gene rearrangements, gene regulation and development are also studied. Other topics also include: cell cycle, cell signalling, cell aging and death, molecular biology of cancer, cellular immunology, tissue culture techniques, cell culture.

SBB4207 Food Technology II: Alcoholic Fermentations 12 Credits

The module gives an overview of methods of production, quality control and legislation on alcoholic beverages, principally beer (including opaque beers), wines and spirits. In the production of distilled alcoholic beverages, aspects of distillation and product recovery will be focused on as well as principles of production of matured and unmatured spirits.

SSB 4208 Biotechnology Of Pharmaceutical Product 12 Credits

The module includes advanced topics in production of vaccines, antibiotics, and hormones using traditional and genetic engineering techniques and hybridoma technology.

BSC (HONS) DEGREE IN BIOTECHNOLOGY

1.0 Degree Profile: BSc (Hons) Degree in Biotechnology

INSTITUTION:	National University of Science and Technology
TYPE OF DEGREE:	Honours
CREDIT LOAD:	504 Credits
LEVEL:	SADC-QF - Level 8
ACCREDITATION ORGANISATION(S):	

PURPOSE OF THE PROGRAMME

To produce high quality graduates equipped with appropriate knowledge, skills and values to be effective in the application of modern techniques and concepts in various fields of Biotechnology.

PROGRAMME CHARACTERISTICS

Areas of Study: The programme comprises but is not limited to the following areas in terms of teaching and research; environmental biotechnology, industrial biotechnology, medical biotechnology and agricultural biotechnology.

Specialist Focus: The programme provides a sound academic and practical foundation for future- and self- employment in the various fields of Biotechnology.

Orientation: Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects.

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability: Production Managers, Quality controllers, Bio-engineer, Entrepreneur, Laboratory technicians in the food industry (brewing, baking, dairy etc), Pharmaceutical, Agricultural (seed production houses, feed manufacturers, egg and chicken industries), Medical (Laboratories at diagnostic and medical centres). Research scientists in research institutions, lecturers at Universities and polytechnics, biotechnology educators in the education sector. Some can proceed and pursue higher degrees. Some can become consultants or become entrepreneurs in biotechnology related businesses.

Further Studies: PhD, MPhil in Biotechnology, Biochemistry, Microbiology, Biology, MSc in Applied Microbiology and Biotechnology.

TEACHING AND LEARNING

Teaching and Learning Methods: Lectures, tutorials, laboratory classes, seminars, group work, industrial visits, industrial attachment, research project, individual independent study.

Assessment Methods: Written and oral examinations, tests, laboratory reports, seminar presentations, industrial attachment report, final year research project report, continuous assessments.

Purpose The programme is designed and modelled to equip students with the practical uses of biotechnology knowledge and to inculcate in the students an entrepreneurial and problem-solving ability. It emphasizes biotechnologies and applications relevant to biotechnology based industries and institutions such as biomedical, agricultural, biopharmaceutical, biotechnological, food industries and the environment.

Objectives

1. To provide the students with a broad, sound and balanced knowledge in a range of areas of Biotechnology in a stimulating and supportive environment that is enriched by research.
2. To provide the students with appropriate laboratory skills and field experience.
3. To prepare the students for post-graduate research work in Biotechnology or other Biology-related disciplines.
4. To create in the students an appreciation of the importance of Biotechnology in agricultural, industrial, economic, environmental, technological and social development.
5. To provide students with a higher level of experience in independent analysis, criticism and research in their chosen field of expertise

Expected Learning outcomes

1. Participate on the global community who understand and can contribute to the debate, research and experimentation on contemporary issues in the area of Biotechnology.
2. Design, conduct, analyze, and communicate (in writing and orally) their academic research.
3. Recognize and be able to apply basic ethical principles to basic and applied biological and biochemical practice and shall understand the role of biological/biochemical science, scientists, and practitioners in society.
4. Display sufficient practical skills and knowledge in Biotechnology to be sought-after practitioners in industries (brewing, dairy, baking, pharmaceutical), research institutions, tertiary education, manufacturing industries and in the medical sector in Zimbabwe, the region and the world at large.
5. Demonstrate a decisive approach in the evaluation of scientific data and information, including the capacity to apply relevant statistical analysis and use of statistical software.
6. Apply relevant Biotechnology techniques to solve real problems in industry.
7. Provide the students with the knowledge and skills to create employment in varied areas of Biotechnology.
8. Recommend the use and adoption of biotechnology to solve the challenge currently being faced by Zimbabwe, Africa and other developing countries around the world.
9. Analyze the opportunities for the use of biotechnology in business

to bring about transformation in their own livelihoods and that of many others through poverty alleviation, better healthcare and job creation.

2.0 REGULATIONS

These regulations shall be read in conjunction with the Faculty of Applied Science and the NUST General Academic Regulations.

3.0 ENTRY REQUIREMENTS

3.1 Normal Entry

Applicants must have obtained at least two science subject passes at 'A' Level in Biology and Chemistry.

3.2 Special entry

Candidates who have successfully completed at least a National Diploma in Biotechnology or its recognized equivalent may apply for entry into Part I. Candidates should normally have 2 years post qualification working experience and may be required to attend and pass an interview.

3.3 Mature entry

Applicants who are at least 25 years of age on the first day of the academic year in which admission is sought and who are not eligible for entry under the Normal or Special Entry Regulation may apply for mature age entry provided that they have passed at least 5 'O' level subjects including English Language and Mathematics. They should demonstrate potential suitability for university studies by virtue of their attainments or relevant work experience. Normally applicants should have completed their full-time school or college education at least 5 years before the start of the academic year in which admission is sought. Applicants may be required to attend interviews.

4.0 DURATION

The Programme runs over a period of four years.

5.0 STRUCTURE OF THE PROGRAMME

The programme consists of four parts which includes one year Industrial Attachment taken in Year III. In Year IV, a student shall carry out and complete a research project. In the second semester of Year IV, a student will be able to specialize in a specific field of Biotechnology by choosing four elective modules in the area of Industrial, Medical, Environmental or Agricultural Biotechnology. Elective modules will only be offered subject to availability of teaching staff.

5.1 Electives

Elective modules are grouped into four disciplines and a student shall be expected to select a discipline.

Table 1: Elective Modules

DISCIPLINE	Environmental Biotechnology	Industrial Biotechnology	Medical Biotechnology	Agricultural Biotechnology
Elective 1	SBT 4201	SBT 4203	SBT 4204	SBT 4204
Elective 2	SBT 4202	SBT 4204	SBT4205	SBT 4207
Elective 3	SBT 4203	SBT 4205	SBT 4206	SBT 4208
Elective 4	SBT 4204	SBT 4207	SBT 4207	SBT 4209

6.0 ASSESSMENT

6.1 The overall pass mark in any module shall be 50%.

6.2 Modules shall normally be assessed through continuous assessment (20%), practical assessment (20%) and a final written examination (60%).

6.3 A Module which does not offer practical work shall be assessed at 25% for continuous assessment and 75% for the written examination.

6.4 A student who fails a module(s) may proceed to the following year subject to the Faculty of Applied Science and the NUST General Academic Regulations.

6.5 A student shall earn all and be credited with full credits for any given module when they have successfully completed the module.

6.6 During Industrial Attachment a student may register for failed modules and sit for examinations. The Industrial Attachment module shall be assessed by continuous assessment (50%), an oral examination (10%) and a final written report (40%).

6.7 A student shall be required to carry out and submit **a project report** during the final year of the programme**.** The project shall be worth 24 credits**.** The student shall be required to give an oral defence of their project work before a Departmental Panel of Examiners. The oral presentation which shall constitute 10% and the written report shall constitute 90% of the overall module assessment.

6.8 To be eligible for an award of the degree, a student must attain a minimum of **504 credits.**

7.0 WEIGHTING

The contribution of each Year to the overall degree class shall be computed as follows:

Year II – 30%

Year III – 20%

Year IV – 50%

PROGRAMME SUMMARY

YEAR I

Module Code	**Module Description**	**Credits**
SBT 1101	Principles Of Microbiology	10
SBT 1102	Animal & Plant Physiology	10
SBB 1103	Cell Biology	10
SCS 1100	Information Technology & Computer Applications	10
SCH 1116	Organic Chemistry	10
ILI 1108	Communication Theory & Practice	10
SBT 1202	Introduction To Biotechnology	10
SBT 1201	Chemistry Of Biomolecules	10
SBT 1203	Biophysics & Instrumentation	10
SBB 1204	Genetics	10
SCH 1217	General Chemistry	10
CTL 1201	Conflict Transformation & Leadership	10

YEAR II

Module Code	**Module Description**	**Credits**
SBT 2109	Principles Of Fermentation Technology	12
SBB 2104	Introduction To Enzymology & Immunology	12
SBT 2101	Molecular Genetics	12
SBT 2102	Bacteriology & Mycology	12
SBT 2103	Virology	10
SBT 2104	Molecular Cell Biology	10
SBB2211	Principles Of Quality Control	10
SCH 2108	Principles Of Process Engineering	10
SBT 2201	Research Methods & Statistics	10
SBT 2202	Introduction To Analytical Biotechnology	12
SBT 2203	Introduction To Recombinant DNA Technology	12

SBT 2204	Biotechnology Regulation & Biosafety	10

YEAR III

Module Code	Module Description	Credits
SBT 3000	Industrial Attachment	120

YEAR IV (132 Credits)

Module Code	Module Description	Credits
SBT 4010	Research Project	24
SBT 4101	Bioinformatics	12
SBT 4102	Business & Biotechnology	12
SBT 4103	Plant Biotechnology	12
SBT 4104	Molecular Systematics	12
SBT 4105	Animal Biotechnology	12

ELECTIVE MODULES

Module Code	Module Description	Credits
SBT 4201	Fundamentals Of Environmental Microbiology	12
SBT 4202	Bioremediation	12
SBT 4203	Biotechnology For Biofuels & Bioenergy	12
SBT 4202	Enzyme Biotechnology	12
SBT 4205	Biotechnology & Pharmaceuticals	12
SBT 4206	Medical Biotechnology	12
SBT 4207	Industrial Biotechnology	12
SBT 4208	Plant Pathology	12
SBT 4209	Advanced Plant Biotechnology	12

MODULE SYNOPSES

YEAR I

SBT 1101 Principles Of Microbiology **10 Credits**

This module looks at the historical development of microbiology; the scope of microbiology, Prokaryotic cell structure; microscopy and specimen preparation including staining methods and associated theoretical principles; microbial nutrition; classification of microbes; general properties and principles of classification of microorganisms as well as sterilization concepts and techniques.

SBT 1102 Animal & Plant Physiology **10 Credits**

The module explores cell communication, hormonal control, sensory and nervous systems, muscle structure and diversity, muscle fibre types and regulation of contraction, evolution of digestive systems, nutrition, regulation of digestion and gut function, circulatory and respiratory systems, excretory system, plant form and function, transpiration, plant mineral nutrition, solute transport, phloem translocation, photosynthesis light reactions, photosynthesis carbon metabolism in; C3 and C4 plants, crassulacean acid metabolism, photorespiration, assimilation of mineral nutrients; nitrogen and sulphur, water stress physiology, plant growth regulators; auxins, gibberellins, cytokinins, ethylene and abscisic acid, control of flowering and the role of phytochrome in photo morphogenesis.

SBB 1103 Cell Biology **10 Credits**

The module examines the cell concept; structure and function of cell organelles; cell junctions, cell matrix, cytoskeleton, cell membrane structure and function, electron and light microscopy, microtomy, somatic and gamete cell division, cell culture, cell differentiation and specialization as well as cells in Biotechnology.

SCS 1100 Information Technology & Computer Applications **10 Credits**

The module is on data and Information, the Computer, hardware functional components, computer software, computer networking, computer security and emerging computer technologies.

SCH 1116 Organic Chemistry **10 Credits**

The module looks at structure and bonding, Alkanes, Alkenes, Alkynes, introduction to mechanisms of reactions. Stereochemistry- Isomers and Stereoisomers, Benzene and its derivatives, Cyclohexane, Carbohydrates. Amino acids, Spectroscopy-Ultraviolet/Visible Spectroscopy, Infrared Spectroscopy, Nuclear Magnetic Resonance as well as Mass Spectroscopy.

ILI 1108 Communication Theory & Practice **10 Credits**

The module is an overview of Library Services, understanding information literacy, information sources, search strategies, evaluation information sources, use of information, legal and ethical issues and study skills

SBT 1202 Introduction To Biotechnology **10 Credits**

The module is an introduction to the field of biotechnology. Topics include the history of biotechnology, areas of biotechnology, traditional vs. modern biotechnology, overview of recombinant DNA technology, DNA, genes and gene expression, transgenic plants and animals, introduction to green biotechnology, production of biological molecules, gene therapy and careers and employment in the biotechnology and biopharmaceutical industries.

SBT 1201 Chemistry Of Biomolecules **10 Credits**

The module explores the molecular and macromolecular structure of water, Carbohydrates. Classification**,** Lipids classification. Fatty acids' prostaglandins; triacyaglycerols; phospholipids; steroids, Amino Acids. Structure, Physical and chemical properties Proteins. It also looks at classification function, bonds responsible for protein structure. Orders of protein structure, connective tissue proteins, collagen; elastin and proteoglycans; Nucleic acids. Nucleotides, Nucleosides Structure of DNA, DNA conformation, DNA supercoiling. Structure of messenger RNA, transfer RNA and ribosomal RNA.

SBT 1203 Biophysics & Instrumentation **10 Credits**

The module examines the general Biophysical methods – Measurement of pH, Radioactive labelling & counting, Autoradiography, Separation & Identification of Materials - concept of Chromatography. Centrifugation – Basic Principle of Centrifugation, Microscopy – Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM, X-Ray Crystallography, X-ray diffraction, Concept of different crystal structure, determination of crystal structure Spectroscopy. NMR Spectroscopy and Absorption Spectroscopy.

SBB 1204 Genetics **10 Credits**

The module is on cell division, Mendelian Genetics, Control of Gene Expression and Developmental Genetics, Organization of the Gerome in prokaryotes and eukaryotes, Bacterial Genetics, Human Genetics and Population genetics.

SCH 1217 General Chemistry **10 Credits**

The module looks at the fundamental ideas of chemistry, Stoichiometry, Atoms and sub atomic particles, Electronic structures of atoms, Periodicity and chemical bonding, Chemical thermodynamics, Chemical kinetics, Chemical equilibrium, Ionic equilibrium and Nuclear chemistry.

CTL 1201 Conflict Transformation & Leadership **10 Credits**

The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

YEAR II

SBT 2109 Principles Of Fermentation Technology 12 Credits

The module is an introduction to fermentation processes with particular emphasis on those relevant to developing countries such as Zimbabwe. Aspects of microbial physiology and metabolism relevant to industrial fermentations. Industrial micro-organisms, Fermentation media. Fermentation equipment: Design of fermentators and facilities for process control are looked at. Solid state and submerged culture fermentations: Collection and purification of fermentation products, Treatment and disposal of fermentation effluents and Some features of selected fermentation processes are also covered.

SBB 2104 Introduction To Enzymology & Immunology 12 Credits

The module has the major characteristics of enzymes, Mechanism of enzyme reactions, Inhibition of enzyme reactions, Regulation of enzyme activity, Immunolobulins, Structure, Different classes of immunoglobulins, General processes of the immune response. Mechanism of action of T-cell mediators of the immune response Plasma B cells, Memory B cells, Mechanism of action of macrophages and Immune Deficient diseases –e.g. SCID, HIV.

SBT 2101 Molecular Genetics 12 Credits

The module explores the evidence of DNA as the genetic material, DNA structure and function, RNA structure and function, Central dogma of genetics, DNA replication, Transcription, Translation, Prokaryotic and eukaryotic gene structure, genetic variation – mutation and recombination, Regulation of gene expression in porkaryotes and eukaryotes, Epigenetics, Natural plasmids, Biology of restriction as well as modification endonucleases and restriction.

SBT 2102 Bacteriology & Mycology 12 Credits

The module is about microbial growth; Mathematical description, Measurements, Batch cultures, continuos cultures Effect of environmental factors on microbial growth, control of microorganisms, Culture systems: pure cultures, mixed culture systems, Bacterial genetics, recombination, conjugation, transformation, Fungi culture techniques, media, terrestrial fungi major groups, phylogenetics, general characteristics, life cycles, importance in medicine, agriculture, industry and the ecology of fungi.

SBT 2103 Virology 10 Credits

The module examines the basic virology, capsid structure, genomes, complex viruses, Viral genome size and its effect on virus structure, structural mechanisms employed by viruses to enter host cells, How viruses maximise the protein coding potential of their genomes, virus replication cycles, bacteriophages, virus classification, viruses and biotechnology as well as the mechanisms viruses use to evade host defence responses.

SBT 2104 Molecular Cell Biology 10 Credits

This module is an introduction to the study of cell and molecular biology, Interactions between cells and their environment, Cytoplasmic membrane systems, The cytoskeleton and cell motility, The cytoskeleton and cell motility, Cellular reproduction, Cell signalling and

Signal transduction, Cancer, Nature of the Gene and Genome and the molecular anatomy of genes and chromosomes.

SBB2211 Principles Of Quality Control **10 Credits**

The module explores the concept of Quality in Food Processing, Process Control ,Statistical Quality Control, Good Manufacturing Practice (GMP),Good Laboratory Practice (GLP), Probability and Probability Distribution.

SCH 2108 Principles Of Process Engineering **10 Credits**

The module highlights the fluid Mechanics, Fluid in Motion, Heat Transfer, Mass Transfer, Process Engineering Operations -Evaporation, Distillation, Liquid-liquid extraction, Leaching and Dehydration.

SBT 2201 Research Methods & Statistics **10 Credits**

This is an introduction to the process of conducting research. research design introduction - Steps in the Process of Research. Writing a research proposal - Identifying a hypothesis and/or research problem, specifying a purpose, creating research questions. Reviewing literature. Ethics of research and informed consent. Introduction to Qualitative and Quantitative Research – Sampling, Collection, Techniques, interpretation. Sampling Concepts and Sampling Methods. Descriptive Statistics. Inferential Statistics - Drawing inference from data, Modelling assumptions, Identifying Patterns, Regression analysis, T-test, Analysis of Variance, Correlations and the Chi-square.

SBT 2202 Introduction To Analytical Biotechnology **12 Credits**

The module loos at the molecular biology techniques (DNA and RNA extraction, molecular markers, real-time, multiplex and nested PCR, chromatographic techniques, electrophoretic techniques, centrifugation techniques, colorimetry, spectrophotometry and mass spectroscopy, Immunological techniques ELISA, immunoprecipitation, SDS-PAGE, western blot, and flow cytometry as well as Sequencing methods (nucleotide and protein).

SBT 2203 Introduction To Recombinant DNA Technology **12 Credits**

The module has the properties and applications of DNA modifying enzymes, introduction to cloning, Types of cloning and expression vectors, Labelling and detection of nucleic acid sequences, Gene libraries, applications of Polymerase Chain Reaction, Site directed mutagenesis, creation of transgenic organisms, synthetic biology vs Genetic Modifying Organisms, applications of recombinant DNA technology in agriculture, medicine and industry as well as the gene editing technologies.

SBT 2204 Biotechnology Regulation & Biosafety **10 Credits**

This module examines the biosafety guidelines and regulations, Purpose of biosafety in terms of protection of ecosystems, public health, farm animals and plants, Biological risk assessment, Bio-containment facilities, practices and personal protective equipment, Microorganisms levels of containment, Decontamination and disinfection, Waste disposal, Biosecurity, Overview of the legal and socioeconomic impacts of biotechnology, Bioethical concerns on biotechnology products, Intellectual Property Rights (IPR) – implications, procedures and types, effects of IPRs on developing countries as well as Patents, applications in biotechnology, examples of patents in biotechnology, impacts of patents.

YEAR III

SBT 3000 Industrial Attachment **120 Credits**

YEAR IV (132 CREDITS)

SBT 4010 Research Project **24 Credits**

The final year research project shall be carried out on an individual basis. In this module students are expected to demonstrate through application, the skills acquired throughout the programme. Students shall be expected to produce a final year project report as outlined in the guidelines for this module and shall be expected to defend their work in front of the Departmental panel of examiners.

SBT 4101 Bioinformatics **12 Credits**

This module explores the use of Bioinformatics databases and software as research and educational tools. Students will use data mining tools to extract DNA and protein sequences from primary and secondary databases. Software tools will be used to compare and analyze these sequences and construct gene and protein models for solving research problems related to molecular evolution, drug discovery and genetic bases for development and disease. Major topics include- Protein Analysis, Nucleic acid sequence analysis, Data Mining, Post-Transcriptional Modifications Functional & Structural Proteomics, sequence alignments, primer design.

SBT 4102 Business & Biotechnology **12 Credits**

The module examines the innovation and entrepreneurship, Law and regulations, Finance, Strategy, What is a biotech business?, Development and management of biotech businesses, managing the transition from a small entrepreneurial firm to a large, sustainable, professionally managed but still entrepreneurial corporation, being an entrepreneur and promoting entrepreneurship in a large corporation.

SBT 4103 Plant Biotechnology **12 Credits**

This is an introduction to plant cell, protoplast and tissue culture, plant gene structure and genomic organization; transformation in plants, nuclear and plastid transformation; development of transgenic plants; molecular markers and marker-assisted selection in plants as well as GMO regulation.

SBT 4104 Molecular Systematics **12 Credits**

The module looks at the molecular methods for studying DNA and protein sequence variation between individuals and among populations, Sequencing of target genomics regions for systematics (ribosomal DNA – 16S, ITS, 18S, mitochondrial sequences e.t.c), Measures of similarity from molecular marker and sequence data, clustering techniques, dendrograms and ordination techniques, parsimony, distance and maximum likelihood approaches for defining operational taxonomic units, Introduction to metagenomics, next generation sequencing of metagenomic samples, tools and approaches for analysing and interpreting metagenomic datasets (EBI metagenomics, MEGAN, MG-RAST), comparative metagenomics, metatranscriptomics and metaproteomics.

SBT 4105 Animal Biotechnology **12 Credits**

The module deals with the mammalian cell culture, gene transfer methods in animals, transgenic animals, molecular techniques in animal diseases (detection, diagnosis and MDR profiling), animal propagation, conservation biology/ embryo transfer techniques, genetic modification in medicine, ethics and genetically engineered organisms.

ELECTIVE MODULES

SBT 4201 Fundamentals Of Environmental Microbiology **12 Credits**

This module highlights the microbial cell structure and function; microbial growth; microbial metabolism and its regulation; microbial energetics; microbial metabolic diversity; microbial diversity - phylogenetic, physiologic and metabolic; microbial habitats – air, water, soil and extreme environments; microbial ecology; microbial ecosystems – aquatic and terrestrial; interactions among microbes; microbial interactions with the environment; biogeochemical cycles - carbon, nitrogen, sulphur, iron and oxygen; the microbiology of solid and liquid waste treatment; microbiology of portable water treatment.

SBT 4202 Bioremediation **12 Credits**

The module covers a history of bioremediation; intrinsic and extrinsic bioremediation; *in-situ* and *ex-situ* bioremediation; environmental pollutants – organic and inorganic; pollutant availability; bioremediation process requirements; bioremediation strategies applicable to polluted aquatic, atmospheric and soil environments; important bacterial and fungal bioremediators; mechanisms of microbial catabolism of pollutants; the bioremediation of common xenobiotic organic pollutants: PAHs, PCBs, Pesticides, petroleum hydrocarbons, DDT; the bioremediation of heavy metals; Phytoremediation; Application of recombinant DNA technology in bioremediation; Pollutant biomonitoring and the limitations of bioremediation.

SBT 4203 Biotechnology For Biofuels & Bioenergy **12 Credits**

The module looks at biofuels versus fossil fuels; Biofuels feedstock: lignocellulosic biomass, energy crops; Conversion and utilisation of biofuels feedstock; First generation biofuels: bioethanol; Second generation biofuels: lignin modification and degradation, cell wall degrading enzymes, lignocellulosic bioethanol, biodiesel (Jatropha), processing technology for FAME, biogas, Third generation biofuels: Hydrogen and biological processes for hydrogen production, Algae-based hydrogen production and water splitting, Microbe fuel cells; Traditional and molecular breeding of energy crops; metabolic engineering of energy crops; Commercialisation of biofuels; Biofuels and food security conflict; Bioenergy Industry Development and Government Policy.

SBT 4202 Enzyme Biotechnology **12 Credits**

This module reviews the methods employed in bioseparations to obtain increased purity of biological products. It examines the methods of protein purification including protein precipitation, chromatographic and affinity methods, aqueous two-phase systems, protein and enzymes including genetically engineered organisms, industrial use of soluble enzyme products, carbohydrases, proteases and lipases in food industries, brewing and detergents, Methods of enzyme immobilization - Advantages and Disadvantages, Comparison of enzyme reactor designs for soluble and insoluble enzymes, Methods of using immobilized cells, both viable non-viable, for biotrans formations, Enzyme and cell based biotrans formations for production of pharmaceutical and fine chemicals, The use of enzymes in water-poor non-aqueous solvent, The use of enzymes and cells in aqueous two-phase systems. Enzymes in medical diagnostics and related analyses as well as biosensors utilizing enzymes and cells.

SBT 4205 Biotechnology & Pharmaceuticals **12 Credits**

This module is an introduction to biopharmaceuticals, Definition of biopharmaceuticals, Drug and product development process and stages, Upstream and downstream processes, Product formulation, Role of regulatory authorities, The biopharmaceutical environment and quality assurance and control, Production and medical applications of selected biotechnology products such as Insulin, FSH, blood coagulating factors VIII and IX, tPA, interferons, monoclonal antibodies and Gene therapy.

SBT 4206 Medical Biotechnology **12 Credits**

The module is an introduction to the biology of disease and immunology, disease diagnostics and immunotechnology, monoclonal antibodies, hybridoma technology and monoclonal antibody production, drug development and gene therapy, vaccines and vaccine development, applications of gene profiling, micro-array techniques and DNA finger printing in medical science, stem cell technology and its potential applications, Gene therapy and diagnostic techniques in medicine.

SBT 4207 Industrial Biotechnology **12 Credits**

The module looks at industrially relevant microorganisms and enzymes; isolation, characterisation, preservation and improvement of industrially important microorganisms; bioprospecting microbial enzymes from diverse environments, their characterisation and improvement; Fermentation processes: batch, continuous and fed-batch culture; fermenter design and operation; fermentation media; inoculum development, preservation and improvement; kinetics of growth and product formation; fermentation downstream processes; industrial processes for the production of microbial enzymes and microbial biomass, fuels and industrial chemicals, food and beverage products (alcoholic, dairy); biomining; production of bioplastics and biosurfactants; use of microbial enzymes in paper production and tannery industry; genetic engineering of plants and microbes for industrial processes.

SBT 4208 Plant Pathology **12 Credits**

This module is an introduction to the importance of Plant Disease, Plant Disease – Concept, Description and Diagnosis, Cycle Terminology. Plant–Microbe Interactions – Cellular, Biochemical, and Molecular events that determine the diseased state. Gene-for-Gene Hypothesis and Disease Management: Host Resistance. Oomycota – Life Strategies of Plant

Pathogens, Infection Processes. Ascomycota – Host Defenses, Systemic Acquired Resistance and Review of Concepts, Disease Dynamics. Basidiomycota – Disease dynamics, Host Resistance. Bacteria – Disease Management, Biological Control. Virus Diseases and Virus Vectors – Life of a Virus, Disease Management: Transgenic Viral Resistance as well as Nematodes – Disease Management, Protection and Eradication.

SBT 4209 Advanced Plant Biotechnology 12 Credits

The module looks at the advanced plant cell, protoplast and tissue culture. Plant genetic engineering for pest, pathogen and disease resistance, herbicide tolerance, quality traits, biotic and abiotic stress, plants as bioreactors in the production of plastics, fats/oils, fibres, proteins and biofuels and plant molecular breeding.

MASTER OF SCIENCE IN APPLIED MICROBIOLOGY AND BIOTECHNOLOGY

1.0 Degree Profile : Master of Science In Applied Microbiology and Biotechnology

INSTITUTION:	National University of Science and Technology
TYPE OF DEGREE:	Masters
CREDIT LOAD:	300 Credits
LEVEL:	SADC-QF - Level
ACCREDITATION ORGANISATION:	ZIMCHE
PERIOD OF REFERENCE:	2018

PURPOSE OF THE PROGRAMME

To develop in students a thorough understanding of the general and advanced principles in the field of Applied Microbiology and Biotechnology.

PROGRAMME CHARACTERISTICS

Areas of Study: Medical Biotechnology, Plant Biotechnology, Industrial Biotechnology

Specialist Focus: It is designed to provide graduates with the practical skills required to produce relevant cost-effective solutions in the development of local manufacturing, agricultural and food production industries, environmental pollution and monitoring and also medical technologies.

Orientation: Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects.

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability: Research and Academia, Fermentation industry, Food and dairy industry, Pharmaceuticals industry, Biopharmaceutical companies, Quality control, Environmental Assessment, Microbial waste

	management, Medical and pathology laboratories, Water treatment plants.
Further Studies:	PhD in Biology, Biochemistry, Microbiology, Biotechnology

TEACHING AND LEARNING

Teaching and Learning Methods:	Lectures, tutorials, laboratory classes, seminars, group work, farm research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, seminar presentations, mini-research project report, final year research project report

2.0 REGULATIONS

The Regulations for the Master of Science Degree in Applied Microbiology and Biotechnology should be read in conjunction with the Faculty of Applied Science Regulations and the General Academic Regulations.

2.1 Entry requirements

The normal entry qualification shall be an Honours Degree with at least a 2.2 classification in Biological Sciences, Microbiology, and Biochemistry

2.2 Mode of study

2.2.1 The programme shall normally be offered over a period of eighteen (18) months [three (3) semesters] on full-time study and 24 months on block release. When running on fulltime a student shall register for four modules in the First Semester and four in the Second Semester making a total of eight modules in the first year of study. A student shall choose one elective module during the first semester and two electives during the second semester and shall be required to register for the Project Module at the start of the Third Semester.

2.2.2 When running on block release, the programme shall comprises of two blocks of 3 weeks of contact time in the first academic year and two blocks of 2 weeks of contact time for the second academic year. A student shall register for a total of eight modules in addition to a Project module. A student shall choose one elective module during the first academic year and two modules in the second year of study. A research project shall commence during Block 3 in the second academic year.

2.2.3 There are three fields of specialisation with elective modules from which to choose. The three elective modules chosen by the student shall all belong to one discipline or field of specialisation.

2.2.4 Part II shall consist of seminars in assigned readings, reports and a research project leading to a dissertation and an oral presentation.

2.3 Award of the degree

To be awarded the MSc degree, a minimum of 304 credits must be satisfied.

2.4 Electives

Elective modules (given in Table I) are grouped into three disciplines of Medical Biotechnology, Plant Biotechnology and Industrial Biotechnology.

Table 1: Elective module clusters

Medical Biotechnology	**Plant Biotechnology**	**Industrial Biotechnology**
SBB 5213	SBB 5209	SBB 5204
SBB 6116	SBB 6115	SBB 6110
SBB 6117	SBB 6117	SBB 6114
-	SBB 6118	-

2.5 **Assessment**

A student shall be assessed through continuous assessment (20%), practical assessment (20%) and a final written examination (60%) for each taught Module.

2.5.1 The overall minimum pass mark in any module shall be 50%.

2.5.2 A student who fails one module may be allowed to proceed to the next Part of the degree programme whilst carrying the failed module.

2.5.3 A student who fails more than one module but passes at least 50% of the Modules may be allowed to repeat the Part.

2.5.4 A student who fails more than 50% of the modules or fails the same Part of the programme twice shall be required to withdraw.

2.5.5 A student shall be required to submit two typed and spiral bound copies of the dissertation for assessment.

A student who passes all 8 modules but fails the Research Project may be awarded a Postgraduate Diploma in Applied Microbiology and Biotechnology.

2.6 **Weighting**

The weighting of the programme shall be as follows:

Part I taught modules	45 %
Part II taught modules	15 %
Dissertation and seminar(s)	40 %

PROGRAMME SUMMARY

PART I

Module Code	Module Description	Credits
SBB 5101	Microbial Genetics	23
SBB 5102	Recombinant DNA Technology	23
SBB 5111	Environmental Microbiology	23
SBB 5211	Entrepreneurial Skills	23
SBB 5212	Analytical Biotechnology And Bioinformatics	23
SBB 5209	Plant Biotechnology (Optional)	23
SBB5213	Medical Microbiology And Biotechnology(Optional)	23
SBB 5204	Advanced Food Microbiology (Optional)	23

PART II

SBB 6110	Industrial Biotechnology (Optional)	23
SBB 6114	Environmental Biotechnology (Optional)	23
SBB 6115	Plant Pathology (Optional)	23
SBB 6116	Immunology (Optional)	23
SBB 6117	Virology (Optional)	23
SBB 6118	Advanced Plant Biotechnology (Optional)	23
SBB 6010	Research Project	116

MODULE SYNOPSES

PART I

SBB 5101 Microbial Genetics 23 Credits
The module looks at gene organization in prokaryotes and eukaryotes, Molecular basis and mechanisms of mutations, Molecular evolution. Regulation of gene expression and metabolic pathways, allosteric proteins, protein-DNA interaction. Yeasts and molecular genetics of cell cycle control and epigenetics.

SBB 5102 Recombinant DNA Technology 23 Credits
The module explores gene cloning, vectors-plasmid, bacteriophage, cosmids, YAC, expression of heterologous proteins in *E. coli, S. cerevisiae*, plant and mammalian cells, design of a protein producer, application of RFLPS and PCR techniques, horizontal gene transfer versus vertical gene transfer as well as gene editing technologies and their applications.

SBB 5111 Environmental Microbiology 23 Credits
This module examines soil and water microbiology; role of microbes in marine, freshwater and terrestrial ecosystems, biogeochemical cycling; C N, P, S. population and community diversity; interactions between microbial communities. Microbiology of extreme environments, the role of microorganisms in biodegradation, classical and contemporary biochemical, molecular and genomic approaches to microbial physiology, metabolism and ecology and the use of genetically modified microorganisms in the environment.

SBB 5211 Entrepreneurial Skills 23 Credits
The module looks at the entrepreneurship and entrepreneurs, reading a Balance Sheet, The business plan. Managing markets, Managing finances. Legal aspect, general Management, conflict management skills, environmental policy and management, release and management of genetically modified organisms (GMO's) as well as biosafety regulations.

SBB 5212 Analytical Biotechnology And Bioinformatics 23 Credits
This module examines spectrophotometry, Chromatography GC-HPLC-MS, RIA, Electrophoresis (High molecular and restricted DNA, gel and capillary), DNA and RNA isolation, NA labelling, PCR- qualitative and quantitative, DNA – sequencing, chemical synthesis of polynucleotides. It also looks at protein isolation and purification (enzymes, antibodies, heterologous expressed proteins) in laboratory scale, scale-up of protein purification, proteomics – mass spectrometry-based workflows, experimental design, sample collection and preparation. The module is also an introduction to bioinformatics databases and basic computational tools used in sequence alignment, analyzing genomics and proteomics sequence data.

SBB 5209 Plant Biotechnology (Optional) 23 Credits

The module looks at genetic modification and manipulation to increase and improve the production of plants; crop protection by gene manipulation; plants important for agriculture, plant viruses, fungi as plant pathogens; molecular basis of pathogenicity-Molecular basis of disease resistance; plant tissue culture; genetics of host plant resistance, breeding for resistance, hypersensitive response, systemic acquired resistance, manipulation of host-pathogen interactions; transgenic plants and the expression of heterologous proteins in plants.

SBB5213 Medical Microbiology And Biotechnology(Optional) 23 Credits

The module highlights medically important bacteria with emphasis on taxonomy, pathogenesis and isolation; identification of microbes – bio typing, quick methods (classical and DNA probes, pulse-field electrophoresis) DNA; probes in medicine (inborn errors, surgical pathology (HPV), oncology, forensic medicine); vaccines interferon, antibodies, hormones and laboratory diagnostics for tropical diseases.

SBB 5204 Advanced Food Microbiology (Optional) 23 Credits

The module explores the biodegradation and bio-deterioration of food; types of foodstuffs in relation to chemical composition and susceptibility to spoilage; principles and techniques employed to prevent and control spoilage; sample preparation and its role in microbial analysis; analytical microbiology techniques and their practical application; food poisoning, causative agents, sources of contamination and determination of contaminant level.

PART II

SBB 6110 Industrial Biotechnology (Optional) 23 Credits

The module looks at the application of microbial processes in industry; industrial microorganisms and their nutrition, physiology, growth, selection, isolation, screening, culture collections; production of microbial cells, primary and secondary metabolites, antibiotics, vaccine; immobilization of microbial cells and proteins (enzymes and hormones); application of immobilized products in the industrial production of food, medicines, fine chemicals, ethanol and in the environmental analysis and monitoring.

SBB 6114 Environmental Biotechnology (Optional) 23 Credits

The module examines biological waste water treatment; aerobic processes (bio filters, bio contractors, activated sludge), anaerobic conversions, (anaerobic digestion, septic tanks, biogas; biological treatment of industrial waste and reuse of solid organic waste; biomass utilization of starch and cellulose; application of fungi for degradation of lignocellulosics, biofuel production; biodegradation of xenobiotics; bioremediation technologies and soil bioremediation, recovery of minerals from low grade ores; biomining and biooxidation, bioremediation of heavy metal contaminated sites, Biofertilizers and Biopesticides, Bioprospecting.

SBB 6115 Plant Pathology (Optional) 23 Credits

This module looks at the plant pathology basics and epidemiology; host-Plant recognition symbiosis, pathogenicity and resistance; mechanisms of pathogenicity; symbiosis with bacteria, nitrogen fixation, mycorrhizae; deuteromycetes, Ascomycete and Basidiomycete diseases; bacterial and viral diseases, Nematode and insect related disease; seed borne, soil borne and post-harvest diseases; disease control strategies; resistance mechanisms and biological control.

SBB 6116 Immunology (Optional) 23 Credits

The module examines the advanced aspects of immune response, structure of immunoglobulins, complement, mechanism of action B-T-cells ; innate immunity.; polyclonal, monoclonal and synthetic antibodies; hybridoma technology; production and application of immunochemicals; recombinant antibody technology and animal cell culture techniques.

SBB 6117 Virology (Optional) 23 Credits

This module is about molecular structure and assembly of viruses (Tobacco mosaic virus, Tomato virus, HIV); function and role of virus encoded proteins and viral nucleic acids in symptom induction; herpesviruses in humans (Herpes simplex, Herpes zoster and Varicella, Epstein-Barr virus, Cytomegalovirus); measles, Mumps, poliomyelitis, Rubella; other neurotropic viruses and Prions (Rabies, Encephalitis virus, Creutzfeldt-Jakob disease, Kuru, Human T-cell Lymphotropic virus); other system viral diseases (Dengue, Colorado Tick fever, Yellow Fever virus, Haemorrhagic fever viruses (Marburg, Lassa, Ebola), Adenovirus, Coxsackie virus; respiratory syncytial virus, Influenza virus, Rotavirus. Viruses in birds and animals. Avian flu virus, Newcastle disease virus. Plant viruses and analytical virology.

SBB 6118 Advanced Plant Biotechnology (Optional) 23 Credits

This module looks at molecular markers and their applications in plant diversity studies and marker assisted breeding; reverse genetics techniques for functional genomics; principles and applications of plant genomics (based on new generation sequencing) transcriptomics, metabolomics.; molecular farming; plant synthetic biology enabled biofuels, metabolic engineering, chloroplast transformation. Biotechnology status and future status of economic crops; biosafety and International regulation of plant biotechnology.

SBB 6010 Research Project 116 Credits

The research project shall be in an area chosen by the candidate and approved by the student's supervisor and the Departmental Board. This process shall take place during their first block release period, at the start of Part II. The student may be placed for a minimum of 10 weeks in an industry, commercial organization or research institute working on the elected research project. The research work shall be completed and the dissertation submitted one week before the examinations at the end of the block release period of Part II. Submissions after that date shall receive no more than a basic pass mark of 50%, unless dispensation is sought from the Department.

POSTGRADUATE DIPLOMA IN APPLIED MICROBIOLOGY AND BIOTECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

Lecturer and Chairperson
D. Dube, MBA (NUST, Z'bwe), MSc (Higher Institute of Chemical Technology, Bulgaria), CEd (UCE, Z'bwe)

Associate professor
Professor S. Sibanda, PhD (King's College, London, UK), BSc (Hons) (CNAA), CEd

Senior lecturers
C. T. Parekh, PhD (Manchester, UK), MPhil (Manchester, UK) MSc (South Gujarat, India), BSc (South Gujarat, India)

Lecturers
A. Maringa, PhD (Rhodes, SA), MSc (Wits, SA), BSc (Hons) (NUST, Z'bwe), PGDE (NUST, Z'bwe)

B. N. Yalala, PhD (Wits, SA), MSc (UWC, SA), BSc (Hons) (NUST, Z'bwe), QA Cert (City & Guilds), PGDE (NUST, Z'bwe)

D. Nyoni, PhD (Rhodes, SA), MSc (Rhodes, SA), BSc (Hons) (MSU, Z'bwe)

A. Ndiripo, PhD (Stellenbosch, SA), MSc (Stellenbosch, SA), BSc (Hons) (NUST, Z'bwe)

B. Nyoni, MEng. (NWU, SA), BSc (NUST, Z'bwe)

M. Moyo, MTech (Vaal, SA), BSc (Hons) (NUST, Z'bwe)

C. R. Madzivire, MSc (Cape Town, SA), BSc (Hons) (Cape Town, SA)

Staff Development Fellows
S. Mlilo BSc (NUST, Z'bwe)

Senior Secretary
F. Jonathan, Diploma in Business Management (NUST, Z'bwe), Diploma in Secretarial Studies (Hre Polytechnic, Z'bwe)

Chief Technician
C.Mpofu, BSc Chemistry/Physics (UZ, Z'bwe), City & Guilds QA Certificate

Senior Technicians
E. Bere, BSc (Hons) (NUST, Z'bwe), MSc (BUSE, Z'bwe), PGDE (NUST, Z'bwe)

P. Nyama, BSc (ZOU, Z'bwe), BSc (Special Honours)(NUST, Z'bwe), HND (Hre Polytechnic, Z'bwe),City & Guilds

D. Nyama, BSc (General with Education (MSU) in collaboration with UZ, Z'bwe

UNDERGRADUATE DEGREE PROGRAMME

BACHELOR OF SCIENCE HONOURS IN APPLIED CHEMISTRY

1.0 Degree Profile : Bachelor of Science Honours In Applied Chemistry

INSTITUTION:	National University of Science and Technology
TYPE OF DEGREE:	Honours
CREDIT LOAD:	544 Credits
LEVEL:	SADC-QF - Level 8
ACCREDITATION ORGANISATION(S):	Zimbabwe Council For Higher Education

PURPOSE OF THE PROGRAMME

To produce graduates capable of providing chemistry knowledge based solutions to scientific, technological, economic and social challenges.

PROGRAMME CHARACTERISTICS

Areas of Study: Classical chemistry, Polymer science and Chemical engineering Modules

Specialist Focus: Applied Chemistry

Orientation: Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability: Chemist in Pharmaceutical, mining, fertilizer, rubber, metallurgical and chemical industries etc.

Further Studies: MPhil and PhD in Chemistry, MSc by Module work.

TEACHING AND LEARNING

Teaching and Learning Methods:	Lectures, tutorials, laboratory classes, seminars, group work, industrial visits, industrial attachment, research project, individual independent study.
Assessment Methods:	Written and oral examinations, tests, laboratory reports, seminar presentations, industrial attachment report, final year research project report, continuous assessments.

2.0 REGULATIONS

These regulations should be read together with the Faculty of Applied Science and the University General Regulations for undergraduate degrees.

3.0 ENTRY REQUIREMENT

3.1 Normal Entry

The applicant must have passed 'A' level Chemistry plus EITHER Mathematics or Physics.

3.2 Special Entry

The applicant who has successfully completed a National Diploma in Chemical Technology or its recognized equivalent may apply for entry into Part 1.

4.0 STRUCTURE

The Programme shall consist of thirty one modules plus industrial attachment and a research project. Part III consists of Industrial Attachment which will culminate in the submission of an Industrial Attachment report.

PROGRAMME SUMMARY

YEAR I

Module Code	Module Description	Credits
SCH 1101	Inorganic Chemistry I	10
SCS 1101	Introduction to Computer Science	12
SPH 1101	Mechanics and Relativity	10
SCH 1102	Organic Chemistry I	10
SCH 1103	Professional Studies	10
SPH 1106	Modern Physics for Chemists	10
SMA 1111	Mathematics for Science I	10
Semester II		
CTL 1101	Conflict, Transformation and Leadership	10
SCS 1200	Data Concepts and Data Processing	10
SCH 1201	Inorganic Chemistry II	10
SCH 1202	Organic Chemistry II	10
SCH 1206	Analytical Chemistry I	10
SPH 1209	Engineering Material	10
SMA 1211	Mathematics for Science II	10
YEAR II		
Semester I		
SCH 2104	Physical Chemistry I	12
SCH 2106	Analytical Chemistry II	12
SCH 2107	Polymer Science I	12
SCH 2108	Transport Phenomena	12
SORS 2110	Introduction to Applied Statistics	10
SCH 2114	Industrial Inorganic Chemistry I	12
Semester II		
SCH 2117	Heterocyclic Chemistry I	12
SCH 2204	Physical Chemistry II	12
SCH 2207	Polymer Science II	12
SCH 2208	Unit Operations	12
SCH 2211	Quality Assurance Management and Control	12
SCH 2215	Industrial Organic Chemistry I	12
YEAR III		**120**
SCH 3010	Industrial Attachment	120

YEAR IV

Semester I

SCH 4108	Chemical Engineering Plant Design	12
SCH 4114	Industrial Inorganic Chemistry II	12
SCH 4115	Industrial Organic Chemistry II	12
SCH 4206	Analytical Chemistry III	12
SCH 4210	Project Development and Management	12
SCH 4010	Project	10

Semester II

SCH 4208	Reactor Technology	12
SCH 4214	Industrial Inorganic Chemistry III	12
SCH 4215	Industrial Organic Chemistry III	12
SCH 4217	Heterocyclic Chemistry II	12
SCH 4292	Chromatographic Separations	12
SCH 4010	Project	10
TOTAL		**544**

SERVICE MODULES

SCH 1116	Organic Chemistry for SBB, ESH, EFW, TXT	10
SCH 1120	Physical Chemistry for TCE	10
SCH 1217	General Chemistry	10
SCH 1221	Organic Chemistry for Engineers (TCE)	10

TOTAL CREDITS FOR THE PROGRAMME

Part I	142
Part II	142
Part III	120
Part IV	140
Total	**544**

MODULE SYNOPSES

YEAR I

Semester I

SCH 1101 Inorganic Chemistry I(Structure And Bonding) 10 Credits

The module explores atomic and molecular orbitals; molecular shape and electronic structure; bonding in covalent and ionic compounds; principles of stoichiometry and mass and composition changes in chemical reactions.

SCS1101 Introduction To Computer Science And Programming 12 Credits

The module examines information society and the history of computers. The topics to be covered include data and Information, Number systems and arithmetic; data representation, Basic Computer Component:- CPU I\O units, Storage; *Brief Concepts of Computer Languages and Programming Techniques:* High\low level languages, compiler, interpreter, grammar, recursion, simple data structures (arrays, lists, trees, hash tables, queues and stacks), problem solving; *Algorithms:* Sorting, compression, numerical and encryption; Operating systems and its functions:- process and memory management, I\O, *Data Communication,* Job Control; processing:- File structures, organization and access, Databases; *Fundamentals of Networks as well as a* simple program, initialisation, printing, comments, keywords, constants, assignments and expressions.

SPH 1101 Mechanics And Relativity 10 Credits

This module looks at the following topics: Kinematics and Kinetics. Inertial frames of reference; motion in two and three dimensions.; dynamics of system of particles; interactions between bodies, ralative of motion; conservation of momentum and energy; motion of systems of particles with variable mass; collisions of particles; rotational Dynamics**:** Rotation of rigid bodies; moment of Inertia and its calculations for bodies of various shapes and about different axes; work and energy in rotational motion; angular momentum; and principles of conservation of angular momentum. It also looks at gravitation: Kepler's laws of planetary motion; gravitational potential; gravitation and gravity; effect of earth's rotation on "g"; gyroscope; motion of a satellite; coriolis force; the fundamental forces and their unification; inertial forces in linearly accelerating frame, oscillatory motion**:** Simple harmonic motion; mechanical oscillators; superposition of S.H.M's. Damped and forced S.H.M. together with lissajous and resonance. The properties of Matter Elasticity**:** Hooke's law. Modulli of elasticity and their inter –relationship; applications of elasticity; fluid mechanics**:** Fluid at rest; surface tension and capillarity the continuity equation, various types of flows; boundary layers and turbulence; steady state flow of fluids; bernoulli's equation; viscous flow and viscosity; friction: Nature of frictional forces; motion in frictional medium; rolling and sliding friction; relativity: Space-time frames of reference; Galileo's principle of relativity; simultaneity of events; Einstein’s Special theory of relativity; Lorenttz transformations as well as momentum and energy systems.

SCH 1102 Organic Chemistry I 10 Credits

This module introduces students to the structure and bonding in organic molecules, stereochemistry, organic reaction mechanisms, the chemistry of aliphatic hydrocarbons and the basics of organic spectroscopic analysis.

SCH 1103 Professional Studies 10 Credits

This module covers business Law; Modern Business; Management; Work Study Methods; Marketing; Zimbabwean Political Economy; Effective Communication and Industrial Safety.

SPH 1106 Modern Physics For Chemists 10 Credits

The module covers the yearicle nature of radiation - The photon; the Wave nature of yearicles - The matter wave; the Nuclear Models and an introduction to Elementary Yearicles.

SMA 1111 Mathematics For Science I 10 Credits

The module examines linear Algebra: Matrices, Operations, Inverses, Determinants, Eigen values, Eigenvectors, Solution of Linear Equations; *Functions*: Exponential, Logarithmic, Circular functions and their inverses; Calculus: Idea of limit and continuity. Differentiation; Leibnitz theorem; L 'Hospital's rule; Maxima and Minima; Asymptotes; Concavity; Curve sketching; Taylor's theorem; Power series. Integration - substitution, by years, reduction formulae and Applications.

Semester II

SCS 1200 Data Concepts And Data Processing 10 Credits

This module explores database management systems (DBMS), Database Models: Entity-relationship model; the relational model; the SQL language; database design: ER ro relational mapping; normalisation Aspects of physical database access: Database Transactions: Embedded SQL (PL/SQL); cursors. Distributed databases: Client-server database systems; higher-level and extended data models: Object-oriented data models are introduced. SQL3 and the requirements of multimedia databases.

SCH 1201 Inorganic Chemistry II 10 Credits

This module examines the nomenclature of Inorganic Chemistry. Periodic system; main-groups elements, Noble gases. . d- and f- Transition elements; redox reactions and co-ordination compounds.

SCH 1202 Organic Chemistry II 10 Credits

Module introduces students to aromatic compounds, and the reactions, preparations, and spectroscopic identification of the common organic functional groups. An overview of the organic chemistry of carbohydrates and several other important biomolecules is included.

SCH 1206 Analytical Chemistry I 10 Credits

The module introduces students to Analytical Chemistry. Topics as Evaluation of Analytical Data, Chemical Equilibria (acid-base, redox, complex-formation, precipitation) and their application are dealt with.

SCH 1209 Engineering Materials 10 Credits

The module outline covers topics on Atomic Structures and Bonding, Chemical Reactions and Reactivity, Phases Crystal Classification, Elastic and Plastic Behaviour. Shaping, testing and behaviour of materials in service. It hives an outline of the different types of engineering materials i.e. non-ferrous materials, ceramics thermoplastics, thermosetting and composite materials as well as fabrication of materials.

SMA 1211 Mathematics For Science II 10 Credits
This module explores yearial Differentiation and Applications; multiple Integrals - definition, change of variables, Jacobian, applications; ordinary Differential Equations - separable, homogeneous, exact, linear, integrating factors; linear Differential Equations with Constant Coefficients.

CTL 1101 Conflict, Transformation And Leadership 10 Credits
The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

SERVICE MODULES
Semester I
SCH 1116 Organic Chemistry for SBB, ESH, EFW, TXT 10 Credits
The module outlines the structures and bonding in organic molecules; alkanes, alkenes, and alkynes. It is an introduction to organic chemical reactions and mechanisms; isomerism and Stereochemistry; benzene and its Derivatives; cyclohexane and carbohydrates; amino acids and the functions of various spectroscopes.

SCH 1120 Physical Chemistry For Engineers (TCE) 10 Credits
The module examines the fundamental Concepts of Thermodynamics; the 1st Law of Thermodynamics; the 2nd and 3rd Laws of Thermodynamics; chemical Equilibrium; phase Equilibria; ideal and Real Solutions; electrolyte Solutions; ions in solution; electrode Process; Chemical Kinetics; interfaces and colloidal Dispersions.

Semester II
SCH 1217 General Chemistry for SBB, ESH 10 Credits
The module covers the fundamental Ideas Of Chemistry; stoichiometry; atoms And Sub Atomic Particles; electronic Structures Of Atoms; periodicity and Chemical Bonding; chemical Thermodynamics; chemical Kinetics; chemical Equilibrium; ionic equilibrium; electrochemistry and nuclear chemistry.

SCH 1221 Organic Chemistry for Engineers (TCE) 10 Credits
The module explores structures and bonding in organic molecules; alkanes, alkenes and alkynes. It is an introduction to organic chemical reactions and mechanisms; isomerism and Stereochemistry; benzene and its Derivatives; cyclohexane and carbohydrates; amino acids and the function of various Spectroscopes.

YEAR II

Semester I
SCH 2104 Physical Chemistry I 12 Credits
This module introduces students to interactions and distributions, chemical thermodynamics, phase equilibria, solutions and mixtures.

SCH 2106 Analytical Chemistry II 12 Credits
The module introduces students to Instrumental Analytical Chemistry; spectrometric and Electrochemical methods of analysis and the respective instrumentation are discussed.

SCH 2107 Polymer Science I 12 Credits
The module provides an introduction to polymer classification; polymerization (mechanisms);polymerisation techniques; natural and synthetic fibres; natural rubber, extraction, synthetic rubber and vulcanisation of rubber.

SCH 2108 Transport Phenomena 12 Credits
The module includes: Introduction to Chemical Engineering, Dimensional Analysis, Transport Phenomena, Momentum Transfer (Fluid Statistics, Fluid Dynamics, Flow and Pressure Measurements, Pumping of Fluids), Heat Transfer (Heat Transfer by Conduction, Convection and Radiation Calculation of Heat Transfer Coefficients, Heat Transfer Equipment) and mass Transfer.

SORS 2110 Introduction to Applied Statistics 10 Credits
The module looks at numerical methods: Errors , absolute and relative; the solution of nonlinear equations; the solution of linear systems; interpolation and polynomial approximations; curve fitting.; numerical differentiation and integration; approximate solution of ordinary differential equations; probability and Statistics: Probability, probability distributions, random variables, moments, principle of statistical inference, estimator and hypotheses testing.

SCH 2114 Industrial Inorganic Chemistry I 12 Credits
The module includes: Industrial Gases; Nitrogen industries; sulphur and sulphuric acid; phosphorus industries, ceramic industries. Introduction to nanoscience and nanotechnology.

Semester II
SCH 2117 Heterocyclic Chemistry I 12 Credits
The module introduces students to the structures, nomenclature, bonding, aromaticity, preparation, reactions and reaction mechanisms for monocyclic heterocyclic compounds. Synthesis of selected compounds which contain hetero atom(s) will be covered.

SCH 2204 Physical Chemistry II 12 Credits
Module deals with ions in solution, electrode processes, chemical kinetics, interfaces and colloidal dispersions.

SCH 2207 Polymer Science II 12 Credits
Module includes: Polymer solution and solubility properties, polymer structures and properties of polymers with details in crystallization, polymer morphology and the amorphous state of polymers. concept of molecular weight. Chemical analysis and thermal analysis.

SCH 2208 Unit Operations 12 Credits
Module includes: Material and Energy Balances, Unit Operations used in Chemical Industry, Binary and Multicomponent Distillation ; Evaporation; Liquid Extraction; Leaching and so on.

SCH 2211 Quality Assurance Management And Control 12 Credits
Module includes: Creativity and Creative thinking, Statistical Quality Control, TQM, ISO standards, Management of Quality in Chemical and Allied Industries.

SCH 2215 Industrial Organic Chemistry I 12 Credits
The module looks at coal and Wood Chemicals, Pulp and Paper Industry; destructive Distillation of Coal, Coking of Coal, Distillation of Coal Tar, Coal to Chemicals, Distillation of hard wood, Hydrolysis of wood cellulose derivatives Fire retardants. Manufacture of Pulp and Paper. It also looks at explosives: Raw materials, manufacture of Explosives as well as the types and use of Explosives

YEAR III
SCH 3001 Industrial Attachment 120 Credits

YEAR IV

Semester I
SCH 4108 Chemical Engineering Plant Design 12 Credits
The module looks at the fundamentals of materials and energy balances; flow sheeting, computer-aided design, equipment selection and specification; techniques for Economic Analysis and Evaluations as well as costs of Process Equipment.

SCH 4114 Industrial Inorganic Chemistry II 12 Credits
Module includes: selected topics on salts and its compounds and chlor-alkali industries. It also looks at salt and salt compounds: Common Salts; Sodium sulfate; Sodium Bisulfite; Sodium Sulfite, Sodium Silicates as well as chlor-Alkali Industries: Manufacture of Soda Ash, Sodium bicarbonate, Manufacture of Chlorine and Caustic Soda; Bleaching Powder; Sodium Hypochlorite and Sodium Chlorite.

SCH 4115 Industrial Organic Chemistry II 12 Credits
The module deals with agrochemicals such as pesticides, natural as well as synthetic pesticides which include pyrethroids, nicotine, rotenoids, avermectins, organochlorine, organophosphates, carbamate, herbicides and repellent. It also looks at soaps and detergents industries.

SCH 4010 Project 10 Credits
The project is run over two semesters (Part IV, Semester I and Semester II). Students are expected to undertake a Chemistry related research project in any area of their choice. This is expected to enhance their research, laboratory and problem solving skills.

Semester II
SCH 4208 Reactor Technology 12 Credits
The module explore reaction rates, extents of reactions optimum yields; Generalised material and energy balances for batch, Single and multiple continuously stirred tanks, tubular and fixed bed reactor; Prediction of residence time distribution for continuously starred and tubular reactors as well as heterogeneous reaction. The catalyst reactors are discussed.

SCH 4206 Analytical Chemistry III 12 Credits

Module content includes the steps in an analytical investigation (selecting of a method of analysis, sampling, preliminary sample treatment, separation, measurement, assessment of results), organisation and management of a chemical laboratory in industry. It also covers the quality control in industrial chemistry and the automation of Analysis.

SCH 4210 Project Development And Management 12 Credits

This module is on project development: Initiating the Project; Objects, Processes and Projects; Project Descriptions and Control Organising the Project; Limits of the Project; Project Management; Project Control Process; Organising the Project; Organisational function and limits, Control Communication, Project groups, planning functions, meetings etc. Forms and Specifications for the contents of Documents for Project Control; Reports; Document Files and Practicals.

SCH 4214 Industrial Inorganic Chemistry III 12 Credits

Module deals with selected topics on Metals and Metallurgical Processes; gold, PGMs, Diamonds, Iron and Steel as well as Copper Alloys.

SCH 4215 Industrial Organic Chemistry III 12 Credits

Module deals with selected topics on pharmaceuticals industries-natural and synthetic drugs including synthesis; Vitamins, hormones; Virus such as swine flu, bird flu, Zika virus, synthesis of Tamiflu; fermentation industries- ethanol, citric acid and lactic acid; textile industries-intermediate compounds and their synthesis require for manufacture of various types of dyes; polymer industries-industrial process for manufacturing LDPE, HDPE and polystyrene.

SCH 4217 Heterocyclic Chemistry II 12 Credits

This module further discusses porphorins and porphobilinogen; properties and preparation of condensed five membered ring systems, six-membered ring systems, condensed six-membered heterocycles; selected drugs and their synthesis. Natural products which contain heteroatom(s) will be covered.

SCH 4292 Chromatographic Separations 12 Credits

This module shall introduce students to chromatographic theory and also develop their knowledge and understanding of various chromatographic techniques and their applications in various matrices. The topics covered include: Introduction to Chromatographic Theory (chromatographic retention, peak shape, band broadening and column efficiency, column resolution), gas chromatography (instrumentation, mobile phases, columns and stationary phases, detectors and applications), HPLC (instrumentation, separation modes, mobile phases, stationary phases and applications); Planar chromatography and supercritical fluid chromatography.

SCH 4010 Project 10 Credits

The project is run over two semesters (Part IV, Semester I and Semester II). Students are expected to undertake a Chemistry related research project in any area of their choice. This is expected to enhance their research, laboratory and problem solving skills.

MASTERS DEGREE PROGRAMME SPECIAL REGULATIONS

MASTER OF SCIENCE DEGREE IN ANALYTICAL CHEMISTRY

1.0 Degree Profile of Master of Science Degree in Analytical Chemistry

INSTITUTION: National University of Science and Technology

TYPE OF DEGREE: Masters

CREDIT LOAD: 305 Credits

LEVEL: SADC-QF - Level 9

ACCREDITATION ORGANISATION(S):

PERIOD OF REFERENCE:

PURPOSE OF THE PROGRAMME

This programme is designed to provide comprehensive training in analytical chemistry and its implementation. This industrially relevant programme shall provide a student with a strong background in the theory of analytical techniques and give a student the ability to apply these techniques to complex analytical problems. There is an opportunity to study a specialised module in the area of pharmaceutical and clinical analysis.

On completion of this programme students shall be able to identify, formulate, analyse and solve problems in the analysis of chemical compounds. They shall also be able to manage effectively advanced investigations in analytical chemistry, showing the abilities to plan, execute, communicate and critically review the success of an investigation**.**

PROGRAMME CHARACTERISTICS

Areas of Study: Spectroscopic methods, chemical, pharmaceutical and environmental analysis.

Specialist Focus: The characterisation and analysis of materials in the environmental, pharmaceuticals, metallurgical and chemical industries.

Orientation: Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Chemist in Pharmaceutical, mining, fertilizer, rubber, metallurgical, chemical Research, Academia, Fermentation, Food and dairy industries. Quality control and Water treatment plants.
Further Studies:	PhD in Analytical Chemistry

TEACHING AND LEARNING

Teaching and Learning Methods:	Lectures, tutorials, laboratory classes, seminars, group work and individual independent study
Assessment Methods:	Written and oral examinations, assignments, tests, seminar presentations, mini-research project report, final year research project report.

2.0 REGULATIONS

These Regulations shall be read in conjunction with the Faculty Regulations and General Academic Regulations.

3.0 ENTRY REQUIREMENTS

The normal entry qualification shall be an Honours Degree with at least a 2.2 classifications or better in Chemistry.

4.0 DURATION

The programme shall be offered over a period of 18 months (three (3) semesters) on full-time study and 24 months on block release (four semesters)

5.0 STRUCTURE

5.1 Full-time Programme

The programme consists of 8 taught modules and a research project work leading to a dissertation. The first 12 months are devoted to 8 taught modules and equally divided into two semesters. The last 6 months are devoted to a research project and the writing of a supervised dissertation.

The research project may be undertaken in the Department, at an industry or any other institution approved by the Departmental Board. The dissertation shall normally be submitted at least one month before the end of the third semester of the Degree programme

5.2 Part-time Programme

The programme consists of 8 taught modules and a research project work leading to a dissertation. The 8 taught modules shall be equally divided into the four (4) blocks. Each semester consists of two blocks and in each block, 2 modules shall be taught.

The research project shall commence at the anytime after the second semester examination. It may be undertaken in the department, at an industry or any other institution approved by the Departmental Board. The dissertation shall normally be submitted at least one month before the end of the fourth semester of the Degree programme

5.3 The weighting of modules shall be based on the notional study hours (NSH) credit system in which all learning activities of a student of average ability, taking place in and outside scheduled contact sessions, are taken into consideration (1 credit = 10 notional hours). A student must attain a prescribed minimum number of credits to qualify for the award of a degree or diploma.

6.0 ASSESSMENT

6.1 A student shall be assessed through Continuous Assessment (25%), and a written examination (75%) for all modules without a practical component; for a module that has a Practical component, Continuous Assessment shall comprise 20%, practical component, 20%, and the final written examination, 60% of the overall mark.

6.2 A student registered for the MSc in Analytical Chemistry shall be required to pass all the Modules for which they have registered.

6.3 The overall minimum pass mark in any module shall be 50%.

6.4 A student who fails a module shall be allowed to proceed to the next Part of the Degree programme whilst carrying the
failed module.

6.5 A student may be allowed to proceed carrying not more than 25% of the number of normally scheduled Modules in a particular year of a programme.

6.6 A Students shall be required to submit two typed and spiral bound copies of the dissertation for assessment.
On submission of a satisfactory dissertation, the student shall be required to defend his/her work before a panel of Departmental Examiners. The project module shall be assessed by oral presentation which shall constitute 25% and a dissertation which shall constitute 75% of the overall assessment.

7.0 WEIGHTING

The weighting of the programme shall be as follows:
Taught modules shall contribute 60% (185 Credits)
The research project shall contribute 40% (120 Credits)

8.0 AWARDING OF A POST-GRADUATE DIPLOMA

Students who pass, or are credited with, all eight taught modules (185 Credits), but do not successfully complete the project, shall be awarded a Postgraduate Diploma in Analytical Chemistry.

PROGRAMME SUMMARY

PART I

SEMESTER I

Module Code	Module Description	Credits
SCH 5101	Research methodology and scientific writing	24
SCH 5102	Advanced data-driven chemistry	23
SCH 5103	Advanced sampling and sample preparation	23
SCH 5104	Advanced chromatographic separation and mass spectrometry	23

SEMESTER II

SCH 5205	Thermal analysis and electro analysis	23
SCH 5206	Spectroscopic methods	23
SCH 5207	Environmental analysis	23
SCH 5208	Pharmaceutical and clinical analysis	23

PART II

SEMESTER I

SCH 6111	Research project	120

MODULE SYNOPSES

PART I

SCH 5101 Research Methodology And Scientific Writing 24 Credits

The module looks at the nature and concept of research; type of research and tools of research; research design and conceptualization; survey of research and data collection techniques; scientific and technical writing and research ethics. In the seminar each student is required to carry out a literature review of an analytical topic assigned to him/her and make a presentation on their dissertation topic covering literature review, the scope and purpose of their research.

SCH 5102 Advanced data-driven chemistry 23 Credits

The module looks at data analysis: Modern data analysis techniques, Minitab, R, Origin, Sigma Plot. Practical predictive analytics, models and methods. Data visualization and communication; design of experiments, cheminformatics: Representations of chemical structures; sources of chemical information; molecular properties; molecular similarity and diversity; chemo metrics: Quantitative Structure-Activity Relationships (QSAR) and Predictive Models; combinatorial libraries; structure-based drug design; analysis of high-throughput screening data; advanced sampling and sample preparation; advanced chromatographic separation and mass spectrometry.

SCH5103 Advanced sampling and sample preparation 23 Credits

The module explores sampling theory and methodology: Theory of extraction; sample preservation and stabilization techniques; sample contamination and control; sample homogenization; standards, techniques and method development. It also looks at sampling and sample preparation applications: Quality control and assurance in sampling; sampling strategy for process control; sampling methods in food analysis; as well as advanced sampling methods; passive samplers, SPE, SPME.

SCH5104 Advanced chromatographic separation and mass spectrometry 23 Credits

The module examines fundamentals of Chromatographic Separation: Mechanisms of separation; gas and liquid; detection and data-analysis; fundamentals of Mass Spectrometry: Fundamentals of ion motion and selection; mass spectrometry instrumentation; mechanisms of ionizations; ionization techniques; applications of chromatography and mass spectrometry: ambient mass spectrometry ; high resolution mass spectrometry as well as mass spectrometry based proteomics.

SCH5205 Thermal analysis and electro analysis 23 Credits

The module looks at thermal Analysis: Thermal gravimetric analysis; differential thermal analysis; differential scanning calorimetry; hyphenated analytical techniques e.g TA-MS, TA-FTIR, electroanalysis: Amperometric technique; voltammetric technique, potentiometric technique and electrolytic conductivity.

SCH 5206 Spectroscopic Methods 23 Credits

The module is an introduction to spectroscopy; infrared, Raman, Nuclear magnetic resonance spectroscopy, X-ray diffraction; atomic absorption, inductively coupled plasma spectrometry; atomic, X-ray, molecular fluorescence and phosphorescence spectrometry as well as chemiluminescence.

SCH 5207 Environmental analysis 23 Credits

The module looks at fate and transport of chemical pollutants: Types of contaminants. Physical/chemical distribution among phases/media; biogeochemical processes in soils and groundwater; transport of contaminants; environmental analytical chemistry: Chemical analysis; biochemical analysis; air quality standards; water and waste water quality standards as well as good laboratory practices. ISO17025.

SCH 5208 Pharmaceutical and clinical analysis 23 Credits

The module looks at drug discovery and development: Pharmacokinetics and pharmacodynamics; drug approval process; drug stability testing; design and analysis of clinical trials; formulation development and evaluation; advanced pharmaceutical compound analysis: Sample handling, storage and preparation; medical nanotechnology techniques; biological methods of drug analysis; advanced methods in analysis of biopharmaceuticals and quality assurance; GLP and GMP

PART II

SCH 6111 Research project 120 Credits

Students shall be encouraged to come up with research topics of their choice for their research projects. Such projects shall be approved by the Departmental Board before they embark on them.

DEPARTMENT OF APPLIED MATHEMATICS

Lecturer and Chairperson
Mr Farikayi K. Mutasa, MSc Industrial Mathematics, NUST, BSc Hons Applied Mathematics, NUST, Postgrad Dip in Higher Education, NUST.

Associate Professor
Senelani Dorothy Hove-Musekwa, DPhil Mathematical Epidemiology, UZ,
MSc Mathematical Modelling, UZ, B.A. Special Hons Mathematics, UZ, B.A Gen, UZ
Graduate Certificate in Education, UZ.

Senior Lecturer
Sarudzai Showa, DPhil Applied Mathematics, NUST, MSc Mathematics, UZ, BSc Hons Mathematics, MSU.

Lecturers
Chipo Mufudza, PhD Statistics, Çukurova, MSc Mathematics, UZ, BSc Hons Applied Mathematics, NUST.

Edward. T. Chiyaka, MSc Mathematics, UZ, BSc Hons Mathematics, UZ, Postgrad Dip in Higher Education , NUST.

Masilin Gugoshava, DPhil Marine, Earth and Atmospheric Sciences, North Carolina State, MSc Industrial Mathematics, NUST, BSc Hons Applied Mathematics, NUST, Postgrad Dip in Higher Education, NUST.

Mbakisi Dube, MSc Applied Mathematical Modelling, NUST, BSc Hons Operations Research and Statistics, NUST, Postgrad Dip in Higher Education, NUST.

Mlamuli Dhlamini, MSc Industrial Mathematics, NUST, BSc Hons Applied Mathematics, NUST.

Nomatter Chiduku, MSc Industrial Mathematics, NUST, BSc Hons Applied Mathematics, NUST, Postgrad Dip in Higher Education, NUST.

Nothabo Dube, DPhil Plant and Soil Science, Texas Tech, MS in Statistics, Texas Tech, MSc Industrial Mathematics, NUST, BSc Hons Applied Mathematics, NUST, Dip in Secondary Teacher Education, Belvedere Teachers College.

Simbarashe Chipindirwi, MSc Mathematical Biochemistry, Lethbridge, MSc Mathematics, UZ, BSc Hons Applied Mathematics, NUST.

Tinashe B. Gashirai, MSc Applied Mathematical Modelling, NUST, BSc Hons Applied Mathematics, NUST.

Research Fellow

Noble Malunguza, DPhil Applied Mathematics, NUST, MSc Industrial Mathematics, NUST, BComm Hons Actuarial Science, NUST, Postgrad Dip in Higher Education , NUST.

Senior Technician

Peter Chiguvare, MSc Information Systems, NUST, MSc Operations Research, NUST, BSc Hons Computer Science, NUST, Microtech City and Guilds I and II, HND Computer Science, ZFETC, ND Computer Science, NID Information Processing.

Secretary

Judith Muzvidziwa, BComm Hons Office Management, GZU, HND in Office Management, Bulawayo Polytech, ND in Secretarial Studies, Masvingo Polytech.

UNDERGRADUATE DEGREE PROGRAMME SPECIAL REGULATIONS

BACHELOR OF SCIENCE HONOURS DEGREE IN APPLIED MATHEMATICS

1.0 Bachelor of Science Honours Degree in Applied Mathematics

Degree Profile

Institution:	National University of Science and Technology
Type of Degree:	Honours
Credit Load:	480 credits
Level:	SADC-QF - Level 8
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	From 2018

PURPOSE OF THE PROGRAMME

To develop knowledge, skills and competences in the field of Applied Mathematics relevant to various employment capabilities and careers in the world of work and society. To prepare students for further studies and lifelong learning in Applied Mathematics.

PROGRAMME CHARACTERISTICS

Areas of Study:	Algebra; Calculus; Discrete Mathematics; Computational Mathematics; Modelling; Mechanics; Probability and Statistics; Optimization; Mathematical Analysis, Operations Research
Specialist Focus:	Use of mathematical techniques and models to obtain practical solutions to concrete problems
Orientation:	Research, teaching and learning are professionally oriented and focused on real life problems
Distinctive Features:	Solving problems from many branches of science, engineering, information technology and commerce

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability	Careers in the retail and manufacturing industry; banking, finance and

	insurance industry; research institutions; non-governmental organisations; positions in academia, data mining
Further Studies:	Master's and Doctoral studies in Applied Mathematics

PROGRAMME DELIVERY

Teaching and Learning Methods:	Lectures, tutorials, computer laboratory classes, seminars, group work, industrial visits, industrial attachment, research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, seminar presentations, industrial attachment report, final year research project report.

PROGRAMME COMPETENCES

Generic:

1. **Multidisciplinarity**: Ability to define and solve problems from multiple academic disciplines
2. **Quantitative and innovative reasoning:** Capability to draw on big data and use analytics for informed decision making and strive to seek new ways of doing things
3. **Communication skills**: Ability to communicate effectively and to present information orally and in writing and using ICTs to both expert and non-expert audiences
4. **Analysis and synthesis**: Capacity for analysis using mathematical methods and synthesis using logical arguments and proven facts
5. **Ethical commitment:** Professional integrity and awareness of impact of applied mathematics on society and the environment
6. **Entrepreneurial skills:** Capability to identify and create new business ventures based on knowledge and new thinking paradigms

Discipline specific:

1. **Deep knowledge:** Ability to analyse data in terms of underlying principles and knowledge and by means of appropriate mathematical methods
2. **Production skills:** Ability to formulate and use mathematical models to better understand the real world for sustainable development
3. **Technology development skills:** Ability to develop new technologies in applied mathematics with a view to enhance production efficiencies and outputs in industry
4. **Problem-solving skills**: Ability to solve a wide range of problems in applied mathematics by identifying their fundamental aspects and using both theoretical and practical methods
5. **Analytical and computational skills**: Ability to use data to analyse various phenomena and technological issues using appropriate computer packages

Intended Learning Outcomes

1. Ability to approach problems in an analytical and rigorous way, formulating theories and applying them to solve problems in business, engineering, the sciences, and other fields;

2. Ability to analyse and interpret data, finding patterns and drawing conclusions to support and improve business decisions;
3. Ability to develop mathematical and statistical models
4. Ability to breakdown a complex system into simple and understandable models
5. Ability to design and conduct observational and experimental studies
6. Ability to demonstrate knowledge and understanding of fundamental concepts in areas of applied mathematics
7. Ability to use mathematical and statistical packages to model and solve problems in applied mathematics
8. Ability to deal with abstract concepts and to think logically
9. Ability to present mathematical arguments and conclusions with accuracy and clarity
10. Ability to identify problems in industry and the community and develop appropriate solutions
11. Develop mathematical models to solve current practical problems
12. Communicate effectively and present information methodically and accurately using multi-media

2.0 REGULATIONS

These regulations should be read in conjunction with the Faculty of Applied Science and NUST General Academic Regulations.

3.0 Mode of Study

The BSc (Hons) Degree in Applied Mathematics is offered on fulltime over a period of four years. A student is required to register for the requisite modules, participate in an Industrial Attachment and carry-out a research project that will culminate in a thesis report. A student shall be required to earn a minimum of 480 credits to successfully complete the programme.

PROGRAMME SUMMARY

Modules
Year I –
Semester I

Module Code	Module Description	Credits
SMA1101	Calculus	10
SMA1102	Linear Algebra	10
SCS1101	Introduction to Computer Science and Programming	10
SMA1103	Discrete Mathematics	10
SPH1101	Mechanics	10
SMA1108	Introduction to Computer Packages in Mathematics	10

Year I
Semester II

Module Code	Module Description	Credits
SMA1201	Calculus of Several Variables	10
SMA1204	Ordinary Differential Equations	10
SMA1202	Real Analysis	10
SCS1206	Visual Basic Programming Concepts and Development	10
SORS1201	Applied Statistics	10
CTL1101	Conflict Transformation and Leadership	10
Year I Total Credits		**120**

Year II
Semester I

SMA2102	Advanced Linear Algebra	10
SMA2103	Theoretical Mechanics	10
SMA2108	Computer Packages in Mathematics	10
SORS2103	Probability Theory	10
SORS2105	Linear Programming	10
SORS2104	Operations Research Techniques	10

Year II
Semester II

SMA2201	Complex Analysis	10
SORS2203	Optimisation	10
SORS2206	Survey Methods	10
SMA2206	Numerical Analysis	10
SMA2204	Partial Differential Equations	10
SMA2209	Mathematical Modelling	10
Year II Total Credits		**120**

Year III –
Semester I and Semester II

SMA3010	Industrial Attachment	120

Year IV
Semester I

SMA4103	Fluid Mechanics	10
SMA4135	Dynamical Systems	10
SMA4162	Numerical Methods for Differential Equations	10
SMA Elective		10
SMA Elective		10
SMA4010	Project	

YEAR IV
Semester II

SMA4211	Functional Analysis	10
SMA4236	Control Theory	10
SMA4241	Financial Mathematics	10
SMA Elective		10
SMA Elective		10
SMA4010	Project	20
Year IV Total Credits		120
Total Credits For The Programme		**480**

Year IV
Semester I
Electives

SMA4112	Modern Algebra	10
SORS4102	Statistical Inference	10
SMA4172	Mathematical Programming	10
SORS4106	Experimental Design and Multiple Regression	10
SMA4107	Time Series and Simulation	10

Year IV
Semester II
Electives

SMA4234	Viscous Flow	10
SMA4213	Graph Theory	10
SORS 4207	Multivariate Analysis	10
SMA4253	Categorical Data Analysis	10
SMA4273	Queuing Theory and Stochastic Processes	10
SORS4210	Official Statistics	10

The choice of electives shall be offered subject to staff availability.

3. SERVICE MODULES

MODULES		**Credits**
SMA1111	Mathematics for Science I	10
SMA1112	Preparatory Mathematics	10

SMA1211	Mathematics for Science II	10
SMA1116	Engineering Mathematics IA	10
SMA1216	Engineering Mathematics IB	10
SMA2116	Engineering Mathematics II	10
SMA2217	Engineering Mathematics III	10
SMA3116	Engineering Mathematics IV	10

MODULE SYNOPSES

YEAR I

SMA1101 Calculus **10 Credits**

The module looks at the limits of functions; one-sided and infinite limits; continuity; differentiation: definition, basic properties, Rolle's theorem, mean value theorem, Cauchy's mean value theorem, Leibniz's rule, applications, Taylor series as well as integration: definite integrals, antiderivatives, fundamental theorem of calculus, improper integrals, Gamma and Beta functions, definition of natural logarithm as integral of 1/x and exponential as inverse. It also covers area, volume of revolution, arc length, surface area; parametric equations: arc length, surface area; polar coordinates; graph sketching; area in polar coordinates; complex numbers; algebra of complex numbers; DeMoivre's theorem and exponential form.

SMA1102 Linear Algebra **10 Credits**

The module explores vector Algebra: scalar and vector product. Collinear, coplanar vectors; applications; equations of lines and planes; matrices: products, sums, echelon form, rank, inverse; determinants: definition, properties, evaluation; systems of Linear equations, Gauss's method, Cramer's rule, homogeneous systems as well as vector Spaces: definition, linear independence, bases, subspaces.

SCS 1101 Introduction To Computer Science And Programming

10 Credits

The module examines information and Knowledge Societies, Evolution of Computers, Computer Organisation and Architecture: CPU; Memory; I/O, Number Systems and Conversions (Bin; Dec; Hex; Oct), Concepts of Computer Languages: high\low level languages; compiler; interpreter, Programming Techniques: grammar; recursion; Variables; Data types; Initialization; Comments; Keywords; Constants; Assignment, Programming constructs: branching; looping; recursion; Programming using data structures: arrays; lists; trees; hash tables; queues; stacks; files, Programming Algorithms for Problem Solving: Sorting; compression; numerical and encryption, Fundamentals Operating System, Fundamentals Data Bases as well as the Fundamentals of Networks.

SMA1103 Discrete Mathematics **10 Credits**

This module looks at sets; union, Intersection, Compliment, Empty and Universal sets; number systems; natural Numbers, Integers, Rationals; induction; field axioms; order axioms; completeness; real numbers; decimal representation; irrationals; interval notation; inequalities; functions; definition; domain, range, inverse functions; logic; predicate calculus; truth tables; proportional calculus; methods of proof; contrapositive; converse; contradiction and combinatorics.

SPH1101 Mechanics (10 Credits)

The module is on kinematics and Kinetics: Inertial frames of reference; motion in two and three dimensions; dynamics of system of particles; interactions between bodies, relative motion; conservation of momentum and energy; motion of systems of particles with variable mass; collisions of particles. Rotational Dynamics: Rotation of rigid bodies; moment of inertia and its calculations for bodies of various shapes and about different axes; work and energy in rotational motion; angular momentum; principles of conservation of angular momentum; gravitation: Kepler's laws of planetary motion; gravitational potential; gravitation and gravity; effect of earth's rotation on "g"; gyroscope; motion of a satellite; coriolis force; the fundamental forces and their unification; inertial forces in linearly accelerating frame; oscillatory motion; simple harmonic motion; mechanical oscillators; superposition of S.H.M's. damped and forced S.H.M., Lissajous Resonance. It also looks at properties of Matter:Hooke's law; modulli of elasticity and their inter –relationship; applications of elasticity; fluid mechanics: Fluid at rest; surface tension and capillarity; the continuity equation; various types of flows; boundary layers and turbulence; steady state flow of fluids; Bernoulli's equation; viscous flow and viscosity. Friction: Nature of frictional forces; motion in frictional medium and rolling and sliding friction. It also covers relativity: Space-time frames of reference; Galileo's principle of relativity; simultaneity of events; Einstein's Special theory of relativity; Lorentz transformations; momentum and energy systems.

SMA1108 Introduction To Computer Packages In Mathematics 10 Credits
This module shall be a practical module, dealing with the use of computers in a variety of fields through the use of software tools. This is an introductory module in scientific writing, computer algebra and data analysis. It is an introduction to scientific writing; mathematical package; spreadsheet and a statistical package.

SMA1201 Calculus Of Several Variables 10 Credits
The module explores cartesian coordinates in three dimensions; functions of several variables; quadric surfaces; curves; partial derivatives; tangent planes; derivatives and differentials; directional derivatives; Chain rule. Div, grad and curl; Maxima and minima; lagrange multipliers; double and triple integrals; change of order; change of variable; polar and spherical coordinates; line and surface integrals; green’ theorem in the plane; divergence theorem; stokes theorem and applications.

SMA1204 Ordinary Differential Equations 10 Credits
The module looks at first order differential equations; separable, linear, exact; integrating factors; existence, uniqueness and applications; second Order Equations; linear equations and linear differential operators; linear equations and linear differential operators; linear independence, Wronskian; ordinary Linear Differential Equation with constant coefficients; undetermined coefficients; variation of parameters; applications; systems of equations; phase plane portraits for Linear systems; introduction to Non-linear systems; predator-prey and Lotka - Volterra equations; series solution of ordinary differential equations; method of Frobenius; legendre polynomials and Bessel functions.

SMA1202 Real Analysis 10 Credits
This module explore real numbers; completeness, Supremum and Infimum; maximum and Minimum; sequences; definition of convergence; uniqueness of limits; continuity of algebraic operations; bounded sequences; subsequences; bolzano-Weierstrass Theorem, cauchy sequences; series; definitions, elementary properties; series of positive terms; comparison test, ratio test, root test.; integral test; alternating series; absolute and conditional convergence; power series; limits of functions; continuity; taylor’s theorem (with remainder); riemann integration.

SCS1206 Visual Programming Concepts And Development **10 Credits**

The module examines the structure and Nature Of Visual Applications, user interface Contexts (webpage; business applications; mobile applications; games), Canonical uses (GUIs; mobile devices; robots; servers) , Events and event handlers, Separation of model, view, and controller, Visual Design Elements :Object; Controls; Windows; Forms; Dialogues; Templates; Panels; Panes; etc., user-centred development, interaction design: Physical capabilities; Cognitive models, Social models, Principles of good design and good designers, Accessibility, Principles of graphical user interfaces (GUIs), Elements of visual design, User interface standards, Functionality and usability requirements, Techniques for gathering requirements, Internationalisation, interaction styles and techniques, Representing information to users, Design, implementation and evaluation of non-mouse interaction.

SORS1201 Applied Statistics **10 Credits**

The module is an introduction to Applied Statistics; Statistics: its definition and scope; Descriptive Statistics/Initial Data Exploration: summary statistics, measures of central tendency, mean, mode, median, measures of dispersion, range, variance, standard deviation, Graphical presentation of data, stem and leaf plots, histograms, box plots. Point Estimation/Tests of Hypothesis, interval estimation, $z-test$, $t-test$; Design and Analysis of Experiments, completely randomised designs, randomised complete block designs, Latin squares, factorial designs; Simple linear regression and Statistical computing.

CTL1101 Conflict Transformation And Leadership **10 Credits**

The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

YEAR II

SMA2102 Advanced Linear Algebra **10 Credits**

This module highlights linear Mappings; Matrix representation; Change of basis; Kernel and image of linear mapping; Vector spaces, basis, dimensions; Eigenvectors and eigenvalues; Diagonalization. Basis of eigenvectors; Orthogonal bases; Method of Gramm-Schimdt; Inner product spaces; Cayley-Hamilton theorem; Jordan form and Quadratic forms.

SMA2103 Theoretical Mechanics **10 Credits**

The module looks at frames of reference; Motion of particle in two or three dimensions; Work, power energy for variable forces; Conservative forces; Motion of a system of particles; Rigid body motion; Generalized coordinates; Lagrange's and Hamilton's equations.

SMA2108 Computer Packages In Mathematics **10 Credits**

This module shall be a practical module, dealing with the use of computers in a variety of fields through the use of software tools. It is designed to complement the understanding of some Statistical and Mathematical concepts through practical use. Statistical packages, including data handling, descriptive statistics, distribution fitting, graphs and Mathematical packages including: Solution of equations, Limits, Differentiation and Integration; the Solution of first and second order differential equation and the Solution of systems of linear equations shall be covered.

Sors2103probability Theory **10 Credits**

This module examines probability: random/statistical experiments, sample spaces, events, set theory; Axioms of probability; Laws of probability; Finite sample spaces; Conditional probability, independent events; Random variables and probability distributions; Discrete probability distributions; Continuous probability distributions; Discrete bivariate distributions; Continuous bivariate distributions; Marginal probability distributions; Independent random variables; Conditional probability distributions; Distributions of functions of a single random variable; Conditional probability distributions of mathematical expectations; expectations of discrete and continuous random variables; Expectation of a function of a single random variable; Expectation of a function of several random variables; Properties of expectations; Variance and covariance; Markov and Chebyshev inequalities; Moment generating functions; Properties of moment generating functions; Special Distributions: Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson, Normal, Gamma, Weibull, Exponential and Beta.

SORS2105 Linear Programming **10 Credits**

The module looks at model formulation Solution methods: graphical, simplex, two phase, computer solutions; Duality and sensitivity analysis; Transportation: initial feasible solution methods—north-west corner, least cost, Vogel's methods; Balanced and unbalanced problems, unacceptable routes, degeneracy, Transhipment problems, Assignment problems; Integer Programming: model formulation; Solution methods: graphical, branch and bound method, cutting plane algorithm, implicit enumeration method; Goal programming: model formulation as well as Goal programming algorithms—the weighting and pre-emptive methods.

SORS2104 Operations Research Techniques **10 Credits**

This module explores project management: Critical path analysis. Deterministic activity times. Probabilistic activity times. Gantt charts. Resource scheduling. Cost crashing. Inventory Models: Deterministic demand models: Economic order quantity, Economic production lot size, Economic order quantity with backorders, Quantity discounts. Probabilistic demand models: Single period models, safety stock, Multiple period models. Inventory control: Material requirements planning, materials resource planning, product structure, gross requirements, net requirements. Network Analysis: Terms and definitions; Minimum Spanning Tree problem (Kruskal's Algorithm); Shortest Route problem (Dijkstra's Algorithm); Network Flow problems: Maximum network flow problem (Ford-Fulkerson Labelling Algorithm), Max-flow Min-cut Theorem, Integral flows; Heuristic Problem Solving: Ill structured problems, Heuristics- the human approach to problem solving, Satisfying, heuristic procedures and programs. A case study (e.g. solving a facility location problem) will be looked at.

SMA2201 Complex Analysis **10 Credits**

The module will look at the analytic functions; Cauchy-Riemann Equations; Conformal Mappings; Line Integrals; Cauchy's Integral Theorem and Formula; Power series; Taylor series, Laurent series; Zeros and singularities; The Residue Theorem; Evaluation of real integrals and series.

SORS2203 Optimisation **10 Credits**

The module looks at the deterministic and stochastic dynamic programming; Markov programming: value and policy iteration procedure; Advanced Linear Programming: The revised simplex algorithm, validity proofs of the simplex method, use of column generation to solve large-scale linear programming problems, bounded variables algorithm, parametric linear programming, Dantzig-Wolfe decomposition algorithm as well as the Karmarkar interior point algorithm.

SORS2206 Survey Methods **10 Credits**

This module explores simple random sampling, sample size estimation; Systematic sampling; Sample survey and questionnaire design, postal and telephone questionnaires, interviewer-administered questionnaires; Errors in sample surveys; Ratio and regression estimators, separate and combined ratio estimators; Stratified populations and stratified simple random sampling, optimum allocation and Neyman allocation; Cluster multi-stage sampling and the survey method project.

SMA2206 Numerical Analysis **10 Credits**

The module looks at errors in numerical analysis; Taylor Series; Solutions of equations in one variable: Bisection and Newton-Raphson methods; Fixed point iteration; Order to convergence; Direct and iterative methods of solving linear systems; Gaussian elimination with scaled partial pivoting; Jacobi and Gauss-Seidel iterations; Convergence criteria; Interpolation and extrapolation; Lagrange interpolating polynomial; Newton interpolating polynomial; Richardson extrapolation; Integration;Trapezoidal rule, Simpson's rule. Gaussian quadrature and Numerical Solutions of Ordinary Differential Equations.

SMA2204 Partial Differential Equations **10 Credits**

The module looks at Fourier Analysis; Fourier Series and Fourier Transforms. Laplace Transformations: Definition. Heaviside function; Convolution. Applications to the solution of Ordinary Differential Equations; Sturm-Liouville problems; Orthogonality; Partial Differential Equations; Classification of second order partial differential equations; The partial differential equations of mathematical physics; Derivation of the wave equation and heat equation in one dimension; Separation of variables; Fourier sine and cosine transforms and Fourier transform methods.

SMA2209 Mathematical Modelling **10 Credits**

This module shall be a practical module, dealing primarily with the application of mathematical techniques encountered elsewhere in the degree programme. Whenever necessary, new mathematics shall be introduced. Topics covered may include: Introduction to Mathematical Modelling - Modelling methodology, modelling skills, dimensional analysis. Simple examples. Data Modelling: fitting curves and distribution to data; Simulation Modelling: use of random numbers in investigating simple stochastic situations. Use of Algebra, Statistical and Operational Research Computer Packages.

YEAR III

SMA3010 Industrial Attachment **120 Credits**

YEAR IV

SMA4103 Fluid Mechanics **10 Credits**

The module explores fundamental concepts; Fluids in equilibrium; The principle of fluid motion; Continuity equations; Bernoulli's equation; Momentum equation; Introduction to viscous flow; Laminar flow problem; Dimensional analysis; Potential flow and vorticity.

SMA4135 Dynamical Systems **10 Credits**

The module looks at second order differential equations in the phase plane; First order systems in two variables; Linear systems; Nonlinear systems and linearization; Index of a point; Limit cycles; Poincare-Bendixon theory; Stability; Poincare stability; Liapunov stability; Liapunov's direct method and Liapunov functionals.

SMA4162 Numerical Methods For Differential Equations **10 Credits**

The module looks at systems of Ordinary Differential Equations. Initial Value Problems. Numerical Integration using Runge - Kutta methods. Multistep formulas; Predictor corrector methods; Convergence and stability; Boundary value problems; Shooting methods; Finite difference methods; Partial differential equations; Finite differences; Parabolic equations;Crank-Nicolson methods; Elliptic equations – Dirichlet and Neumann problems; Hyperbolic equations; Methods of characteristics and Finite element methods.

SMA4010 Project **20 Credits**

Projects may be carried out on an individual basis. Where possible the project shall be done in an industrial setting. The projects test students' ability to organise, complete and report on a significant piece of Applied Mathematics.

SMA4112 Modern Algebra **10 Credits**

The module groups definitions and examples; Permutation and symmetric groups; Congruence; Lagrange theorem; Isormophisms and homomorphisms; Quotient groups; Fundamental homomorphism theorem; Rings; Integral domains; Characteristic; Ordered rings; Ring of integers; Fields; Rational numbers; Real numbers; Complex numbers.

SORS4102 Statistical Inference **10 Credits**

The module looks at indicator function, exponential family of densities; Parametric Point Estimation: parameter space and point estimators; Methods of finding estimators, method of moments, maximum likelihood method, least squares method; Properties of point estimators; unbiased estimators, minimum variance unbiased estimators (most efficient estimators), consistent estimators, sufficient estimators, asymptotic normality of estimators; Confidence Intervals: One-sided confidence intervals; Methods for finding confidence intervals, pivotal quantity, statistical and Bayesian; Hypothesis Testing: definitions. Simple and composite hypotheses, test statistic, critical regions, type I and II errors, level of significance, power of a test; Neyman-Pearson lemma; Uniformly most powerful tests and Likelihood-ratio tests.

SMA4172 Mathematical Programming **10 Credits**

The module explores dynamical programming; Elements; Recursive equations; Computational procedure and dimensionality; Deterministic and stochastic applications; Markov programming;

Value and policy iteration procedure; Non-linear programming; Unconstrained optimisation; Equality and inequality constraints; Search methods; Separable, quadratic and stochastic programming; Geometric programming; Basic concepts; Necessary and sufficient conditions for optimality and Solution procedures.

SORS4106 Experimental Design And Multiple Regression **10 Credits**

The module looks at the theory and applications of Statistics which include: Experimental Design and Analysis, 2^k Factorial Experiments; Confounding, complete and partial confounding; Orthogonal contrasts; Fractional Factorial Experiments, Aliasing; Multiple Linear Regression: Variable selection and model building; Multiple coefficient of determination, r^2; Mullow's C_p and S_p statistics; Covariance analysis; Stepwise regression methods; Forward selection, backward elimination, and stepwise regression.

SMA4107 Time Series Analysis And Simulation **10 Credits**

The module looks at time series: Smoothing techniques; Moving averages, simple exponential smoothing, decomposition, identification of trend, seasonal, cyclic and irregular components; Additive and multiplicative models, autocorrelation functions; Autoregressive moving average models; Statistical Process Control: x charts, range charts, statistical control, capable processes; Simulation: Simulation by hand, pseudo random numbers, data collection, distribution fitting, activity cycle diagrams, model development; Verification, validation, experimentation; Analysis of results; Method of common random numbers and the use of simulation package.

SMA4211 Functional Analysis **10 Credits**

The module explores metric spaces; Definitions and examples; Open and closed sets, neighbourhoods; Convergence, completeness; Contraction mapping theorem; Application to linear systems, integral equations, differential equations; Normed spaces; Banach space; Finite dimensional spaces; Compactness and Reisz lemma; Lemma; Linear operators and functionals; Dual space; Hilbert spaces; Cauchy-Schwarz inequality, Pythagoras" theorem; Orthogonal complements and direct sums; Orthonormal sets; Fourier series and orthogonal polynomials; Self adjoint operators; Eigenvalues and eigenfunctions.

SMA4236 Control Theory **10 Credits**

The module highlights the types of control; Feedback control and open loop systems; Principle of superposition; Transfer functions; Block diagrams; State space formulation; Direct solution; Solution using Laplace transforms; Stability; Asymptotic stability; Routh stability criterion; Liapunov's method; Nyquist stability criterion; Controlability and observability criteria; Optimal control; Variational calculus; Free end conditions; Constraints; Optimal control with unbounded continuous controls; Bang-bang control; Pontryagin's principles; Switching curves as well as Transversality conditions.

SMA4241 Financial Mathematics **10 Credits**

The module is an introduction to financial derivatives, the Cox-Ross-Rubinstein model, finite security markets, the Black-Scholes model, foreign market derivatives, American options and exotic options.

SMA4213 Graph Theory **10 Credits**

The module is an introduction to the abstract known as a graph; Definitions and characterisation of classes of special graphs; Distance and connectedness measures; Various algorithms applied to graphs and some of their proofs, classical and contemporary.

SORS4207 Multivariate Analysis **10 Credits**

The module is about methodology and applications of multivariate analysis; Hotelling's T2, multivariate regression and analysis of variance; Classification and discrimination; Principal components, clustering, multidimensional scaling as well as the use of computer packages, MANOVA.

SMA4273 Queuing Theory And Stochastic Processes **10 Credits**

The module explores the Queuing Theory; Elements of queuing models, Queues as birth and death process, Poisson queuing models, non-Poisson queues, P;K; formula, Some simple generalizations such as series queues and applications of queuing theory; Stochastic Processes; Theory and applications of random processes, including Markov chains, Poisson processes, birth-and-death processes, random walks and recurrent events.

SORS4210 Official Statistics **10 Credits**

The module looks at the functions of statistical services; National and International statistical agencies as well as methods of data collection. The module shall put more emphases on; Environmental statistics, Health statistics, Agricultural statistics, Industrial statistics, Economic statistics, Postal censuses and fieldworker surveys.

SERVICE MODULES

SMA1111 Mathematics For Science I **10 Credits**

This module is recommended for students in Applied Sciences who have passed Mathematics at A-level. It looks at Linear Algebra: Matrices, Operations, Inverses, Determinants, Solution of Linear Equations; Calculus: Limits, continuity, derivatives; Techniques of differentiation; MacLaurin and Taylor series; Applications to extremal problems; Definite and indefinite integrals; Methods of integration; Numerical integration; Simpson's rule; Newton- Raphson method; Complex Numbers: Algebra of complex numbers; De Moivre's Theorem and Complex exponentials.

SMA1112 Preparatory Mathematics **10 Credits**

The module is recommended for students in Applied Sciences who have not passed Mathematics at A-level it looks at Algebra: Quadratic equations; Laws of indices and logarithms; Partial fractions; Factor and remainder theorems; Binomial expansion; Complex numbers; Trigonometry: Definition of six trigonometric functions for any angle; Trigonometric identities; Compound angles; Matrices: Operations, Inverses; Determinants; Solution of Linear Systems; Functions: Exponential, Logarithmic, Circular functions and their inverses; Calculus: Idea of limit, continuity and derivative; Techniques of differentiation, maxima and minima; Definite and indefinite integrals; Methods of integration as well as application to areas and volume.

SMA1211 Mathematics For Science II **10 Credits**

This module explores vectors; Equations of lines and planes; Vector and scalar products; Partial differentiation and Applications; Total derivative; Small changes; Maxima and minima; Double Integrals: Evaluation; Change of order; Change of variables; Differential Equations; First order ordinary differential equations; Linear and separable equations; Applications to radioactive decay, mixing problems, reaction rates; Second order linear equations with constant coefficients; Systems of first order equations; Numerical solution of ordinary differential equations: Euler, modified Euler and Runge -Kutta methods.

SMA1116 Engineering Mathematics IA **10 Credits**

This module examines calculus in one Variable: Limits and continuity of functions; Differentiation; Leibniz's Rule; L'Hopital's Rule; Elementary functions including hyperbolic functions and their inverses; Integration - techniques including reduction formulae; Applications - arc-length, area, volumes, moments of inertia, centroids; Plane polar coordinates; Complex Numbers: Basic algebra; De Moivre's theorem; Complex exponentials; Linear Algebra: Vector algebra in 2 and 3 dimensions; Scalar and vector products and equations of lines and planes.

SMA1216 Engineering Mathematics IB **10 Credits**

This module looks at the functions of Several Variables: Partial derivatives, chain rules; Applications - maxima and minima problems, Lagrange multipliers; Linear Algebra: Matrices - basic operations, rank, inverses; Systems of linear equations – Gauss elimination; Determinants and their properties; Eigenvalues and eigenvectors; Linear independence; Ordinary Differential Equations; First Order differential equations - separable, linear; Integrating factors; Linear second order equations with constant coefficients; Variation of Parameters; Systems of equations as well as Applications of differential equations to mechanics, physics and engineering.

SMA2116 Engineering Mathematics II **10 Credits**

This module looks at multiple Integrals; Iterated integrals, change of order; Change of variable; Polar, cylindrical and spherical coordinates; Applications in three dimensions; Vector Calculus; Scalar and vector fields; Directional derivatives; Gradient, divergence and curl; Line and surface integrals; Theorems of Green, Gauss and Stokes; Fourier Analysis; Fourier Series; Half range series; Fourier integrals and transformations.

SMA2217 Engineering Mathematics III **10 Credits**

This module outlines Laplace Transforms; Definitions; Basic ideas; Applications to ordinary differential equations; Statistics; An Introduction to Applied Statistics; Introduction to probability and distribution theory; Descriptive statistics/initial data exploration; Summary statistics, graphical presentation of data; Point estimation/test of hypothesis; Interval Estimation; Analysis of Variance and regression analysis.

SMA3116 Engineering Mathematics IV **10 Credits**

This module highlights differential Equations; Power series solutions; Singular points; Frobenius method; Special functions and their properties; Legendre polynomials, Bessel functions; Partial Differential Equations; Solution of the partial differential equations (the wave equation, the one dimensional heat flow problem); Method of separation of variables; Numerical Methods; Errors, absolute and relative; The solution of nonlinear equations; The solution of linear systems;

Interpolation and polynomial approximation; Curve fitting; Numerical differentiation and integration as well as the approximate solution of differential equations.

MASTERS DEGREE PROGRAMME SPECIAL REGULATIONS

MASTER OF SCIENCE DEGREE IN APPLIED MATHEMATICAL MODELLING

1.0 Master of Science Degree in Applied Mathematical Modelling

Degree Profile

Institution:	National University of Science and Technology
Type of Degree:	Master of Science
Credit Load:	340 Credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	From 2018

Purpose of the Programme

To develop knowledge, skills and competences in the field of Applied Mathematical Modelling relevant to various employment capabilities and careers in the world of work and society. To prepare students for further studies and lifelong learning in Applied Mathematical Modelling.

Programme Characteristics

Areas of Study:	Mathematical Modelling, Numerical solutions of Differential Equations, Stochastic Differential Equations, Financial Mathematics, Functional analysis, Dynamical Systems, Mathematical Epidemiology, Forecasting, Fluid Mechanics.
Specialist Focus:	Use of mathematical techniques and models to obtain practical solutions to concrete problems
Orientation:	Research, teaching and learning are professionally oriented and focused on real life problems
Distinctive Features:	Solving problems from many branches of science, engineering, information technology and commerce

Career Opportunities and Further Education

Employability:	Careers in the retail and manufacturing industry; banking, finance and insurance industry; research institutions; non-governmental organisations; positions in academia, data mining

Further Studies:	PhD in Applied Mathematics or in interdisciplinary programmes related to Applied Mathematics

Programme Delivery

Teaching and Learning Methods:	Lectures, tutorials, computer laboratory classes, seminars, group work, industrial visits, industrial attachment, research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, seminar presentations, industrial attachment report, final year research project report, continuous assessments

Programme Competences

Generic:

1. **Multidisciplinary**: Ability to define and solve problems from multiple academic disciplines
2. **Quantitative and innovative reasoning:** Capability to draw on big data and use analytics for informed decision making and strive to seek new ways of doing things
3. **Communication skills**: Ability to communicate effectively and to present information orally and in writing and using ICTs to both expert and non-expert audiences
4. **Analysis and synthesis**: Capacity for analysis using mathematical methods and synthesis using logical arguments and proven facts
5. **Ethical commitment:** Professional integrity and awareness of impact of applied mathematical modelling on society and the environment
6. **Entrepreneurial skills:** Capability to identify and create new business ventures based on knowledge and new thinking paradigms

Discipline specific:

1. **Deep knowledge:** Ability to analyse data in terms of underlying principles and knowledge and by means of appropriate mathematical methods
2. **Production skills:** Ability to formulate and use mathematical models to better understand the real world for sustainable development
3. **Technology development skills:** Ability to develop new technologies in applied mathematical modelling with a view to enhance production efficiencies and outputs in industry
4. **Problem-solving skills**: Ability to solve a wide range of problems in the sciences, technology and industry, and other fields; by identifying their fundamental aspects and using both theoretical and practical methods
5. **Analytical and computational skills**: Ability to use data to analyse various phenomena and technological issues using appropriate computer packages

Intended Learning Outcomes

1. Ability to approach problems in an analytical and rigorous way, formulating theories and applying them to solve problems in problems in the sciences, technology and industry, and other fields;
2. Ability to apply mathematical techniques to problems arising from the planning, monitoring and management of large-scale systems such as health service, communication, energy distribution and transportation systems.

3. Ability to analyse and interpret data, finding patterns and drawing conclusions to support and improve business decisions;
4. Ability to develop mathematical and statistical models
5. Ability to breakdown a complex system into simple and understandable models
6. Ability to design and conduct observational and experimental studies
7. Ability to demonstrate knowledge and understanding of fundamental concepts in areas of applied mathematical modelling
8. Ability to use mathematical and statistical packages to model and solve problems in applied mathematical modelling
9. Ability to deal with abstract concepts and to think logically
10. Ability to present mathematical arguments and conclusions with accuracy and clarity
11. Ability to identify problems in industry and the community and develop appropriate solutions
12. Develop mathematical models to solve current practical problems
13. Communicate effectively and present information methodically and accurately using multi-media

2.0 REGULATIONS

2.1 Introduction

This programme is regulated by the Faculty of Applied Science and the General University Academic Regulations for Postgraduate Masters Degrees by Module-work.

2.2 Entry requirements

The minimum entry requirement shall be an Honours Degree in Mathematics with at least a Lower Second Class Division. Where an applicant holds an equivalent degree, Senate through the recommendations of the Department and Faculty of Applied Science shall make the final decision on the application.

3.0 DURATION

The programme shall run for 18 months full-time and when offered on Block-Release, it shall run over 24 months.

4.0 STRUCTURE OF THE PROGRAMME

4.1 Full-time Programme

A student in Part I shall register for four taught modules in each semester. In Part II (which consists of one Semester), a student shall register for a Project module leading to a Masters Thesis which shall be submitted to the Department at least a month before the end of the Semester in Part II.

4.2 Block –Release Programme

A student registered on the Block – Release Programme shall register for four taught modules per block whilst in Part I. In Part II a student shall register for a Project Module that shall commence at the beginning of that Part. The Project Module shall run over two Block periods of six months each and the Project report shall normally be submitted to the Department at least a month before the end of Part II.

4.3 A student shall be allowed to proceed to register for a Project Module if he/she has successfully completed all the taught modules.

4.4 A student who is credited with all eight taught modules, but has fails to successfully complete the dissertation may be awarded a Postgraduate Diploma in Applied Mathematical Modelling.

5.0 ASSESSMENT

5.1 Each module shall be assessed at the end of the semester through a written examination. Continuous assessment for the individual modules shall contribute 25% while the written examination shall contribute 75% unless otherwise stipulated as shown in 5.3. The Project Module shall be examined by dissertation and the student shall be required to give a defence to the authenticity of his/her project work before a Panel of Examiners. The dissertation shall normally be submitted for marking, one month before the end of the programme. The taught modules shall contribute 60% while the dissertation shall contribute 40% to the final overall mark.

5.2 A student shall be required to earn a total of 340 credits to be awarded the degree.

5.3 **Modules Assessed at 50% Module-work**

Module	**Examination**	**Module-work**
SMA5191	50	50
SMA5221	50	50

6.0 PROCEED AND REPEATING OF MODULES

6.1 A student may be allowed to repeat Part I if he / she has passed the number of modules as stipulated and allowed by the Faculty and General Academic Regulations. He / she may be allowed to proceed to Part II if he/she has successfully completed Part I.

6.2 A student who fails the project with a mark of at least 40% may be allowed to re-submit the project only once at a later date, normally within three months of notification of the result. The maximum mark for such work shall be 50%.

A student who fails a Project Report with less than 40% or after re-submitting the project has failed to satisfy the examiners, may be allowed to repeat the project or opt for the award of a Postgraduate Diploma in Mathematical Modelling. In repeating the project, a completely new project work shall be undertaken. A repeat of a Project shall be allowed only once.

PROGRAMME SUMMARY

Modules	Credits
Part I	
Semester I	
SMA5111 Advanced Functional Analysis	25
SMA5161 Numerical Solution of Ordinary Differential Equations	25
Elective I	25
SMA5191 Introduction to Mathematical Modelling	25
Part I	
Semester II	
Elective II	25
Elective III	25
Elective IV	25
Elective V	25
Part I - Total credits	**200**
Part II	
Semester I	
SMA5010 Dissertation	140
Programme - Total credits	**340**

Elective Modules		Credits
SMA5131	Continuum Mechanics	25
SMA5141	Integral Equations	25
SMA5151	Variational Calculus	25
SMA5181	Stochastic Differential Equations	25
SMA5211	Advanced Dynamical Systems	25
SMA5221	Forecasting	25
SMA5231	Advanced Fluid Dynamics	25
SMA5241	Perturbation Methods	25
SMA5251	Industrial Statistics	25
SMA5261	Numerical Solution of Partial Differential Equations (pre-requisite is SMA5161)	25
SMA5281	Financial Mathematics (pre-requisite is SMA5181)	25
SMA5291	Mathematical Epidemiology	25

Electives on offer shall be subject to availability of expertise on the staffing.

MODULE SYNOPSES

YEAR

SMA5111 Advanced Functional Analysis **25 Credits**

The module looks at metric spaces; Definitions and examples; Rn, C[a,b]; Inequalities of Holder, Minkowski, Cauchy-Schwarz; Open and closed sets, neighbourhoods; Convergence, completeness; Contraction Mapping Theorem; Applications to linear systems, integrals equations, differential equations; Normed spaces; Definitions and examples; Banach space; Finite dimensional space; Compactness and Riesz Lemma; Linear operators and functionals; Dual space; Second dual; Reflexivity; Weak convergence; Hilbert spaces; Definitions and examples; Cauchy-Schwarz inequality, Pythagoras's theorem; Orthogonal complements and direct sums; Orthonormal sets; Fourier series and orthogonal polynomials; Hilbert adjoint operator; Self-adjoint operators; Eigenvalues and eigenfunctions; Operators; General measure theory as well as Lebesgue Integral and L^p spaces with special emphasis on the case $p = 2$;

SMA5131 Continuum Mechanics **25 Credits**

This module explores rigid deformable bodies; Concept of stress; Deformation and kinetics; Balance equations; Constitutive equations; Examples of complex material together with Solution of problems in elasticity and viscoelasticty;

SMA5141 Integral Equations **25 Credits**

The module outlines iterative methods for linear systems; Initial and Boundary Value Problems for ODES; Methods for Fredholm Integral Equations of the second kind; Neumann series; Degenerate kernels; Quadrature methods; Expansion methods and Applications.

SMA5151 Variational Calculus **25 Credits**

The module highlights calculus of Variations: Function of one variable and several variables, constrained extrema and Lagrange multipliers, Euler-Lagrange equations; Functions with higher-order derivatives and several dependent variables and independent variables as well as applications.

SMA 5161 Numerical Solutions Of Ordinary Differential Equations ` **25 Credits**

The module is an introduction to Matrix Analysis; Solutions of system of linear and non-linear differential equations, Linear and Non-linear initial value problems, Existence and uniqueness of solutions; Dependence of solutions on initial conditions; Numerical methods: - Euler, Runge-kutta methods; Multistep methods and variable step-size methods – Predictor-corrector methods; Refining of the step size convergence; Convergence and stability; Boundary value problems; Shooting methods for linear and nonlinear problems; Finite difference methods for linear and non-linear problems; Raleigh-Ritz method; Applications: growth models and epidemiological models.

SMA5181 Stochastic Differential Equations **25 Credits**

The module is about probability spaces; Random variables and stochastic processes, Ito integrals, Ito's formula and martingale representation theorem; Stochastic differential equations; Diffusions, Boundary value problems; Optimal stopping; Stochastic control and an introduction to jump diffusions.

SMA5191 Introduction to Mathematical Modelling 25 Credits

The model looks at the general principles of mathematical modelling and modelling skills needed for abstraction, idealisation, identification of important factors such as variables and parameters. Case studies shall be chosen from the following list hence Students shall study case studies from the following case studies.

Case 1: *Simulation modelling*; Discrete event simulation; Systems dynamics; Simulation software; Sampling methods; Model testing and validation.

Case 2: *Materials Science Modelling*: Understand the micro-level molecular and sub-atomic effects, subtle engineering of special compounds etc; The behaviour of non-typical materials or new materials like semiconductors, polymer crystals, composite materials, piezoelectric materials, optically active compounds, optical fibres etc; create a multitude of research questions, some of which can be approached with mathematical models and models to design and control the manufacturing processes.

Case 3: *Traffic and Transportation Modelling*: Roads, railway networks and air traffic contain many challenges for modelling; In railway industry, mechanical models about the rail-wheel contact, explaining the phenomena of wear, slippage, braking functions etc; The train itself is a dynamical system with a lot of vibrations and other phenomena; Analysis of traffic flow; Scheduling, congestion effects, planning timetables, derivation of operational characteristics etc.

Case 4: *Modelling in Food and Brewing Industry:* Mathematics has to do with butter packages, lollipop ice-cream, beer cans and freezing of meatballs; The food and brewing industry means biochemical processes, mechanical handling of special sorts of fluids and raw materials; The control of microbial processes and production chain.

Case 5: *Chemical Reactions and Processes Modelling*: Chemical processes modelled on various scales; The spatial structures and dynamical properties of individual molecules, to understand chemical bonding mechanisms etc; The chemical reactions are modelled use of probabilistic and combinatorial methods.

SMA5211 Advanced Dynamical Systems 25 Credits

The module explains systems of differential equations; Two-dimensional linear and almost linear autonomous systems; Finite difference equations; Steady states and their stability; Stability of periodic orbits; Lyapunov methods; Bifurcation, one and two- dimensional systems; Discrete systems; Self-similarity and fractal geometry; Chaos detecting and route to chaos.

SMA5221 Forecasting 25 Credits

The module explores applications to business management; Multiple regression modelling; Binary choice models, multiple discrete choice models and limited dependent models as well as time series analysis: ARIMA, ARMA and VARMA models.

SMA5231 Advanced Fluid Dynamics **25 Credits**

The module outlines the basic principles of fluid dynamics; Equations of continuity and motion; Dynamical similarity; Some solutions of viscous flow equations; Inviscid flow; Boundary layers; Instability and turbulent flows; Flow in rotating fluids; Geotropic flow, Ekman layer and Rossby waves; Stratified flow; Stratification and rotation.

SMA5241 Perturbation Methods **25 Credits**

The module looks at the concept of asymptotic development; Elementary operations on asymptotic expansions; Equations containing a small parameter and or a region slightly perturbed from a regular figure; Solution in terms of the small perturbation parameter; Methods of regular perturbation; Examples of possibility of non-uniform expansions; Methods of singular perturbation: Poincare-Lighthhill-Kuo, matched asymptotic expansion and multiple scales. All the methods shall be illustrated by solving ordinary and partial differential equations.

SMA5251 Industrial Statistics **25 Credits**

The module looks at principles of experimental design; Completely randomised designs; Randomised Block designs; Balanced incomplete Block designs; Latin square and crossover designs; Factorial designs; Fractional factorial designs; Response surface methodology; Nested designs; Split-plot designs; Repeated measures designs; Analysis of covariance; Quality control and reliability.

SMA5261 Numerical Solutions Of Partial Differential Equations **25 Credits**

This module explores the elliptic Partial differential equations; Poisson Problem with Dirichlet, Neumann and Robin Boundary Conditions, finite difference method; Parabolic partial differential equations; Initial-boundary value problems, one-dimensional explicit and implicit methods, stability; First-order hyperbolic partial differential equations; Finite Element Methods and Variational Techniques: Introduction-functional, Green's theorem, divergence theorem, Euler-Lagrange equations, mixed boundary conditions, functionals for differential problems; Approximation of solution-Ritz method; Variational and weak forms in Hilbert (Sobolev) spaces; Finite Element Methods: Review of elliptic and partial differential equations, Laplace, Poisson, biharmonic and Lame's equations all with various types of boundary conditions; Lagrange basis functions; Applications and Fluid flow models, for example air quality modelling.

SMA5281 Financial Mathematics **25 Credits**

The course is an introduction to financial derivatives, the Cox-Ross-Rubinstein model; Finite security markets; Market imperfections; The Black-Scholes model; Foreign market derivatives; American options; Exotic options; Continuous-time security markets; Arbitrages and equivalent Martingale measures; The one period model; Multi period models; The continuous model; Hedging and completeness; Self financing portfolios; Attainability of a claim; Complete markets; Ito representation theorem; Girsanov's first theorem; Option pricing; European options; American options; The Black Scholes option pricing formula; Optimal portfolio and stochastic control; Stochastic control theory; The Hamilton-Jacobi-Bellman equation; Girsanov's second theorem; Numerical analysis in finance (solving nonlinear partial differential equations arising in finance; Use of appropriate computer packages in finance e;g; Matlab) as well as levy processes in finance.

SMA5291 Introduction To Mathematical Epidemiology **25 Credits**

The module looks at modelling Transmission Dynamics of Infectious Diseases: Basic concepts of epidemiological modelling; Epidemiological principles and concepts; Tools required to develop mathematical models to understand the transmission dynamics of infectious diseases and to evaluate potential control strategies. Topics to be covered include: history of mathematical epidemiology, Introduction to population modelling, Basic models of disease transmission, SI, SIS, SIR, SIRS, SIE, SIER, SIERS etc; Epidemiological measures and their relationship to disease transmission models; The reproductive number; Use of models to plan clinical trials as well as modelling of sexual, waterborne and vector borne transmitted diseases. The module also looks at immunological Modelling: focusing on modelling the pathogenesis of infectious diseases; The interaction of human and pathogen; The biochemical, pharmacological, immunological, and molecular biological understanding of how infectious agents and the human body interact; Development of models to study host susceptibility to particular pathogens, development of models to study host resistance to chronic or acute disease, development of models for basic studies of infectious organisms, as long as they are oriented toward understanding how the organism interacts with the host, development of models to study virulence factors, immune mechanisms, and genetic studies in the host and in the pathogens. Work on modelling pathogenesis of HIV, malaria, and tuberculosis shall be given higher priority.

SMA5010 Dissertation **140 Credits**

The dissertations may be carried out on an individual basis. The dissertation normally involves work with some outside organization. The dissertations test students' ability to organise, complete and report on a significant piece of Mathematical modelling.

DEPARTMENT OF APPLIED PHYSICS

Lecturer and Chairperson

Professor G. Azangwe, PhD(University of Aberdeen, UK), MSc Medical Physics, (University of Aberdeen, UK), BSc Applied Physics (NUST), CPhys, MIPEM, MInstP

Associate Professor

Professor J. Gwamuri, PhD (Michigan Technological University, USA), MSc In Lasers & Optics (NUST), Lic Ed (Physics & Electronics) (Cuba)

Senior Lecturers

Dr T. S. Dloldlo, PhD (Finland),MSc Eng. (Delft)

Dr P. Baricholo, PhD(NUST), MPhil (NUST), BSc Physics Education & Astronomy (Cuba)

Lecturers

Ms E. F. Maguranyanga, MSc in Radiography, Kent University, MBA, NUST, Higher Diploma of College of Radiographers (HDCR), London. Teachers Diploma of College of Radiography (TDCR), London. Health Teachers Diploma, Zimbabwe. MAHPC

Dr T. V. Chabata, MSc In Lasers & Optics (NUST), Lic Ed (Physics & Electronics) (Cuba)

Dr D.M. Murape, PhD Material Science (NMMU, South Africa, MSc Renewable Energy (UZ), BSc (Hons) Applied Physics (NUST), PGDHE, (NUST)

Dr I. K. Muchingami, PhD In Groundwater Studies (University of Western Cape, SA), MSc Geophysics (NUST), BSc (Hons) Applied Physics (NUST), PGDE (NUST

Dr B. Muchono, PhD (University of Johannesburg, SA), MSc in Applied Physics (UZ),BSc (Hons) Applied Physics (NUST)

Mr R . T. Mashingaidze, MSc Geophysics (NUST), BSc (Hons) Applied Physics (NUST)

Mr G. G. Nyambuya, MSc NWU (RSA), BSc (Hons) UZ,

Mr C. Chuma, MSc Geophysics (NUST),BSc (Hons) Applied Physics, (NUSTPGDHE (NUST), Post Graduate Diploma in Remote Sensing (ARCSSTEE, OAU, Nigeria)

Mrs S. Nleya, MSc in Radiography (Radiotherapy) (Canterbury Christ Church University College, UK), DRC(T), (COR,UK), ZFETC, (Byo Polytechnic)

Mrs J. Tityiwe, MSc in Radiography (UK), DDR (UZ),PGDHE (NUST), FETC (Harare Polytechnic), CMU (Burwin, Canada)
Dr L. Sibanda, MTech in Radiography (RSA), BSc (Gen) (UZ), BSc (Hons) in Radiography (NUST)

Ms P. Mukwada, BSc (Hons) in Radiography (NUST), MSc in Radiography (NUST)

Mr S. T. Gashirai, BSc (Hons) in Radiography (NUST), MSc in Radiography (NUST)

Mr S. Gunda, BSc (Hons) in Radiography (NUST), MSc in Radiography (NUST)

Mr B. T. Rakata, BSc (Hons) in Radiography (NUST), MSc in Radiography (NUST)

Dr D. J. Hlatywayo, PhD in Geophysics, Sweden

Research Fellow
Mr M. Gumbo, MSc Geophysics (NUST), BSc (Hons) Applied Physics (NUST)

Senior Secretary

C Dambaza, Diploma in Management (NUST) Bachelor of Commerce (Hons) Degree in Management (NUST) National Diploma in Secretarial Studies (Bulawayo Polytechnic)

Chief Technician
Mr C. Dzingai, MBA (NUST), BSc (Hons) Applied Physics (NUST)

Senior Technicians
Mr H. Manuel, BSc (Hons) Applied Physics (NUST)

Mr Z. Zulu, MSc Physics (MSU), BSc (Hons) Applied Physics (NUST)

Technicians
Mr W. Chirume, BSc (Hons) Applied Physics (NUST)

Mr J. Dongo, BSc (Hons) Applied Physics (NUST)

UNDERGRADUATE DEGREE PROGRAMME

SPECIAL REGULATIONS

BACHELOR OF SCIENCE HONOURS DEGREE IN RADIOGRAPHY

1.0 Degree Profile of Bachelor of Science Honours Degree in Radiography

Institution:	National University of Science and Technology
Type of Degree:	Honours
Credit Load:	480 credits
Level:	SADC-QF - Level 8
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	Accredited by ZIMCHE 2018

PURPOSE OF THE PROGRAMME

To develop knowledge, skills and competences in the field of radiography relevant to various employment capabilities and careers in the world of work and society. To prepare students for further studies and lifelong learning in radiography and related radiation sciences.

PROGRAMME CHARACTERISTICS

Entry Requirements	The programme is governed by the University General Academic Regulations for Undergraduate Honours Degrees. The minimum entry requirement is at least a pass in ‘A’ level Mathematics and a pass in ‘A’ level Physics.
Areas of Study:	Engineering Mathematics, Electronics, Physics, Radiographic Imaging, Psychology and Sociology, Professional Studies in Healthcare, Anatomy and Physiology, Information Management and Research Methods, Radiation Protection in Practice, Quality Management
Specialist Focus:	Application of imaging technics in diagnosis and treatment of disease. The program aims to meet patient needs by encompassing the technological developments and the evolving roles of healthcare practitioners.
Orientation:	Research, teaching and learning are professionally oriented and focused on real life problems
Distinctive Features:	Solving problems from many branches of science, engineering, information technology and commerce

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Careers as diagnostic or therapy radiographers, applications specialists, inspectors, lecturers, research scientists.
Further Studies:	Master’s and doctoral studies in Radiography or in related interdisciplinary programmes.

PROGRAMME DELIVERY

Teaching and Learning Methods:	Lectures, tutorials, clinical exercises, seminars, group work, case studies, industrial attachment, research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, seminar presentations, industrial attachment report, final year research project report, continuous assessments

PROGRAMME COMPETENCES

Generic:

- **Multidisciplinarity**: Ability to define and solve problems from multiple academic disciplines and work with professionals from other disciplines.
- **Quantitative and innovative reasoning:** Capability to draw conclusions for analysis of different case studies and use information from previous cases to for informed decision making and strive to seek new ways of doing things.
- **Communication skills**: Ability to communicate effectively and to present information orally and in writing to both expert and non-expert audiences
- **Analysis and synthesis**: Capacity for analysis for selection of optimal treatment choices through use of evidence based patient management.
- **Ethical commitment:** Professional integrity and awareness of impact of the radiography profession on society and the environment.
- **Entrepreneurial skills:** Capability to identify and create new business ventures based on knowledge and new thinking paradigms

Discipline specific:

- **Deep knowledge:** Ability to analyse various cases presented and decide on the best imaging techniques to use.
- **Production skills:** Ability to formulate and use protocols to better understand safer delivery of treatments
- **Technology development skills:** Ability to develop and adapt to new technologies in radiography with a view of improving patient care delivery.
- **Problem-solving skills**: Ability to solve a wide range of problems in radiography by identifying their fundamental aspects and using both theoretical and practical methods
- **Analytical and computational skills**: Ability to use data to analyse various phenomena and technological issues using appropriate computer packages

Intended Learning Outcomes

- Ability to approach problems in an analytical and rigorous way, formulating theories and applying them to solve problems in healthcare and other fields;
- Ability to analyse and interpret data, finding patterns and drawing conclusions to support and improve care delivery;
- Ability to develop and optimize scanning protocols
- Ability to breakdown a complex system into simple and understandable components
- Ability to demonstrate knowledge and understanding of fundamental concepts in areas of applied radiography

- Ability to present clinical cases with accuracy and clarity
- Ability to identify problems in hospitals and clinics and develop appropriate solutions

2.0 REGULATIONS

These Regulations shall be read in conjunction with the Faculty Regulations and General Academic Regulations.

3.0 ENTRY REQUIREMENTS

3.1 Normal entry

Applicants must have obtained a minimum of five passes in the General Certificate of Education, Ordinary Level, of an approved Examining Board or equivalent. English Language, Mathematics and a Science subject are obligatory. In addition, an applicant must have at least two passes at Advanced Level of the General Certificate of Education from an approved Board or equivalent. The applicant must have passed Physics and any one of
Chemistry, Mathematics or Biology at Advanced Level.

3.2 Special entry

Applicants who do not meet the above entry requirements may be considered under special entry with the approval of the University. Students who qualify under this regulation may apply to be exempted from certain modules and examinations. Permission may be given to complete the programme for the Bachelor's Degree in less than the normal required period provided that no student shall be allowed direct entry to the final part of the programme. Normally the exemption will not include the clinical practice component.

3.3 Mature entry

3.3.1 Applicants who are 25 years of age at the time of applying for entry into the programme and are not eligible for normal entry may apply for mature entry.

3.3.2 Candidates must have passed at least five approved 'O' Level subjects including English Language and Mathematics and must have demonstrated potential suitability for University studies by virtue of their attainments and/or relevant work experience. Such experience shall be in the medical field.

3.3.3 Normally, applicants should have completed their full-time school or college education at least five years before the time of their application.

3.3.4 For both special and mature entry, applicants will be required to attend a formal interview as part of the final selection procedure.

4.0 PRACTICAL MODULES

Students shall undertake their clinical learning and practice in radiology departments and shall be assessed during the period of their attachment. They shall be attached to a radiology department in Zimbabwe, both during the semester and vacation periods. A student shall have no less than 95% attendance in the clinical practice in order to complete his / her clinical attachment for any Part of the Program.

In order to pass the clinical assessment, a student shall be expected to attain a mark of **at least 75%.** For grading purposes, the following shall apply:

Mark	Grade/Classification
75% - 79%	Pass
80% - 84%	2.2
85% - 89%	2.1
90% - 100%	1

Practical module-work shall be weighted against other modules in the program as follows:
Part I equivalent to 1 module
Part II equivalent to 1 module
Part III equivalent to 4 modules
Part IV equivalent to 6 modules

5.0 PROJECT MODULE

All students in Part IV must undertake a research project on a topic approved by the Department. The Project module is weighted as two modules.

6.0 DETERMINATION OF RESULTS

6.1 One three-hour written examination paper at the end of each semester shall contribute 75% and module-work 25% towards the final mark. To proceed to the next part of the degree program, the student must obtain a pass mark in the practical module.

6.2 Students are required to pass all modules they will have registered for on any part of the degree program. The pass mark for all the modules on the program shall be 50%. A student who fails a module shall be allowed to carry the module to the next academic year provided regulations are satisfied.

6.3 A candidate who on answering any part of the examination questions describes a “dangerous practice” shall be deemed to have failed that whole question for that particular examination paper. The weighting of the components for the degree classification shall be:

Part I 10%
Part II 20%
Part III 30%
Part IV 40%

PROGRAMME SUMMARY

Module	Code Module Description	Credits
SMA 1116	Engineering Mathematics 1A	10
SPH 1104	Modern Physics	10
SPH 1101	Mechanics and Relativity	10
SPH 1105	Electricity and Magnetism	10
SRA 1101	Fundamentals of Radiography	10
SRA 1102	Professional Studies in Healthcare	10
SRA 1202	Introduction to Psychology and Sociology	10
SRA 1216	Introduction to Radiobiology and Radiation Protection	10
SRA 1214	Occupational Health, Safety and Welfare Services	10
SRA 1204	The Appendicular Skeleton	10
SRA 1000	Practical	10
CTL 1101	Conflict Transformation and Leadership	10
SRA 2104	The Axial Skeleton	10
SRA 2105	The Respiratory System	10
SRA 2103	The Urinary System	10
SRA 2110	Radiographic Imaging and Instrumentation	10
SPH 2108	Analogue Electronics for Radiographers	10
SRA 2207	The Cardiovascular and Lymphatic System	10
SPH 2203	Instrumentation Physics	10
SPH 2201	Vibrations and Waves	10
SPH 2206	Digital Electronics	10
SCS1211	Programming and Program Design	10
SMA 1216	Engineering Maths 1B	10
SRA 2000	Practical	10
SRA 3108	The Digestive System	10
SRA 3103	The Reproductive System	10
SRA 3109	Specialised Imaging Techniques	10
SRA 3110	Research Methods	10
SRA 3116	The Neuro-Endocrine System I	10
SRA 3211	Ultrasound Imaging	10
SRA 3212	Radiography Practice & Different User Groups	10
SRA 3216	The Neuro-Endocrine system II	10
SRA 3000	Practical	30
SRA 4213	Quality Management	10

SRA 4102	Applied Psychology and Sociology	10
SRA 4118	Image Reporting I	10
SRA 4218	Image reporting II	10
SRA 4010	Project	20
SRA 4000	Practical	60

MODULE SYNOPSES

YEAR I

SRA 1101 Fundamentals Of Radiography **10 Credits**

The module looks at medical terminology; Animal cell anatomy and physiology; An introduction to human microscopic and gross anatomy; physiology and pathology (Tissues ; organs, systems and the whole body); Topographical anatomy; Body cavities and their boundaries and subdivisions; Ionizing and non-ionizing radiation; Positioning terminology; Projection terminology; Principles of radiographic Image formation both in conventional film-screen imaging and digital radiography, principles of radiotherapy - Inter relation of x-ray tube, object and film: direction and centering of the x-ray beam in relation to the object; Two dimensional limitations of a radiographic image, requirement for at least two complementary projections for full demonstration of an object; Image quality (conventional film-screen system and digital imaging): Density, Unsharpness of the image, Contrast of the image, Noise; Introduction to exposure factor selection and an introduction to radiographic imaging and treatment; it is an overview of other imaging and radiotherapy modalities (CT, MRI, Ultrasound, RNI, brachytherapy; teletherapy) etc.

SRA 1102 Professional Studies In Healthcare **10 Credits**

The module explores group Dynamics, Stages of group formations, Being an Effective team member; Study techniques; Communication Skills as health workers; Communication with different stack holders; Types of communication channels; Experiential Learning; Reflection – definition, Types of reflection; The process of reflection; Decision-Making and Professional Judgement; Theories of Decision-making; Group decision making; Medico Legal Considerations; Records Relating to Patients; The Patient's Charter; The radiographer and professional organizations; Research; Introduction to research; The value of research in the health care sector as well as the research process and basic research skills.

SRA 1202 Introduction To Psychology And Sociology **10 Credits**

The module looks at sociology: Introduction to sociology; Socialization; Social mobility and Social change; An introduction to sociology of health and illness; Sociological theories (Functionalist theories; Social Action theories; Structural theories; Marxist theories; Feminist theories Conflict versus Symbolic Interaction Theories) Social organization of health care services; The family and impact on health. It also looks at psychology: An Introduction to psychology; Perspectives in psychology (Biological, Behavioural, Cognitive, Psychoanalytic, Phenomenological); Individual differences; Personality and behaviour; Trait approach, Psychoanalytic approach, Behaviourist approach; Phenomenological approach; Humanistic psychology; An Introduction to Abnormal psychology as well as social psychology;

SRA 1204 The Appendicular Skeleton **10 Credits**

The module outlines imaging equipment necessary for radiography of the upper limb; Osteology, arthrology, pathology, radiographic techniques and patient care required for radiography of the hand, pathological image appearances related to the above areas; Application of CT in imaging of the above areas; Osteology, arthrology, pathology, radiographic technique and patient care required for radiography of the humerus, elbow, shoulder girdle and shoulder joint of ambulant patients of all ages; Normal and common pathological radiographic anatomy related to the above areas; Role of imaging in patient management of upper limb; Exposure factor manipulation and effect on image quality; Osteology, orthology, pathology, radiographic technique and patient care required for radiography of the foot, lower ankle, lower leg, femur and hip of ambulant patients of all ages and the role of CT in imaging of the above.

SRA 1214 Occupational Health, Safety And Welfare Services 10 Credits

The module examines the hazardous Substances Act, Safety in processing areas, Design of the X-ray department and its impact on health and safety, infection control, Communicable diseases, Notifiable diseases, Fire hazards and precautions, Local rules, Health and safety regulations, The employer's responsibilities, The employee's responsibilities, Moving and lifting techniques, Correct methods and hazards of lifting and moving patients, Electrical hazards and precautions, Injury on duty, Design of the imaging/ radiotherapy departments, Consideration of their design which affect patient care, Facilities, amenities and safety factors to be included; Welfare issues and health insurance.

SRA 1216 Introduction To Radiobiology And Radiation Protection 10 Credits

The module covers ionising radiation, biological effects of ionising radiation, radiobiology, dosimetry, clinical dosimetry, principles of radiation protection, radioactive waste management, external radiation hazard, internal radiation hazard, ionising radiation regulations, Quality assurance in radiation monitoring, radiation protection, justification, dose limitation, dose optimisation, Non-ionising radiation, biological effects as well as sources and protection from non-ionising radiation.

SPH 1101 Mechanics And Relativity 10 Credits

This module highlights kinematics and Kinetics: Inertial frames of reference; Motion in two and three dimensions; Dynamics of system of particles; Interactions between bodies, relative motion; Conservation of momentum and energy; Motion of systems of particles with variable mass; Collisions of particles. It also looks at rotational Dynamics: Rotation of rigid bodies; Moment of Inertia and its calculations for bodies of various shapes and about different axes; work and energy in rotational motion; Angular momentum; Principles of conservation of angular momentum as well as
gravitation: Kepler's laws of planetary motion; Gravitational potential; Gravitation and gravity; Effect of earth's rotation on "g"; Gyroscope; Motion of a satellite; Coriolis force; The fundamental forces and their unification and inertial forces in linearly accelerating frame. The module also looks at oscillatory motion: Simple harmonic motion; Mechanical oscillators; Superposition of S;H;M's; Damped and forced S;H;M;, Lissajous Resonance and properties of Matter: Hooke's law; Moduli of elasticity and their inter-relationship; Applications of elasticity. The module also highlights fluid mechanics: Fluid at rest; Surface tension and capillarity; The continuity equation; Various types of flows; Boundary layers and turbulence; Steady state flow of fluids; Bernoulli's equation; Viscous flow and Viscosity and friction: Nature of frictional forces; Motion in frictional medium; Rolling and sliding friction as well as relativity: Space-time frames of reference; Galileo's principle of relativity; Simultaneity of events; Einstein's Special theory of relativity; Lorentz transformations; Momentum and energy systems.

SPH 1104 Modern Physics **10 Credits**

The module explores the particle nature of radiation: Planck's postulate and thermal radiation, Blackbody radiation, the photoelectric effect, the Compton effect, X-ray production and pair production; Interaction of radiation with matter-photon emission and absorption; Stationery states, discrete energy spectrum and the continuous energy spectrum; The Frank-Hertz experiment; Spontaneous and stimulated emission. The module also covers the Wave nature of particles: De Broglie's Postulate; The electron diffraction experiment; The wave-particle duality; The uncertainty principle; Matter waves and their properties; The Thomson and Rutherford atomic models; The stability of the atom and Bohr's Postulates and his model of the atom; Atomic spectra; The Hydrogen Atom; Correction for finite nuclear mass as well as the Nuclear Models: Nuclear properties, sizes and densities, masses and densities; The Nuclear Models - Liquid drop; The deuteron; Shell Fermi gas models; Binding energy nuclear forces; Magic numbers and the nuclear decay and nuclear reactions, e-capture,$\alpha$and β emission; Fission and fusion and other nuclear reactions; The origin of elements and an introduction to Elementary Particles: Isospin, Pions, Leptons and Families of elementary particles.

SPH 1105 Electricity & Magnetism **10 Credits**

This module examines the static Electric fields: Coulomb's Law; The electric field; Motion of point charges in electric fields; Lines of force; Electric dipoles in electric fields; Electric flux; Gauss's Law; Applications of Gauss law; Electric Scalar Potential of a system of point charges; Capacitors in circuits; Energy stored in a capacitor; Dielectrics; Applications of Static electricity in Industries;
Electric Current and Resistance: Electric conductors; Current and current density; Kirchhoff's Rules; DC Network Theorems; RC circuits; Wheatstone's bridge; More complex circuits; Measurement of current, Potential Difference and Resistance; Changing sensitivity of Instruments; Thermoelectricity;
Magnetic fields: The force between currents; Definition of magnetic field and Magnetic flux Density; Magnetic intensity, Magnets in magnetic fields and Magnetic dipole moment; Torque on a current loop in a uniform magnetic field; Motion of charges in magnetic fields; Biot-Savart Law; Ampere's Law; Magnetic field of a solenoid and a bar magnet; Induction and Inductance: Faraday's and Lenz's Law; Self and Mutual Inductance Generation of High voltages using principles of induction; Energy storage in inductors and B fields; Electric motors and generators and the Lorentz force. The module also looks at electromagnetic Oscillations and Alternating Currents: L-R, L-C, and L-CR circuits; Basic Alternating current circuits; Phasor notation; Power in AC circuit; A-C network Theorems; AC bridges; Frequency filtering and tuning circuits; Transformers, capacitor and inductor circuits with generator as well as Eddy currents.

SMA1116 Engineering Mathematics IA **10 Credits**

This module looks at calculus in one Variable: Limits and continuity of functions; Differentiation; Leibniz's Rule; L'Hopital's Rule; Elementary functions including hyperbolic functions and their inverses; Integration - techniques including reduction formulae; Applications - arc-length, area, volumes, moments of inertia, centroids; Plane polar coordinates; Complex Numbers: Basic algebra; De Moivre's theorem; Complex exponentials; Linear Algebra: Vector algebra in 2 and 3 dimensions; Scalar and vector products; Equations of lines and planes.

SMA1216 Engineering Mathematics IB **10 Credits**

The module explores functions of Several Variables: Partial derivatives, chain rules; Applications - maxima and minima problems, Lagrange multipliers; Linear Algebra: Matrices - basic operations, rank, inverses; Systems of linear equations – Gauss elimination; Determinants and their properties; Eigenvalues and eigenvectors; Linear independence; Ordinary Differential Equations; First Order differential equations - separable, linear; Integrating factors; Linear second order equations with constant coefficients; Variation of Parameters; Systems of equations and applications of differential equations to mechanics, physics and engineering.

YEAR II

SRA 2103 The Urinary System **10 Credits**

This module examines anatomy physiology and pathology of the urinary tract and pelvic cavity, Imaging of the Abdomen and Urinary tract, Plain radiography, Contrast examinations, CT, RNI, Ultrasound, Relevant Equipment and Imaging equipment for Abdomen, Role of imaging in patient management, Patient care and management, The use of resources and associated risk, Use of contrast agents/isotopes, Radiation doses, Imaging relevant i;e; exposure factors, film selection, intensifying screens, magnification and FFD methods of maintaining contrast etc Phlebotomy, ;venepuncture, Equipment relevant; Technique: To include basic projections and specialised views, paediatric technique neonate and baby to be included, modifications of technique in accident and emergency patients, non-ambulant patients; C O P relevant to each section as well as the role of other imaging modalities in imaging the abdomen i;e; CT, USS, RNI, MRI etc.

SRA 2104 The Axial Skeleton **10 Credits**

The module highlights the anatomy and physiology of the spine, pelvis and thoracic cage; Radiographic anatomy and common pathology of the spine, thoracic cage and pelvis e;g; metastatic, degenerative and inflammatory processes; The cause and nature of fractures of these areas such as crush impacted, pathological, comminuted and transverse; Patient care and management with particular reference to patients whose condition is comprised by age and/or trauma; Applied specialist communication techniques; The radiographic techniques for AP and lateral projections of each anatomical area of the vertebral column; AP pelvis/hips, lateral hip, lateral neck of femur; Projections of sternum and ribs; The application of CT examinations to the diagnosis and management of conditions related to the pelvis and vertebral column, the protocols and procedures associated with such examinations; X-ray table design and use; Stationary and moving grids and their applications to imaging the spine and pelvis; Exposure factor manipulation and its effects on image quality.

SRA 2105 The Respiratory System **10 Credits**

This module outlines anatomy physiology and pathology of the thoracic cavity, excluding heart and great vessels; Imaging relevant exposure factors, film selection, intensifying screens, magnification and FFD methods of maintaining contrasts etc; Equipment relevant, i;e; dedicated chest units; Technique: To include basic projections and specialised views, paediatric techniques neonate and baby, modifications of technique in accident and emergency patients, non-ambulant patients; C O P relevant to each section as well as the role of other imaging modalities in imaging the chest i;e; CT, USS, RNI, MRI, etc and the critical Pathways: - Patient Care and Management.

SRA 2107 The Cardiovascular And Lymphatic System **10 Credits**

The module examines anatomy, physiology and pathology of the cardiovascular system, lymphatic and reticulo -endothelial system; Imaging relevant above systems; Special cassette, exposures, screens; Equipment relevant: Special angio units and associated details; Relevant technique; Role of other imaging modalities in imaging the cardiovascular system; Matching imaging methods to pathology i.e.; the use of a modality to produce the optimum image and the most effective health care within the available resources; The place of imaging in the patient's pathway through the hospital i;e; to emphasise the role that imaging has in influencing patient management; Patient care and management and basic life support cardiopulmonary resuscitation.

SRA 2110 Radiographic Imaging And Instrumentation 10 Credits

The module looks at the production of x-rays – characteristic x-rays, bremsstrahlung; Nuclear decay, the electromagnetic wave spectrum and significance in imaging, The x-ray tube design, types of x-ray tubes, x-ray generators- types and application, image intensifier and the fluoroscopy machines; The control panel, X-ray interaction processes with matter and their implications for imaging; Control of x-ray tube output, reciprocity law, reciprocity failure; The latent image, image quality metrics; Radiographic image receptors, historical image receptors - film/screen systems and image processing; Radiographic image digitisation; Modern image receptors; Computed radiography systems, Digital radiography (DR) systems; Image quality and dose optimisation in DR; Image post-processing, image viewing, digital image display, specifications of monitors (display units) in digital radiography, printers, image quality in digital radiography era and information management systems –PACS, HIS, RIS, telemedicine.

SPH 2203 Instrumentation Physics 10 Credits

The module looks at measurement Systems: Purpose, structure and elements; Static characteristics of measurement instruments, repeatability, tolerance, calibration, measurement standards, frequency response of measurement elements, error calculations and error compensation; Noise and interference in measurement circuits, random signals, probability density, spectral density and autocorrelation functions, noise reduction methods, economics, reliability and choice of measurement systems. It also looks at transducers: Principles and types; Capacitive, resistive, inductive, electromagnetic, thermoelectric, elastic, piezoelectric, piezo-resistive, electrochemical, gas, ion selective electrodes; signal conditioners and data acquisition: Applications and limitations of op-amps, instrumentation amplifiers, current transmitters, frequency to voltage converters, current to voltage converters, energy to voltage converters, phase locked loops, ADC and DAC application in instrumentation systems, analogue and digital recorders, digital printers; introduction to flow measurement: Velocity, volume flow-rate, mass flow-rate, types of flow meters - ultrasonic, Doppler flow meter, pulse transmission and reflection, medical imaging flow measurement; radiation Measurements: Photo-multiplier tubes, scintillators, ionisation chambers, infrared detectors, semiconductor detectors, nuclear instrumentation and standards.

SPH 2206 Digital Electronics 10 Credits

The module looks at denary, Octal, Hexadecimal, Binary Numbers; Various codes used; Binary addition, subtraction, multiplication, division; logic Gates, Semiconductor Diodes & Transistor as switching devices NAD, NOT, NOR, OR and Exclusive 'OR* gates Boolean Algebra; Principle of Duality De Morgan's theorem; Half Adder and Full Adder; Karnaugh Map (2, 3, and 4 variables); Mini-terms and Maxi-terms; Use of K-Map using Mini-terms to simplify logic functions; Canonical forms of a function; Symmetric functions; Equivalence and Non-Equivalence Symmetry; Incompletely specified functions; Combinational gates; Logic gate Analysis and Synthesis, logic Technology: D-T and TTL logic; Fan in, fan out and noise margins; Logic Threshold; Interfacing logic devices. The module also looks at sequential Logic Systems: Flip-flops, 'SR*, JK, D and T type; Race around condition in clocked flip-flop; Master Slave flip-flop; Shift Registers; SIPO, SISO, PISO, and PIPO; Shift left to right; Schmidt Trigger; Types of memory used in computers; Counters: Synchronous and non-synchronous; Binary & Denary counters; Divide by n or Modulo ‘n’ counters; Up and down counters, series and parallel carry modes; ADC and DAC: Sample and Hold circuit, Resolution of conversion, Successive Approximation ADC, Counter Ramp ADC; Weighted Resistor ladder DAC; Counter Properties.

YEAR III

SRA 3103 The Reproductive System **10 Credits**
This module reviews the anatomy and physiology of the reproductive system; begin to critically assess the available optimum imaging modalities; review the range of pathologies most commonly found within the reproductive system; match available imaging modalities to both patients’ needs and pathology; the role of radiography in the application of therapeutic methods within the reproductive system; assess the critically image produced by a variety of imaging methods applied to the reproductive system and the risk associated with imaging and therapeutic methods applied to the reproductive system. The module looks at the illustrative module content: Anatomy, physiology and pathology of the male and female reproductive system; Imaging relevant to the reproductive system; Equipment relevant to the reproductive system; Technique of demonstrating the reproductive system: Relevant care of patient and the role of other imaging modalities in demonstrating the reproductive system.

SRA 3108 The Digestive System **10 Credits**
This module reviews the anatomy and physiology of the gastrointestinal system; begin to critically assess the available optimum imaging modalities; review the range of pathologies most commonly found within the gastro-intestinal system; match available imaging modalities to both patient needs and pathology; the role of radiography in the application of therapeutic methods within the gastro-intestinal system; assess critically image produced by a variety of imaging methods applied to the gastro-intestinal system; review the risk associated with imaging and therapeutic methods applied to the gastro-intestinal system. The module looks at the illustrative module content: Anatomy, Physiology and Pathology of the gastro-intestinal tract (GIT) i;e; Alimentary tract i;e; division and boundaries, The tongue, The teeth, mouth oral cavity, Salivary glands, Pharynx, Oesophagus, Stomach, Small and large intestines, Liver, Biliary tract, Pancreas, Physiology of digestion i;e; mechanical and chemical processes of digestion, metabolism; Imaging relevant to the GIT; Equipment relevant to the GIT Technique of demonstrating the GIT; COP relevant; role of other imaging modalities in demonstrating the GIT.

SRA 3109 Specialised Imaging Techniques **10 Credits**
This module deals with the principles and applications of radionuclide imaging, SPECT, PET, hybrid systems, bone mineral densitometry, mammography sport science imaging, molecular imaging and interventional techniques; clinical applications and protocols are discussed for each technology.

SRA 3116 The Neuro-Endocrine System I **10 Credits**
The module explores the anatomy, physiology and pathology for the central and peripheral nervous system and organs of the endocrine system in all patients of all ages; Central Nervous System:

Nervous tissue, brain, spinal cord meninges, cerebrospinal fluid, blood barrier system; Peripheral Nervous System: Cranial nerve, sensory, motor and integrative system, spinal nerves and plexuses, reflexes; Autonomic Nervous System: Structural and functional differences between somatic efferent and autonomic portions of the nervous system; Principal structural features of the autonomic nervous systems; Structure, physiology and neurotransmitters of the sympathetic and parasympathetic division of autonomic nervous system; Post synoptic receptors; Visceral autonomic reflexes and components; Hypothalamus; Meditation and autonomic nervous system; The Eye and Ear: Special sense organ, structure and function physiology of binocular vision, lacrimal apparatus, nose, tongue, skin sensory function, normal and common pathological image appearances.

SRA 3210 Research Methods **10 Credits**

This module introduces students to methods of experimental design, data acquisition and analysis. The biostatistics section seeks to impart a conceptual understanding of the statistics used in medical and health research, emphasizing the appropriate use of each test, specifically what each test measures, the underlying assumptions and the meaning of the calculated results. The second part of the module introduces and critically reviews various research designs related to experimental studies, quasi-experimental studies, clinical trials, survey research and qualitative methodology. Weekly tutorials provide an opportunity to take up practical exercises related to lecture material and to obtain feedback regarding research designs submitted in response to stated study questions.

SRA 3211 Ultrasound Imaging **10 Credits**

The module explains the physical and biological principles of medical ultrasound; technological aspects of diagnostic ultrasound; informed choices in relation to equipment, technology and technique parameters; Carry out quality assurance procedures and discuss their implications; the role of medical ultrasound in the clinical management and care of patients; apply clinical information to the interpretation of images, discriminating between normal and abnormal anatomy and physiology and recognising common pathology; the role of other imaging modalities in relation to diagnostic ultrasound; Participate in a broad range of clinical procedures; Carry out standard clinical procedures with minimal supervision. The illustrative module content includes the physics of sound, Transducer design and principles of operation, Scan parameters and factors affecting selection, Patient care and management with particular reference to those whose condition is compromised in any way; Quality assurance procedures; The role of ultrasound in conjunction with other imaging modalities and image interpretation

SRA 3212 Radiography Practice and Different User Groups **10 Credits**

The module enables students to adapt radiographic practice to the individual needs of children, the elderly, women, less privileged groups and people with physical and mental disability; assess the needs of specific groups in the provision of imaging services, for example, breast screening for women, the provision of play areas for children, religious or cultural specific needs; assess the implications for the continued provision of imaging services for specific groups following the introductions of concepts such as patient- focused care and the extended role of the radiographer; reflect on the experiences of individuals in the provision of imaging services to specific groups and use communication strategies to improve the delivery of imaging services to specific groups. The illustrative module content includes principles of good radiographic practice in relation to particular user groups; Specific needs of different user groups to promote good radiographic practice; Practical adaptation of radiographic practice to suit specific user groups; Equipment suitable for specific user groups; Patient centred care and user environment.

SRA 3216 The Neuro-Endocrine System II **10 Credits**

The module allows students to discuss the features of imaging equipment required for diagnostic imaging of the neuro-endocrine systems; Relate anatomy, physiology and pathology to image appearances of the neuro-endocrine systems; Demonstrate an understanding of techniques and patient care required for patients of all ages and conditions during imaging of the neuro-endocrine systems; Develop further the academic qualities of reflection, criticism and analysis appropriate to the above performance indicators. The module looks at illustrative module content: Equipment relevant to imaging of the nervous system; Technique relevant for imaging central and peripheral nervous systems and organs of the endocrine system; Relevant care of patient; Role and application of radiography CT, MR, U/S and Nuclear Medicine in Imaging of the neuro-endocrine system.

YEAR IV

SRA 4102 Applied Psychology and Sociology **10 Credits**

The module will enable students to relate the issues raised in the module to the hospital environment and in particular to the field of diagnostic medical imaging and therapeutic radiography, understand the processes that produce individual differences; relate individual differences to the functioning of groups; consider issues of gender, culture etc; especially as they relate to health and social care; recognise issues of dominance and submission in human relationships, relating these to health and illness and to radiographic practice. The module’s illustrative content includes the Application of Applied Sociology and Psychology in health and illness; Culture and tradition and their impact on health; Diversity Issues in health care and illness: Health and Behaviour; Role of Behavioural factors in Disease and Disorder; Behaviour change; Personality and behaviour, and the implications of different theories for treatment of behavioural problems; Psychoanalytic approach, Behaviourist approach; Phenomenological approach (Humanistic psychology); Biological, Cognitive, and trait theories; Understanding Abnormal Behaviour and implications on health and illness; Industrial Psychology; Emotion and Behaviour; Perception and Behaviour; Psychosocial theories and development; Counselling and psychology; Positive psychology; Emotional intelligence; Interpersonal attraction, implications of the theories for liking and disliking patients; Conformity and compliance, Theories of motivation, Introduction and clinical relevance, Self-presentation and survival strategies.

SRA 4118 Image Reporting I **10 Credits**

The module is a review of radiographic anatomy, image assessment image quality, pattern recognition in musculoskeletal system (MSK), professionalism and ethical issues in image reporting, use of computer aided diagnosis systems in MSK reporting, MSK radiographic pathology, MSK image reporting language, terminology and protocols, procedures in writing a radiographic report, practical image interpretation of the skeletal system**.**

SRA 4213 Quality Management **10 Credits**

The module aims to critically analyse the content and use of quality assurance programmes in diagnostic imaging departments; understand how quality is directly related to patients' needs at departmental and organisational level; understand how local department quality programmes relate to broader organisational quality objectives; explore common quality assurance tools such as clinical audit; Examine quality models and the concept of TQM; Share with colleagues an understanding of the applications of quality initiatives in their clinical placements; Relate the operations of the imaging department to aspects such as departmental design, equipment selection, procurement and maintenance, human resources, inventory management; Recognise the value of inter-departmental and inter-professional collaboration to achieve organisational objectives. The illustrative module content includes operations in the imaging department, Design considerations in departments, Equipment selection and procurement, Equipment maintenance, Inventory control, Human resources in imaging departments, Organisational structure, Interdepartmental and Inter-professional collaboration; Quality assurance tests on equipment, The principles of quality, organisational quality, Evaluation quality, Quality and the Imaging Department as well as quality and the customer.

SRA 4218 Image Reporting II **10 Credits**

The module is a review of chest radiographic anatomy, image assessment, image quality, pattern recognition in the chest, chest pathology and differential diagnosis, use of computer aided diagnosis systems in chest pathology, chest image reporting language and terminology, writing a chest radiographic report, Professionalism and ethical issues in chest image reporting s well as practical image interpretation of the chest.

BACHELOR OF SCIENCE HONOURS IN APPLIED PHYSICS

1.0 DEGREE PROFILE: Bachelor of Science Honours in Applied Physics

Institution:	National University of Science and Technology
Type of Degree:	Honours
Credit Load:	485 credits
Level:	SADC-QF - Level 8
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	2018

2.0 REGULATIONS

These regulations should be read in conjunction with the Faculty of Applied Science and the NUST General Academic Regulations**.**

3.0 ENTRY REQUIREMENTS

An applicant must have passed both Physics and Mathematics at ‘A’ level.

4.0 DURATION

The Programme normally runs over a period of four years.

5.0 STRUCTURE

5.1 A student shall register for the requisite modules that will earn him the required Credits for the Year. Normally, he / she shall register for 12 modules in a year leading to a total of 36 taught modules for the Programme. Each module shall be assessed through a Continuous Assessment (25%) that comprises of assignments and at least two tests and a three hour written examination (75%).

5.2 During Year III, a student shall proceed to go on Industrial Attachment for a minimum of 28 weeks. The Industrial Attachment Module is equivalent to 12 modules. At the end of the Attachment period, the student shall present both an Oral and Written Report of what he learnt when he / she was in the Industry, before a Departmental Panel of Examiners.

5.3 In Year IV, a student shall choose a specific field of study by electing to take two modules, one in the First Semester and the other, in the Second Semester.

5.4 The student shall also register for the Research Project module at the start of Year IV. The area and topic of study shall be chosen by the student but should be approved by the Departmental Board who should assign a supervisor to the student for the work. The Research Project Module carries a weighting of two modules. The project shall be examined both Orally and by a Written Project Report which is the Honour’s Degree

Thesis. A student shall complete and hand in his project report, at least two weeks before the beginning of the Semester Final Examinations.

6.0 ASSESSMENT

6.1 For a module without a practical component, one three hour examination paper written at the end of the semester counts 75% and the continuous assessment counts 25%, towards the final mark. For a module with a practical component, a three hour examination paper written at the end of the semester counts 60%, the practical counts for 20% and the continuous assessment counts 20%, towards the final mark.

6.2 A students is required to pass all modules registered for in any part of the degree programme. A minimum of 485 credits are required for the award of a degree.

PROGRAMME SUMMARY

Part	Module Code	Module Description	Credits
	SPH 1101	Mechanics and Relativity	10
	SPH1104	Modern Physics	10
	SPH1105	Electricity and Magnetism	10
	SMA1101	Calculus	10
	SMA1102	Linear Algebra	10
	SPH 1114	Thermal Physics I	10
I	SPH 1201	Waves and Optics	10
	SPH 1202	Analogue Electronics	10
	SMA 1201	Calculus of several variables	10
	SCS 1211	Programming and programme Design for Physicists	10
	SMA 1204	Ordinary differential Equations	10
	CTL1101	Conflict Transformation and Leadership	10
			120
	SPH 2104	Thermal Physics II	10
	SPH 2101	Quantum Mechanics	10
	SPH 2106	Digital Electronics	10
	SPH 2115	Research Methodology	10
	SPH 2103	Classical Mechanics	10
	TEE 2112	Microprocessors	10
II	SPH 2202	Solid State Physics	10
	SPH 2203	Instrumentation Physics	10
	SPH 2205	Atomic Physics	10
	SMA 2201	Complex Analysis	10
	SMA 2204	Partial Differential Equations	10
	SMA 2206	Numerical Analysis	10
			120
III	SPH 3010	Industrial Attachment	**120**
	SPH 4111	Statistical Mechanics	10
	SPH 4102	Nuclear Physics	10
	SPH 4113	Electromagnetism	10
		Elective I	15
IV	SPH 4201	Management and Quality Assurance	10
	SPH 4202	Lasers and Modern Optics	10
	SPH 4214	Material Science	10
		Elective II	15
	SPH 4010	Project	25
			125
Total programme Credits			**485**

Part	Module Code	Module Title	Credits
	Elective I		
	SPH 4120	Geophysics I	15
	SPH 4130	Industrial Instrumentation I	15
IV	SPH 4150	Energy Physics I	15
	SPH 4160	Medical Physics I	15
	SPH 4170	Applied Optics I	15
	SPH 4180	Plasma Physics I	15
	SPH 4190	Astronomy and Astrophysics I	15
	Elective II		
	SPH 4220	Geophysics II	15
	SPH 4230	Industrial Instrumentation II	15
	SPH 4150	Energy Physics II	15
IV	SPH 4260	Medical Physics II	15
	SPH 4270	Applied Optics II	15
	SPH 4280	Plasma Physics II	15
	SPH 4190	Astronomy and Astrophysics II	15

The choice of electives shall be offered subject to staff availability. With the agreement of both Departments, students may also take a maximum of two modules from other Departments.

SERVICE MODULES

Part	**Module Code**	**Module Title**	**Credits**
I	SPH 1106	Modern Physics For Chemists	10
	SPH 1209	Engineering Materials	10

MODULE SYNOPSES

YEAR I

SPH 1101 Mechanics **10 Credits**

The module explores kinematics and kinetics: Inertial frames of reference; Motion in two and three dimensions; Dynamics of system of particles; Interactions between bodies, relative motion; Conservation of momentum and energy; Motion of systems of particles with variable mass; Collisions of particles; Rotational Dynamics: Rotation of rigid bodies; Moment of Inertia and its calculations for bodies of various shapes and about different axes; Work and energy in rotational motion; Angular momentum; Principles of conservation of angular momentum. It also looks at gravitation: Kepler's laws of planetary motion; Gravitational potential; Gravitation and gravity; Effect of earth's rotation on "g"; Gyroscope; Motion of a satellite; Coriolis force; The fundamental forces and their unification; Inertial forces in linearly accelerating frame; oscillatory motion: Simple harmonic motion; Mechanical oscillators; Superposition of S;H;M's; Damped and forced S;H;M;, Lissajous Resonance; Properties of Matter: Hooke's law; Moduli of elasticity and their inter-relationship; Applications of elasticity. The module also looks at fluid mechanics: Fluid at rest; Surface tension and capillarity; The continuity equation; Various types of flows; Boundary layers and turbulence; Steady state flow of fluids; Bernoulli's equation; Viscous flow and Viscosity; Friction: Nature of frictional forces; Motion in frictional medium; Rolling and sliding friction; Relativity: Space-time frames of reference; Galileo's principle of relativity; Simultaneity of events; Einstein's Special theory of relativity; Lorentz transformations; Momentum and energy systems.

SPH 1104 Modern Physics **10 Credits**

The module explores the particle nature of radiation: Planck's postulate and thermal radiation, Blackbody radiation, the photoelectric effect, the Compton effect, X-ray production and pair production; Interaction of radiation with matter-photon emission and absorption; Stationery states, discrete energy spectrum and the continuous energy spectrum; The Frank-Hertz experiment; Spontaneous and stimulated emission. It also covers the wave nature of particles: De Broglie's Postulate; The electron diffraction experiment; The wave-particle duality; The uncertainty principle; Matter waves and their properties; The Thomson and Rutherford atomic models; The stability of the atom and Bohr's Postulates and his model of the atom; Atomic spectra; The Hydrogen Atom; Correction for finite nuclear mass; the Nuclear Models: Nuclear properties, sizes and densities, masses and densities; The Nuclear Models - Liquid drop; The deuteron; Shell Fermi gas models; Binding energy nuclear forces; Magic numbers and the nuclear decay and nuclear reactions, e-capture,$\alpha$and β emission; Fission and fusion and other nuclear reactions; The origin of elements as well as an introduction to Elementary Particles: Isospin, Pions, Leptons and Families of elementary particles.

SPH 1105 Electricity & Magnetism **10 Credits**

The module highlights the Static Electric fields: Coulomb's Law; The electric field; Motion of point charges in electric fields; Lines of force; Electric dipoles in electric fields; Electric flux; Gauss's Law; Applications of Gauss law; Electric Scalar Potential of a system of point charges;

Capacitors in circuits; Energy stored in a capacitor; Dielectrics; Applications of Static electricity in Industries; Electric Current and Resistance: Electric conductors; Current and current density; Kirchhoff's Rules; DC Network Theorems; RC circuits; Wheatstone's bridge; More complex circuits; Measurement of current, Potential Difference and Resistance; Changing sensitivity of Instruments and Thermoelectricity. It also covers Magnetic fields: The force between currents; Definition of magnetic field and Magnetic flux Density; Magnetic intensity, Magnets in magnetic fields and Magnetic dipole moment; Torque on a current loop in a uniform magnetic field; Motion of charges in magnetic fields; Biot-Savart Law; Ampere's Law; Magnetic field of a solenoid and a bar magnet; Induction and Inductance: Faraday's and Lenz's Law; Self and Mutual Inductance Generation of High voltages using principles of induction; Energy storage in inductors and B fields; Electric motors and generators; The Lorentz force; Electromagnetic Oscillations and Alternating Currents: L-R, L-C, and L-CR circuits; Basic Alternating current circuits; Phasor notation; Power in AC circuit; A-C network Theorems; AC bridges; Frequency filtering and tuning circuits; Transformers, capacitor and inductor circuits with generator together with Eddy currents.

SPH 1106 Modern Physics For Chemists 10 Credits

This module acquaints students with the introductory concepts in Modern Physics, Optics and Sound; In addition, selected topics in Electronics are dealt with as applied to Instrumentation Physics;

SPH 1114 Thermal Physics I 10 Credits

The module looks at Thermodynamic system, the working substance, state of a working substance, thermodynamic- co-ordinates, reversibility, thermodynamic equilibrium, and thermodynamic process; Temperature: Zeroth law and the concept of temperature, measuring temperature, temperature scales, Thermal expansion; Thermodynamic System: The concept of thermodynamic equilibrium; Equation of state; PV and Pq diagram for pure substances; PVq surfaces; Differential changes of state; Mathematical theorems; Examples of thermodynamic systems: stretched wire, surface film, reversible cell, dielectric slab, paramagnetic rod and work done in changing these parameters; Heat and the First Law of Thermodynamics: Heat, measuring heat capacities, heats of transformation, heat and work; First Law of Thermodynamics: non-flow energy equation, steady flow energy equation; The Heat Engine Cycle: The Carnot cycle, Carnot cycle for a perfect gas, constant pressure cycle, air standard cycles, steam cycles, gas turbine cycles; Refrigeration and Heat Pumps: Vapour compression cycles, pressure-enthalpy diagram, vapour-absorption cycles, and liquefaction of gases - isoentropic and isoenthalpic cooling, air and hydrogen liquefiers; Heat transfer: Conduction, convection, radiation, electrical analogy, thermal resistance; Properties of Thermodynamic substances: PV, PT diagrams of pure substances, PVT surfaces, use of vapour tables; The ideal gas: Properties and model of an ideal gas as well as the Equation of state for an ideal gas.

SMA1201 Calculus Of Several Variables 10 Credits

This module explores the Cartesian coordinates in three dimensions; Functions of several variables; Quadric surfaces; Curves; Partial derivatives; Tangent planes; Derivatives and differentials; Directional derivatives; Chain rule; Div, grad and curl; Maxima and minima; Lagrange multipliers; Double and triple integrals; Change of order; Change of variable; Polar and spherical coordinates; Line and surface integrals; Green' theorem in the plane; Divergence theorem; Stokes theorem and Applications.

SPH 1201 Waves And Optics 10 Credits

The module examines coupled Harmonic and anharmonic Oscillations: Normal modes; energy transfer in the coupled system; Coupled oscillations and the wave equation; Anharmonic Oscillations due to a non-linear return forces; The large amplitude pendulum; Thermal expansion of crystals; Wave Phenomena: Longitudinal and transverse progressive waves; Superposition of waves; pulses and wave packets; Fourier analysis of wave motion; Frequency spectrum; The Fourier integral; Waves in 2D and 3D; Resonating cavities and wave guides; Application to fibre optics Sound: Sound wave propagation in gases and solids; Energy distribution; Reflection and transmission of sound at boundaries; Acoustic phenomena - reverberations; music and noise; Infra and Ultrasound; Applications of ultrasound in medicine; material testing etc. it also looks at interference: Young's two slit experiment; Multi-beam interference; Newton's rings; Lloyd's mirror Michelson interferometer; Fabry-Perot interferometer; Applications of interferometry; Diffraction: Fraunhoffer diffraction; Diffraction gratings; Fresnel diffraction Kirchhoff's diffraction theory; Application of diffraction; Polarization: Methods of production of linearly polarised light; Circular and elliptical polarisation and the Polarisation of polychromatic light.

SPH 1202 Analogue Electronics 10 Credits

This module looks at Electronic Devices: Semiconductor diodes, transistors, FET, UJT, SCR, MOSFETS; Rectifier Circuits: Power supplies, half and full wave rectifiers, filter circuits, series and shunt voltage regulators; Amplifiers: Transistor biasing, stability factors, C-E amplifiers, linearity and distortion, h-parameter analysis, frequency response, feedback amplifiers, Operational amplifiers, ideal differential amplifiers, slew rate, frequency response;
Power amplifiers: Amplifier classes and efficiency, push-pull amplifiers, transformerless push-pull amplifiers; Oscillators: Barhausen criteria, phase shift, Wien bridge and Hartley oscillators and Crystal Oscillator for the stability of frequency.

CTL 1101 Conflict Transformation & Leadership 10 Credits

The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

YEAR II

SPH 2101 Quantum Mechanics 10 Credits

The module is on Schrodinger's theory of Quantum Mechanics: The wave function and its required properties; The probability densities; Solution of the time – independent Schrodinger equation for all known simple potentials including the Harmonic Oscillator - Hermite polynomial; Operator algebra: Hermiticity of Operators: Communicators; The Hamiltonian; The equation of Motion; The eigenvalues and Eigen-functions; Observables and expectation values; The one electron atoms: Spherical Harmonics; Quantum numbers; Selection rules; Angular momentum; The Zeeman Effect; The electron spin the Stern - Gerlach experiment; Addition of angular momentum; The Spin Orbit interaction; Total Angular Momentum; Spin -

Orbit Interaction and the Hydrogen Energy levels; Many-electron atoms: Pauli exclusion principle, electronic states, bonding in molecules and solids, the classical free electron model, Fermi energy.

SPH 2102 Thermal Physics II **10 Credits**
The module looks at the Second Law: Formulations of Second Law of Thermodynamics, entropy, the T- S diagram, entropy and irreversibility, entropy and disorder; Quasi-static processes; Reversible and irreversible processes; The TdS and Energy equations; The method of Thermodynamic Potentials: U(S,V), F(V,T), H(S,P) and G(P,T); Thermodynamic Functions: Enthalpy Function; Helmholtz Function; Gibbs Function; Maxwell's Relations with thermodynamic variables, TdS equation, energy equations, heat capacity equations, heat capacity at constant pressure/volume, thermal expansivity, compressibility; Applications to various thermodynamic systems: The cooling and liquefaction of gases in a reversible and irreversible adiabatic expansion – the Joule Kelvin Effect; The Thermodynamics of dielectric and magnetic substances: the piezo-electric and piezo-magnetic effects; The Magneto- Caloric Effect; Phase transitions of the first kind: - The Classius-Clapeyron Equation; Nernst Theorem The Third Law of Thermodynamics: The behaviour of thermal coefficients as the temperature T approaches absolute zero as well as The unattainability statement of absolute Zero.

SPH 2103 Classical Mechanics **10 Credits**
The module looks at fundamental forces: Classification and unification; Inertial forces in linearly accelerating frame; Non-inertial systems; Lagrange's and Hamilton's formulation of mechanics; Generalised co-ordinates; Principle of least action; Lagrange's equation of motion and applications; Simple and double pendulum; Inclined plane; Orbital mechanics; Equivalence of Lagrangean and Newtonian mechanics; Lagrange's undetermined multipliers and Hamilton-Jacobi theory and Relativity.

SPH 2105 Research Methodology **10 Credits**
The module looks at the importance of Research; Generating and Prioritising Research ideas; Review of Literature; Formulation of hypothesis and objectives; Introduction to study designs; Research proposal writing; Sampling Methods; Data collection; Presentation and analysis; Plagiarism; Referencing and citation as well as Report writing skills.

SPH 2106 Digital Electronics **10 Credits**
This module looks at Denary, Octal, Hexadecimal, Binary Numbers; Various codes used; Binary addition, subtraction, multiplication, division; Logic Gates, Semiconductor Diodes & Transistor as switching devices NAD, NOT, NOR, OR and Exclusive 'OR* gates Boolean Algebra; Principle of Duality De Morgan's theorem; Half Adder and Full Adder; Karnaugh Map (2, 3, and 4 variables); Mini-terms and Maxi-terms; Use of K-Map using Mini-terms to simplify logic functions; Canonical forms of a function; Symmetric functions; Equivalence and Non-Equivalence Symmetry; Incompletely specified functions; Combinational gates; Logic gate Analysis and Synthesis; Logic Technology: D-T and TTL logic; Fan in, fan out and noise margins; Logic Threshold; Interfacing logic devices; Sequential Logic Systems: Flip-flops, 'SR*, JK, D and T type; Race around condition in clocked flip-flop; Master Slave flip-flop; Shift Registers; SIPO, SISO, PISO, and PIPO; Shift left to right; Schmidt Trigger; Types of memory used in computers; Counters: Synchronous and non-synchronous; Binary & Denary

counters; Divide by n or Modulo ‘n’ counters; Up and down counters, series and parallel carry modes; ADC and DAC: Sample and Hold circuit, Resolution of conversion, Successive Approximation ADC, Counter Ramp ADC; Weighted Resistor ladder DAC and Counter Properties.

SPH 2202 Solid State Physics 10 Credits

This module examines crystal Structure and Defects: Unit cell, crystal systems, elements of symmetry, Miller indices, diffraction, imperfections-vacancies, colour centres, dislocations; Burger's vector; Lattice Vibration: Elastic waves; Density of states; Specific heat models of Einstein and Debye; Scattering of X-rays, neutrons and light by phonons; Free-electron Model: Free electron gas; Electrical conductivity; Heat capacity of free electrons; Fermi surface; Thermionic emission; Semi-conductors: Direct and indirect band gap semiconductors, conductivity, mobility and life times in intrinsic semiconductors, extrinsic semiconductors: p-type and n-type semiconductors; Fermi energy level; P-N junctions, light emitting-, Zener -, tunnel diodes; Ohmic and non-Ohmic contacts, Hall effect in semiconductors; Schottly barrier; Oxide and non-oxide semiconductors; Magnetism: Classification as dia-, para-, ferro-, ferri- and antiferro-magnetics; Domains and other macroscopic phenomena; Magnetic measurement techniques; Applications-magnetic bubbles, magnetic phase analysis of alloys, imaging etc;
Dielectrics and Ferro-electrics: Electric polarisation, Mechanisms of polarisation-electronic, ionic orientational and space charge, derivation as a function of temperature and frequency; Claussius-Mossoti equation; Classification of ferro-electrics, ferroelectric domains, pyro-electricity, and piezoelectric materials and applications; Superconductivity: Theory of superconductivity, Meissner effect, flux quantization, type II superconductors heat capacity and applications.

SPH 2203 Instrumentation Physics 10 Credits

This module looks at Measurement Systems: Purpose, structure and elements; Static characteristics of measurement instruments, repeatability, tolerance, calibration, measurement standards, frequency response of measurement elements, error calculations and error compensation; Noise and interference in measurement circuits, random signals, probability density, spectral density and autocorrelation functions, noise reduction methods, economics, reliability and choice of measurement systems; Transducers: Principles and types; Capacitive, resistive, inductive, electromagnetic, thermoelectric, elastic, piezoelectric, piezo-resistive, electrochemical, gas, ion selective electrodes; Signal conditioners and data acquisition: Applications and limitations of op-amps, instrumentation amplifiers, current transmitters, frequency to voltage converters, current to voltage converters, energy to voltage converters, phase locked loops, ADC and DAC application in instrumentation systems, analogue and digital recorders, digital printers; introduction to flow measurement: Velocity, volume flow-rate, mass flow-rate, types of flow meters - ultrasonic, Doppler flow meter, pulse transmission and reflection, medical imaging flow measurement; Radiation Measurements: Photo-multiplier tubes, scintillators, ionisation chambers, infrared detectors, semiconductor detectors, nuclear instrumentation and standards.

SPH 2205 Atomic Physics **10 Credits**

This module looks at Multi-electron Atoms: Identical particles and Indistinguishability; The Schrödinger Equation and the wave functions of multi-electron atoms: The two and three electron atoms; The exclusion principle: Fermions and Bosons; The Hartree Theory and its applications to multi-electron atoms; Electronic configuration and the ground states of multi-electron atoms; The periodic table; X-ray line spectra; Optical Excitations in Multi-electron atoms: Alkali atoms, Atoms with several Optically Active electrons, LS Coupling; Energy Levels in multi-electron atoms: The Carbon Atom; The Zeeman Effect in multi-electron atoms; Molecules: Bonding in molecules: Ionic and Covalent bonds; Molecular Spectra: Rotational, Vibrational and Electronic Spectra; Molecular energy levels; The Raman effect; Applications of Raman scattering;

YEAR III

SPH 3010 Industrial Attachment **120 Credits**

A student is attached to the Industry with the assistance of the Department for a period of 28 weeks. The student is assigned an academic supervisor and at the point of his attachment, he/she shall be assigned a supervisor by the Company/Institution where he/she shall be attached. The academic supervisor shall from time to time liaise with the student and visit him/her for purposes of assessment. The Industrial supervisor shall also assess the student separately. The end of the attachment period, the student shall be jointly assessed by the two supervisors. The student shall write a report of what transpired when on attachment. He/she may be required to give an Oral Presentation before the Departmental Panel of Examiners and submit a written Industrial Attachment Report to the department at least two weeks before the beginning of the Semester Written Examination Schedule.

YEAR IV

SPH 4101 Statistical Mechanics **10 Credits**

The course looks at Statistical Systems Microcanonical, Canonical and Grand Canonical Ensembles; Phase space; Classical Statistics: Liouville Theorem; Entropy and thermodynamic probability; Entropy of perfect gas using Microcanonical ensemble; Partition function; Evaluation of partition function for monatomic and diatomic gases; Maxwell's velocity distribution function; Equipartition of energy; Quantum Statistics: Inadequacy of classical statistics; Partition function for Bosons; Plank's law Derivation; Systems with variable particle numbers; The Gibbs and B;E distribution functions; Bose-Eistein condensation; Fluctuations in Bose System; Statistics of fermions; Fermi-Dirac energy distribution; Zero point energy; Concept of absolute zero of temperature; Fermi energy level and its physical significance; Electron contribution to specific heat capacity in metals; Fluctuations in fermion systems; Cryogenics: Phase equilibrium; The Clausius-Clapeyron equation; Pressure dependence of melting and boiling points; Critical point; Liquefaction of gases; Cryostat cooling with ^{3}He; Production of milli degree temperatures; Applications of cryogenics in rocket propulsion, electronics, biology and medicine.

SPH 4102 Nuclear Physics **10 Credits**

The module offers a review of elements and Principles of Quantum Mechanics - 3-dimensional problems, angular momentum, Parity, Transitions between states; The predictions of the shell model; Fermi Gas and Collecture model; Nuclear decay: Alpha decay; Basic Alpha decay processes; Theory of Alpha emission; Angular momentum and parity in α - decay; α - decay spectroscopy; Beta decay; Fermi Theory of β-decay; Energy release in β -decay; Angular Momentum and Parity Selection Rules; Forbidden decays; Double β -decay; β -decay spectroscopy; γ- Decay; Energetics of γ-decay; Angular Momentum and parity selection rules; Internal convection; Lifetimes for γ-emission; γ- ray spectroscopy, Nuclear Resonance, Fluorescence and the Mossbauer Effect; Nuclear Reactions: Energetics of Nuclear Reactions, Reaction cross section; Coulomb scattering; Nuclear scattering; Experimental Techniques; The optical model; Direct, Resonance and Heavy-Ion Reactions; Neutron Physics: Absorption and moderation of Neutrons; Neutron Sources and Neutron Detectors; Neutron Capture; Interference and diffraction with Neutrons; Nuclear fission: Characteristics of Fission, Fission and Nuclear Structure; Controlled Fission Reactions; Fission Reactors and Radiature Fission.

SPH 4103 Electromagnetism **10 Credits**

The module covers Boundary Value Problems: Poisson's Equations; Solution of Poisson's equation for graded junctions, Child-Langmuir Relation; Laplace's equation; Uniqueness theorem; Solution in one and two variables; 90^o Corner, Potential well, Parallel plate capacitor etc; Field and Circuit Theory: Maxwell's Equations for static and harmonically varying Currents; Displacement Current; Applications of circuit Theory and Field Theory; Electromagnetic Waves: Helmholtz Generalized Wave equation; Plane waves in dielectric, lossy dielectric and conducting medium; Phase and group velocities; Impendance of the medium; Poynting's Vector; Reflection, refraction, polarisation and dispersion of waves. It also looks at transmission Lines: Coaxial, Two wire and Infinite plane transmission line; Telegrapher's equation; Impedance at a point on a terminated transmission line; Matched impedance; Impendance matching with a quarter wavelength line; Smith Chart and its applications; Rectangular Waveguides; TE and TM mode of propagation; Cut-off frequency, attenuation in guides, Characteristic properties of Waveguides; Cavity resonators; Antennas and Radiation: Retarded Potentials, Radiation field due to a short dipole; Radiation due to half wave dipole; Radiation patterns due to linear arrays; Various types of antennas; Plasmas and Propagation in Ionised Medium: Definition of plasma in laboratory; Plane waves in ionised medium and Faraday Rotation.

SPH 4010 Research Project **25 Credits**

Each student shall be required to undertake a research project in their fourth year of study. The project may be of an applied theoretical, experimental or industrial nature. The defining characteristic shall be one of quality and maturity of work expected of a graduating student. Results of the project work carried out during the entire year are to be typewritten, bound and submitted before the beginning of the Year IV second semester examinations. All students shall be required to give a seminar on their project work and the final grade shall be determined on the basis of the written report and the seminar.

SPH 4201 Management Science And Quality Assurance **10 Credits**

The module looks at general and personnel management; Management control and Marketing Strategies; Business and Finance; Quality control plans for factories with special reference to physics equipment; Cost Effective Product Development; ISO standards; Research and Development Strategies in factories as well as quality and reliability.

SPH 4202 Lasers And Modern Optics **10 Credits**

The module explore the Introductory concepts: Spontaneous and stimulated emission Rates of absorption and stimulated emission; Line broadening mechanisms; Transition cross-section and Gain co-efficient; Einstein Thermodynamic treatment; Saturation of absorption; Gain saturation; Pumping processes: Optical pumping; Radiative and transfer efficiencies; Quantum efficiencies for absorption and power; Electrical pumping; Electron impact excitation; Ionization balance equation; Pump rate calculation; Optical Systems: matrix formulation of geometrical optics; The Fabry Perot Interferometer; Fox and Li treatment, Confocal resonator; Gaussian beam propagation and 'ABCD' law; Stability condition; Unstable resonators; Hard-Edge Unstable resonators; Transformation of impedance through multi-layer optional systems; Resonator design; Types of lasers: Structure and operation of gas lasers, solid state laser, semiconductor laser, excimer lasers and dye lasers; Applications: Industrial applications, medical applications, telecommunication applications, environmental applications and military applications.

SPH 4203 Materials Science **10 Credits**

This module looks at solid Solutions: Substitutional and interstitial solid solutions; Rules for solid solutions - Hume-Rothery; Intermediate Phases - crystal structure and properties; Examples of alloy systems; Constitutional Phase Diagrams: Solidification; Non-ferrous metals and alloys; Cooling curves and construction of phase diagrams; Examples of complete, partial and incomplete phase diagrams; Interpretation of phase diagrams - phases and compounds e;g; Al-Cu, Pb-Sn, Cu-Z and A1-Si systems; Ceramic phase systems; Eutectic, hypereutectic and hypo-eutectic compositions; Aluminium-rich end of A1-Cu and A1-Si systems. It also looks at Diffusional Processes: Mechanisms of diffusion - substitutional and interstitial; Diffusion equations - Fick's 1st and 2nd Laws; Applications of diffusion Laws; Deformation of Metals: Elastic and plastic deformation - introduction; Critical resolved shear stress in single crystals slip systems; Engineering stress-strain curves - modulus of elasticity, tensile strength, yield strength, ductility; Methods of metal deformation - rolling, extrusion, forging, drawing; Hardness measurement - Vickers, Brinell and Rockwell; Engineering application of cold and hot annealing. The module also examines corrosion: Oxidation of metal surfaces; Corrosion in acids and alkalis; Types of corrosion - electrochemical, atmospheric, intergranular; Methods for corrosion prevention - e;g; cathodic protection; Structure and Properties of Ceramic, Polymeric and Composite Materials; Simple Ceramic Materials: Alumina ($A1_2O_3$), Magnesia (MgO), Silicates -asbestos, mica, clay, Mullite, Spinels, Carbides, Glasses - glass formers, modifiers, intermediates; Crystal Structures of Ceramic Materials e;g; NaC1, CsC1, CaF_2, Diamond, corundum, perovskite silica; Some Properties of Ceramics: Porosity and densities, Thermal shock resistance; Thermal coefficient of expansion, Thermal conductivity, Hardness and strength, Rupture strength; Piezo-electricity;Composites: General treatment of composites

- concrete, asphalt, wood; Fabrication of composites; Classes of composites - different configurations of matrix and fibres and the Mechanical properties of composites.

SPH 4204 Industrial Instrumentation **10 Credits**

This module looks at the measurement concepts: Measurement Energetics, Measurement Dynamics; Transducer Design and applications; Electronic and optical instrumentations; Digital and analogue signal processing: Digital and analogue signal processing and digital measurement techniques; Image processing as well as measurement Systems hardware.

ELECTIVE MODULES

The choice of electives shall be offered subject to staff availability.; With the agreement of both Departments, students may also take a maximum of two modules from other Departments.

SPH 4120 Geophysics I **15 Credits**

The module highlights the Physics of the earth: Elementary plate tectonics; Geophysical methods and their applicability; Organisation of the geophysical work; Magnetic methods: Magnetic potentials; magnetic properties of rocks; The geomagnetic field -elements; measurements; measuring instruments; Anomalies of simple bodies; Qualitative and quantitative interpretation; Gravity methods: Electrical properties of rocks and minerals; Self-potentials; Resistivity method; Interpretation and the method of curve matching.

SPH4220 Geophysics II **15 Credits**

This module looks at refraction and reflection seismology: Basic theory on refraction and reflection seismic methods, instruments for seismic data acquisition, interpretation of seismic data and seismic data processing techniques; Seismic reflection methods in engineering and environmental applications.

SPH 4150 Energy Physics I **15 Credits**

This module is on energy sources: Renewable and non-renewable sources; Solar Energy: Solar energy, solar cells, solar panels, solar-chemical cells; Solar thermal applications; Solar energy storage; Efficiencies and applications.

SPH 4150 Energy Physics II **15 Credits**

This module is on non-conventional energy sources: Wind, micro-hydro, tide, chemical, geothermal, biomass and biogas; Efficiencies and applications.

SPH 4160 Medical Physics I **15 Credits**

The medical Physics elective is designed to prepare students to get employment in the health sector, medical equipment companies, equipment sales, pharmaceutical companies, public and private hospitals, etc. Major topics include: Radiotherapy, Nuclear medicine; Diagnostic radiology; MRI and Ultrasound.

SPH 4260 Medical Physics II **15 Credits**

The module looks at therapeutic applications; Human anatomy and Physiology; Audiological measurements; Detectors, scintillators; PMT, TLD and film; Introduction to neurological measurements and Radiation Protection.

SPH 4170 Applied Optics I **15 Credits**

The module outlines optical Detectors; Photonic devices for imaging and storage; Basic principles and applications of holography and Fibre optic telecommunication.

SPH 4270 Applied Optics II

The module is on laser Spectroscopy and Non-linear Optics.

SPH 4180 Plasma Physics I **15 Credits**

Topics in this module include: Plasmas in nature; Plasma-fluid equations; Wave propagation in plasma Controlled fusion; Magnetic and inertial confinement.

SPH 4280 Plasma Physics II **15 Credits**

The module explores plasma etching, deposition spraying; Plasma devices; MHD generators; Laser induced plasmas and Plasma diagnostics.

SPH 4190 Astronomy And Astrophysics I **15 Credits**

This module is an introduction: Scope of astronomy; Size and age of the universe; Objects of the night sky: (Stars, constellations, planets); The Celestial Sphere: Rotation and hourly change of the night sky; Coordinate systems: declination and right ascension; Effect of the movement of the Sun in the sky; The ecliptic and the zodiac; equinoxes and solstices; Sedereal and solar day; Precession of the equinoxes; The Moon: Physical characteristics and orbit; phases and eclipses; sidereal and synodic month; Lunar surface and exploration; Theories of origin; The Solar System: Planetary orbits; Kepler's laws; Retrograde motion; Overview of specific characteristics of each planet and its satellites; Asteroids and comets; Formation of the solar system; The Sun: Characteristics and structure; Spectrum; Sunspots and Energy output.

SPH 4290 Astronomy And Astrophysics II **15 Credits**

This module looks at stars: Measuring distances – light year and parsec; Stellar motion; Star brightness – apparent and absolute magnitude; Star colours and spectra: spectral classification; Hertzsprung-Russel diagram; Evolution of stars – red giant, white dwarf, stellar collapse; Supernovae, pulsars, quasars; Black holes; Variable stars; Binary stars, open and globular clusters; Galaxies: The Milky Way; Galaxy types, sizes, distances; Recession and Hubble's law; Age of the universe and the Big Bang; Cosmology; Solar System Formation: Collapse of Nebula; Capture theory; Condensation and Accretion theory; Star Formation: Jeans Collapse mechanism, Hydrogen burning, Accretion: free-fall, disk, outflows and Initial Mass Function.

BACHELOR OF SCIENCE HONOURS IN EARTH SCIENCES

1.0 DEGREE PROFILE: Bachelor of Science Honours in Earth Sciences

Institution:	National University of Science and Technology
Type of Degree:	Honours
Credit Load:	480 credits
Level:	SADC-QF - Level 8
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	2018

2.0 REGULATIONS

These regulations shall be read in conjunction with the Faculty of Applied Science and University General Academic Regulations.

3.0 DURATION

The Programme shall normally be offered over a four-year period.

4.0 ENTRY REQUIREMENTS

Normal Entry

An applicant must have at least two 'A' Level passes in Physics and Mathematics.

5.0 PROGRAMME STRUCTURE

5.1 The Programme consists of 4 parts. A student shall register for at least six prescribed and approved modules or their equivalents in each semester. Most of these modules carry practical and fieldwork work where students shall learn and gain an appreciation of the practical and technological applications of Earth science.

5.2 **Fieldwork**

The majority of the modules on the programme have a fieldwork component that is carried out concurrently with the theory part of the modules. Fieldwork comprises the practical component of the degree programme. For a module with a fieldwork component, the fieldwork shall comprise 40% of the overall continuous assessment.

5.3 **Research Project Module**

A student in Part IV is required to undertake a Research Project weighted at two modules.

5.4 Industrial Attachment

A student on this programme shall be required to complete an industrial attachment component that runs from January to the end of July during Part III of the programme. At the end of the attachment period, the student shall be required to present both a written and an oral report to the Departmental Panel of Examiners.

6.0 ASSESSMENT

6.1 Taught modules shall be assessed through continuous assessment and a three-hour final written examination at the end of each semester. Continuous assessment shall be 25% and the written final examination shall be 75% of the final mark.

6.2 The Industrial Attachment module shall be assessed by a detailed attachment report and continuous assessment from industrial or field supervisors, a prescribed logbook and a viva voce. The continuous assessment mark from industrial or field supervisors shall constitute 20%, and viva voce 30% and the overall report mark shall constitute 50% of the overall assessment.

6.3 The Research Project shall be assessed by means of a written research project report and an oral presentation. The oral presentation mark shall constitute 50% of the overall project mark. The research project report shall constitute the other 50% of the overall research project mark.

6.4 A minimum of 480 credits shall be required for the degree to be awarded.

7.0 WEIGHTING

The Parts of the Degree programme shall be weighted as follows: -

Year I	15%
Year II	20%
Year III	25%
Year IV	40%

PROGRAMME SUMMARY

YEAR I: Semester I

Module Code Module Description	Credits
SES 1101 Introduction to Earth Systems Science	10
SPH 1101 Mechanics and relativity	10
SPH 1107 Electric Circuits and instruments	10
SMA 1101 Calculus	10
SMA 1102 Linear Algebra	10

SEMESTER II

SMA 1204 Ordinary Differential Equations	10
SES 1202 Physical Geology	10
SPH 1201 Waves and Optics	10
SES 1203 Geo Chemistry	10
SMA 1201 Calculus of Several Variables	10
SCS 1201 Computer applications and Programming	10
CTL1101 Conflict Transformation and Leadership	10

YEAR II: Semester I

SES 2101 Geotectonics and Geohazards	10
SORS 2106 Probability Theory	10
SES 2102 Geomicrobiology	10
SPH 2105 Electromagnetism	10
SES 2103 Elements of Geomorphology	10
SES 2104 Surveying I	10

SEMESTER II

SES 2201 Soil Physics	10
SES 2202 Theory of Seismology	10
SES 2203 Elements of Meteorology	10
SES 2204 Surveying II	10
SMA 2206 Numerical Analysis	10
SMA 2104 Partial Differential Equations	10

YEAR III: Semester 1

SES 3106 Petrology	10
SES 3101 Remote Sensing	10
SES 3102 Potential Field Exploration Methods	10
SES 3103 Research Methods	10
SES 3105 Electrical and Electromagnetic Exploration Methods	10
SES 3104 Principles of Surface and Groundwater Hydrology	10

Semester II

SES 3200 Industrial Attachment	60

YEAR IV

Semester I

SES 4101 Seismic Exploration Methods	10
SES 4102 Borehole Logging Techniques	10
SES 4103 Groundwater Modelling and Management	10
SES 4104 Geographical Information Systems	10
SES 4105 Structural Geology	10
SES 4010 Research Project	10

Semester II

SES 4201 Climate Dynamics	10
SES 4202 Environmental Geo-science and Impact Assessment	10
SES 4203 Geotechnical Investigations	10
SES 4204 Quality Assurance and Project Management	10
SES 4205 Time Series Analysis and Signal Processing	10
SES 4010 Research Project	10

MODULE SYNOPSES

YEAR I

SES1101 Introduction to Earth Systems Science 10 Credits

The module is an introduction to the processes of and linkages among major components of planet Earth; Geosphere, hydrosphere, atmosphere, biosphere as dynamic and interdependent systems; Influence of human activity on earth systems, structure and dynamics of the Earth; stratigraphy and geological history; climatology; surface processes and evolution of landscapes; biogeography; humans and the environment; Processes operating on and below the earth's surface and the resulting features of landscape, earth structures, and earth materials; Occurrences and utilization of the earth's physical resources.

SPH1101 Mechanics and Relativity 10 Credits

The module is on kinematics and Kinetics: Inertial frames of reference; Motion in two and three dimensions; Dynamics of system of particles; Interactions between bodies, relative of motion; Conservation of momentum and energy; Motion of systems of particles with variable mass; Collisions of particles; Rotational Dynamics: Rotation of rigid bodies; Moment of Inertia and its calculations for bodies of various shapes and about different axes; Work and energy in rotational motion; Angular momentum; Principles of conservation of angular momentum; Gravitation: Kepler's laws of planetary motion; Gravitational potential; Gravitation and gravity; Effect of earth's rotation on "g"; Gyroscope; Motion of a satellite; Coriolis force; The fundamental forces and their unification; Inertial forces in linearly accelerating frame; Oscillatory motion: Simple harmonic motion; Mechanical oscillators; Superposition of S;H;M's; Damped and forced S;H;M;, Lissajous, Resonance; Properties of Matter Elasticity: Hooke's law; Moduli of elasticity and their inter-relationship; Applications of elasticity; Fluid mechanics: Fluid at rest; Surface tension and capillarity; The continuity equation; Various types of flows; Boundary layers and turbulence; Steady state flow of fluids; Bernoulli's equation; Viscous flow and Viscosity; Friction: Nature of frictional forces; Motion in frictional medium; Rolling and sliding friction; Relativity: Space-time frames of reference; Galileo's principle of relativity; Simultaneity of events; Einstein's Special theory of relativity; Lorentz transformations; Momentum and energy systems.

SPH1107 Electric Circuits and Instruments 10 Credits.

The module is an introduction to electric field; Motion of point charges in electric fields; Lines of force; Electric dipoles in electric fields; Electric flux; Gauss's Law; Electric Scalar Potential; Capacitors in circuits; D;C and A;C circuit analysis; Thevenin and Norton’s Theorems; Power supply, rectifiers and filters; Potential dividers; Introduction to semiconductors, diodes and transistors; Basic Concepts of Electrical Measuring Instruments, Current Measurement and Voltage Measurement, Power Measurement and Energy Measurements, Measurement of other Electrical Quantities, A;C; Bridges, Dielectric Measurement; Frequency Analysis of Circuits:

Steady-state sinusoidal analysis and impedance, Magnetic fields: The force between currents; Instrumentation: Measuring System, Transducers/sensors, Signal conditioner, Indicators and Recorders, Measurement of Physical Quantities, Telemetry; Magnetic flux Density; Magnetic intensity, Magnets in magnetic fields; Magnetic dipole moment; Torque on a current loop in a uniform magnetic field; Motion of charges in magnetic fields; Biot-Savart Law; Ampere's Law; Magnetic field of a solenoid and a bar magnet; Induction and Inductance: Faraday's and Lenz's Law; Electric motors and generators.

SMA1101 Calculus 12 Credits

The module examines the limit of functions; One-sided and infinite limits; Continuity; Differentiation; Definition, basic properties; Rolle's Theorem, mean value theorem, Cauchy's mean value theorem; Leibniz' rule; Applications; Taylor series; Integration, Definite integrals; Antiderivatives; Fundamental theorem of calculus; Improper integrals; Gamma and Beta functions; Definition of natural logarithm as integral of 1/x and exponential as inverse; Area, volume of revolution, arc length, surface area; Parametric equations; Arc length, surface area; Polar coordinates; Graph sketching; Area in polar coordinates; Complex numbers; Algebra of complex numbers; De Moivre's theorem and exponential form.

SMA1102 Linear Algebra 12 Credits

The module looks at vector Algebra: Scalar and vector product; Collinear, coplanar vectors; Applications; Equations of lines and planes; Matrices; Products, sums, echelon form, rank, inverse; Determinants; Definition, properties, evaluation; Systems of Linear Equations; Consistency, Gauss' method, Cramer's rule; Homogeneous systems; Vector Spaces, linear independence, bases and Subspaces.

SES1202 Physical Geology 10 Credits

This module is about scientific methodology applied to the study of common rock-forming minerals, common rocks, topographic maps, geologic structures and geological maps; Physical processes involved in igneous, metamorphic and sedimentary rock formation, modification and destruction; Physical geology and principles of stratigraphy; Sedimentology: Mechanisms of transport and deposition of siliciclastic sediment; Textual analysis of sedimentary rocks; Sedimentary structures, traces fossils and bioturbation; siliciclastic, diagenesis of carbonate rocks, evaporitic and other sedimentary rocks; earthquakes, stress, displacement and strain; brittle and ductile deformation; classification and petrography of igneous rocks; physical processes in magma chambers; the relationship between chemical and mineralogical composition; types of metamorphism, metamorphic textures and mineral assemblages and Field work.

SCS1201 Computer Applications and Programming 10 Credits

The module explores data types, basic control structures; Python, Object-oriented programming, classes and data hiding, dynamic object construction and destruction, derived classes and inheritance, virtual functions; file processing; engineering applications;

Introduction to C++, basic structure of C++, variables, single & Multidimensional arrays, string, for, while, do-while, conditional statement (if, switch, question mark operator), functions, structures, Application of set theory to program specification, Programme design through pseudocode, JSP, Klarner, O, Diagrams and FORTRAN.

SES1203 Geochemistry 10 Credits

The module looks at the earth as a closed geochemical system; Geochronology, Geochemical surveys, orientation soil surveys, Practicalities of a soil survey; Dispersion-primary dispersion, secondary dispersion, primary dispersion patterns, secondary dispersion patterns, displaced anomalies, physical form and classification of secondary dispersion patterns; Geochemical associations; Geochemical data; Analytical terms in geochemistry; Wet analyses; Preparation of samples for analyses, analytical methods in geochemistry, data analysis and data presentation as well as Geochemical techniques for mineral exploration.

SMA1201 Calculus of Several Variables 10 Credits

This module explores the Cartesian coordinates in 3 dimensions; Functions of several variables; Quadric surfaces; Curves; Partial derivatives; Tangent planes; Derivatives and differentials; Directional derivatives; Chain rules; Div, grad and curl; Maxima and minima; Lagrange multipliers; Double and triple integrals; Change of order; Change of variable; Polar and spherical co-ordinates; Line and surface integrals; Green's theorem in the plane; Divergence theorem; Stokes theorem and Applications.

SPH1201 Waves and Optics 10 Credits

This module looks at Coupled Harmonic Oscillations: Normal modes; energy transfer in the coupled system; Coupled oscillations and the wave equation; Anharmonic Oscillations: due to a non-linear return forces; The large amplitude pendulum; Thermal expansion of crystals; Wave Phenomena: Longitudinal and transverse progressive waves; Superposition of waves; pulses and wave packets; Fourier analysis of wave motion; Frequency spectrum; The Fourier analysis of wave motion; Frequency spectrum; The Fourier integral; Waves in 2D and 3D; Resonating cavities and wave guides; Application to fibre optics; Sound: Sound wave propagation in gases and solids; Energy distribution; Reflection and transmission of sound at boundaries; Acoustic phenomena - reverberations; music and noise; Infra and Ultrasound; Applications of ultrasound in medicine; material testing, etc; Young’s two slit experiment; Multi-beam interference; Interference: Newton's rings; Lloyd's mirror Michelson interferometer; Fabry-Perot interferometer; Applications of interferometry; Diffraction: Fraunhoffer diffraction; Diffraction gratings; Fresnel diffraction; Kirchhoff's diffraction theory; Application of diffraction; Polarization: Methods of production of linearly polarised light; Circular and elliptical polarisation and Polarisation of polychromatic light.

SMA1204 Ordinary Differential Equations 10 Credits

The module looks at first order ordinary differential equations; Separable, Linear, Exact; Integrating factors; Existence; Uniqueness; Applications; Second Order Equations; Linear equations and linear differential operators; Linear independence, Wronskian; Ordinary Linear Differential Equations with constant coefficients; Undetermined coefficients; Variation of parameters; Applications; System of Equations; Phase plane portraits for Linear Systems; Introduction to Nonlinear systems; Predator-prey and Volterra-Lotka equations; Series solution of ordinary differential equations; Method of Frobenius; Legendre polynomials and Bessel functions.

CTL 1101 Conflict Transformation & Leadership 10 Credits
The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

YEAR II

SES2101 Geotectonics and Geo-hazards 10 Credits
This module is an examination of modern tectonic principles and fundamental tectonic elements of the earth's lithosphere; orogenic belts, cratons, island arcs, rift zones, continental margins, etc; The geological record of plate tectonics past and present; Geotectonic models; plate geometries, geodynamical processes, and sedimentary products; Reconstructing of ancient tectonic settings with an emphasis on methodology (paleomagnetism, basin analysis, and provenance) and case; Mechanical aspects of lithospheric deformation and mantle dynamics; The elastic behaviour of the lithosphere, its thermal structure, the forces that drives plate tectonics, and mantle convection; Tectonic processes and types of plate interaction are then analysed in terms of seismicity, geodetically defined deformation fields, and a range of different approaches to mechanical analysis, includingthin-viscous-sheet theory, block tectonics, critical wedge theory, and fluid mechanics. It also looks at contemporary methods used to identify and assess natural hazards, techniques used for the probabilistic forecasting, spatial representation and communication of hazards; The relationship between hazard information, risk mitigation and emergency management. The module is best offered with a strong focus on the use of case studies.

SES 2102 Geo-Microbiology 10 Credits
The module examines the interactions of microbes with earth materials (soils, rocks, water, etc;); The relationships between the microbial life forms and their environment, from localized niches, that occur on the order of micrometres, to global elemental cycles; Microbial physiology and genetics; geochemical controls on microbial diversity and activity; microbiological controls on geochemical reaction networks; redox and acid-base geochemistry; Biomineralisation, origin and evolution of life, microbial weathering and rock formation, and influences on environmental problems; Bio signatures and life detection and origin and evolution of microbial life.

SES2103 Elements of Geomorphology 10 Credits

The module explores the history and Methodology of Geomorphology: Time scales; Development of scientific methods; Development of major scientific principles pertaining to geomorphology; Reconstructing the past: dating techniques; Structural Geomorphology: - Plate tectonics and global scale landforms, Seismic activity; Development of continents, orogens, continental boundaries, cratons, volcanism; Structural geomorphology of deformed rocks, fractures and faults, mountain building, landforms controlled by faults and folds; Process Geomorphology: - Weathering and Karst landforms; Slope processes / mass movement; Hydrology, flow principles in open channels, scientific means to determine discharge and velocity, rating curves, hydrographs and flood frequencies. It also looks at fluvial processes and landforms; Glacial processes and landforms; Glacial Periods; Periglacial processes and landforms; Coastal and aeolian processes and landforms; Geomorphic change: long-term evolution of landscapes and Field Work.

SPH2105 Electromagnetism 10 Credits

The module looks at boundary Value Problems: Poisson's Equations; Solution of Poisson's equation for graded junctions, Child-Langmuir Relation; Laplace's equation; Uniqueness theorem; Solution in one and two variables; 90^{O} Corner, Potential well, parallel plate capacitor etc; Field and Circuit Theory: Maxwell's Equations for static and harmonically varying Currents; Displacement Current; Applications of circuit Theory and Field Theory; Electromagnetic Waves: Helmholtz generalized Wave equation; Plane waves in dielectric, lossy dielectric and conducting medium; Phase and group velocities; Impedance of the medium; Poynting's Vector; Reflection, refraction, polarization and dispersion of waves; Transmission Lines: Coaxial, Two wire and Infinite plane transmission line; Impedance at a point on a terminated transmission line; Matched impedance; Impedance matching with a quarter wavelength line; Smith Chart and its applications; Rectangular Waveguides; TE and TM mode of propagation; Cut-off frequency, attenuation in guides, Characteristic properties of Waveguides; Cavity resonators; Antennas and Radiation: Retarded Potentials, Radiation field due to a short dipole; Radiation due to half wave dipole; Radiation patterns due to linear arrays; Various types of antennas; Plasmas and Propagation in ionised medium: Definition of plasma in laboratory; Plane waves in ionised medium as well as Faraday rotation.

SES2104 Surviving I 10 Credits

This module is an introduction to surveying; Measurements and SI Units in survey; Errors in measurements: Systematic and Random errors; Methods of eliminating or minimizing these errors; Plane and Geodetic survey; Application of plane and geodetic surveys; Topographical, Cadastral, Hydrographic, Mine, Photo grammetry and Engineering Survey; Chain Surveying; Types of measurements in chain survey; Booking Methods Chain Survey Equipment; Care and maintenance; Methods of setting up; Checks and adjustments to the optical square; Ranging a straight line using a prism square; Taping; Corrections to measured lengths; Temperature, slope, standardization, tension, reduction to mean sea level; Electromagnetic measurements; Microwave, Infrared and Laser Instruments; Compass Surveying; Meridian, magnetic bearing, true north/geographic north, isogons, agonic line and magnetic declination; Factors affecting declination, types of compasses; Bearings; Elimination of local attraction, compass traverses, distance measurement; Adjustment of compass traverses using Bowditch graphical method and reconnaissance work for compass surveys; Areas of regular and irregular figures; Planimetry; Levelling: - dumpy, tilting and automatic levels; Levelling for construction, longitudinal and cross-sections, grading of constructions as well as cut and fill work.

SORS 2106 Probability Theory 10 Credits

The module outlines probability; Random/Statistical Experiments, Sample Spaces, Events, Set Theory; Axioms of probability; Laws of probability; Finite Sample Spaces; Conditional Probability, Independent events; Random Variables and Probability Distributions; Discrete probability distributions; Continuous probability distributions; Discrete bivariate distributions; Continuous bivariate distributions; Marginal probability distributions; Independent random variables; Conditional probability distributions; Distributions of functions of single random variables; Conditional probability distributions of Mathematical Expectation; Expectations of discrete and continuous random variables; Expectation of a function of a single random variable; Expectation of a function of several random variables; Expectation of a function of a single random variable; Expectation of a function of several random variables; Properties of expectations; Variance and Covariance; Markov and Chebyshev inequalities; Moment generation functions; Properties of moment generating functions; Special Distributions; Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson distributions; Normal, Gamma, Exponential and Beta distributions.

SES2201 Soil Physics 10 Credits

The module explores basic characteristics of soils, permeability of soils, seepage and site investigation; Basic Characteristics of Soils: Soil-phase diagrams, definitions and calculations of the following soil properties - Bulk density, dry density, void ratio, porosity, water content, degree of saturation, specific gravity of soil particles, bulk unit weight, saturated unit weight, dry unit weight, submerged density, submerged unit weight and water content; Determination of water content of a soil sample and specific gravity of soil grains are to be carried out, including classification of soil by the sieve analysis method and the Cassagrande's apparatus; Permeability of Soils: Darcy’s Law, coefficient of permeability and its determination by construct head method –Guelph Permeameter, falling head method and pumping well test analysis; Seepage: Pore water pressure and effective stress in a soil mass, critical hydraulic gradient, quicksand conditions and piping, drawing of flow nets and determination of factor of safety against ping; Site Investigation: methods used to collect soil samples for identification and testing - trial pits, hand auger or post-hole auger, deep boring and drilling methods and some Field work.

SES2202 Theory of Seismology 10 Credits

This module explores the wave Theory: Fundamentals of wave motion; seismic wave types; Stress tensor, strain tensor, stress-strain relations; linearized equations of motion; elastic moduli; The wave equation: dilatational and rotational solutions; separation of variables; plane and spherical waves; Reflection and refraction of plane waves at a plane boundary; independence of SH and P and of SV waves; boundary conditions; P, SV and SH waves incident at the free surface of a homogeneous half-space and at general interfaces; energy conversions; Rayleigh waves for a homogeneous half-space; Love waves for a two-layer half-space; Superposition of plane waves, group velocity, dispersion; Free oscillations, toroidal and spheroidal modes; Earthquake Seismology: The Earthquake Source: Focal mechanisms, moment tensors, source time function; Earthquake Mechanics: Friction and fracture, populations, dynamics, scaling; Seismic Recording: Sensors, recorders, networks and arrays; Seismograms: Natural and synthetic, time and frequency domain, combined influence of source, ray path, recording site and instrument; Earthquake Location: Ray parameters (arrays) and the Geiger method (networks); Global Earth Structure: Layered structure from travel time tables and 3D structure from seismic tomography.

SES2203 Elements of Meteorology 10 Credits

This module outlines Local Area Forecast, Heat transfer, Temperature humidity and pressure in Meteorology; Moisture and Atmospheric Stability, Forms of Condensation and Precipitation; Air Pressure and Winds, Air Masses, Thunderstorms and Tornadoes, Surface and Upper-Air Charts; T-Φ graphs, Converting raw Radiosonde Data into a forecast; Recognizing specific RADAR and other satellites signatures and forecasting weather; Forecasting Simulations-Forecasting weather for a specific location; Field and laboratory work.

SES2204 Surveying II 10 Credits

The module covers the spatial coordinates system or Gaussian system of coordinates; Traversing, triangulation and resection; Fieldwork/reconnaissance, station marking, angular measurement and centring errors; Sources of errors during angle measurement, distance measurement and the three-tripod system; Determination of angular misclosures in closed polygon and closed route traverses and distribution; Coordinate misclosures during traversing and their distribution by the Bowditch and Transit methods; Types and classification of triangulation fieldwork; Adjustment of angles in braced quadrilaterals and centre point polygons using the method of equal shifts and coordinate calculations; Resection calculations using Collins Auxiliary Point method and Tan K Formula; Theodolites and theodolite work: Temporary and permanent adjustments of theodolite angle measurement using; the repetition, directional and sector methods; Tachometry work; Curves: circular, reverse, compound, transition and vertical curves; Theory and calculations; Setting out methods: Site inspection, error detection, communication on site and stages; Vertical control, temporary bench marks, sight rails, travellers and boring rods; Slope rails or batter boards, profile boards; Positioning techniques; Setting out Civil Engineering structures and Practical work**.**

SMA2104 Partial Differential Equations 10 Credits

The module is on Fourier Analysis; Fourier series and Fourier transforms; Laplace Transforms: Definition basic results; Heaviside function; Convolution; Applications to the solution of ordinary differential equations; Sturm-Liouville problems; Orthogonality; Partial Differential Equations; Classification of second order partial differential equations; The partial differential equations of mathematical physics; Derivation of the wave equation and heat equation in one dimension; Separation of variables; Fourier sine and cosine transforms and Fourier trans-form methods.

SMA2206 Numerical Analysis 10 Credits

The module looks at errors in numerical analysis; Taylor Series; Solutions of Equations in One Variable: Bisection and Newton-Raphson methods; Fixed point iteration; Order to Convergence; Direct and Iterative Methods of Solving Linear Systems; Gaussian elimination with scaled partial pivoting; Jacobi and Gauss-Seidel iterations; Convergence criteria; Interpolation and Extrapolation; Lagrange interpolating polynomial; Newton interpolating polynomial; Richardson extrapolation; Integration; Trapezoidal rule, Simpson's rule; Gaussian quadrature and Numerical Solutions of Ordinary Differential Equations.

YEAR III

SES3101 Remote Sensing 10 Credits

The module explores electromagnetic (EM) and remote sensing- Interaction of EM radiation with the Earth's atmosphere; Interaction of EM radiation with the Earth's surface; Sensors- passive sensors and active sensors: RADAR, LIDAR and Platforms of remote sensing: Airborne and Space borne; Image data characteristics; Photographic systems: aerial camera; Multispectral scanners: Whiskbroom, push broom, Earth observation systems; Thermal infrared remote sensing; Digital data processing: Image pre-processing - radiometric correction and geometric correction; Image enhancement and visualisation; Band transformations; Visual image interpretation; Digital image classification; Forest and Agricultural Crop Inventories, wetlands mapping and Productivity Assessment, Land Use Mapping /Land Cover mapping, Environmental Impact Assessment (Coastal Erosion, etc;) Predictive Models for Archaeology and Highway Planning, Urban Applications of Remote Sensing, Delineating subsurface structures and fieldwork.

SES3102 Potential Field Exploration Methods 10 Credits

The module examines the role of gravity and magnetics in exploration; Conservative forces, Central force fields, Value of a scalar potential, Divergence theorem, Poisson's and Laplace's equations, Spherical Harmonic Analysis: general solution, solution for rotating Earth, significance of terms, International Gravity Formula; Absolute and relative gravity measurements, Gravity instruments, Data acquisition, land gravity data, marine gravity data, airborne gravity data, satellite methods, Reduction of gravity data, instrument, tidal and drift corrections, free air correction, Bouguer correction, borehole gravity, isostasy; Anomaly separation and filtering: smoothing, gridding, least squares, Fourier filtering, Interpretation of gravity data, uniqueness problem, direct approach, indirect methods, rock densities, gravity due to simple bodies, solid angle method, line-integral method, chart methods, computer-aided interpretation and field work. It also looks at the earth's magnetic field: the main field, source, distribution, secular variations, external field, International Geomagnetic Reference Field; Rock magnetism, susceptibility, remanent: TRM, CRM, DRM, paleomagnetism and effect on present-day field; Acquisition of magnetic data: measuring susceptibility and magnetism, land magnetic data, marine magnetic data, airborne magnetic data, Reduction of magnetic data: diurnal correction, drift correction, regional correction; Anomaly separation and filtering: filtering, reduction to pole, downward and upward continuation; Interpretation of magnetic anomalies: Poisson's formula, magnetic field due to simple bodies, solid angle method, basement depth determinations, computer-aided interpretation; Applications to environmental and engineering studies: delineating structural trends, mapping structures, detection of archaeological objects and field work.

SES3103 Research Methods 10 Credits

This module is about research designs, Literature survey, Qualitative and quantitative methodology, Technical Report writing, Ethics and confidentiality in technical reporting, Presentation of Graphs, Tables, Figures, Data collection and analysis; Preparation of abstracts and manuscripts, Referencing and citation of references, Writing business proposal for consultative work and research grants, Research Budgets, Research presentation; Field procedures as well as safety in the field.

SES 3104 Principles of Surface and Groundwater Hydrology 10 Credits

The module highlights the hydrologic Cycle: Basic picture of the hydrologic cycle including storage, fluxes, and residence times; Concepts of discharge, watershed, and drainage or catchment basin introduced; Infiltration: Introduction to soil moisture; Rainfall rates, interception, depression storage, and infiltration; Measuring infiltration; Calculation of saturated and unsaturated hydraulic conductivities from infiltration methods with numerical solutions; Ground Water: Overview of aquifers, the water table, streams, springs, marshes and wells; Porosity, specific yield, field capacity, and wilting points in soils and rocks; Permeability and Hydraulic Conductivity of rocks and soils; Application of Darcy's law; Well hydraulics, practical interpretation of well pumping tests and log test data, failing head test, Steady and unsteady groundwater flow; Flow to wells; Well function and Theis Method; Various methods for determination of sequence of strata and ground water levels. It also looks at water Quality: elements of groundwater surface water interaction, surface and groundwater contaminant systems, Dissolved materials; Contaminant process; introduction to groundwater contamination, historical incidents, advection, dispersion, diffusion, biodegradation of groundwater contamination; Transport, diffusion, and remediation of pollutants through the soils as well as field work.

SES 3105 Electrical and Electromagnetic Methods 10 Credits

The module explores the Archie’s law, Factors affecting current flow - resistivity, permittivity, permeability, isotropic and anisotropic media; Self-potential method; Mechanisms of producing natural ground potentials; Fixed and moving source resistivity methods; Apparent resistivity, field layouts, Data interpretation/curve matching; Electrical tomography; Quantitative solutions for layered media; Induced Polarisation -physical basis of the electro-magnetic (EM) technique, Frequency and time domain induced polarisation; The pseudo-sections; Case studies; Generation of Induced EM fields; Propagation of EM waves in the ground; Time domain and frequency domain techniques; Dip angle measurement, AFMAG/Audio-frequency, HLEM, VLF, Airborne EM systems; Telluric and magnetotelluric methods of surveying; Applications to environmental and engineering studies: Groundwater exploration and quality, characterisation of geothermal, minerals exploration, location archaeological objects and field work.

SES3106 Petrology 10 Credits

The module has an overview of Fundamental Concepts, Composition and Classification of Magmatic Rocks, Thermodynamics and Kinetics: Silicate Melts and Volatile Fluids in Magma Systems Crystal-Melt Equilibria in Magmatic Systems, Chemical Dynamics of Melts and Crystals, Kinetic Paths and Fabric of Magmatic Rocks, Physical and Thermal Dynamics of Bodies of Magma, Magma Ascent and Emplacement: Field Relations of Intrusions, Magma Extrusion: Field Relations of Volcanic Rock Bodies, Generation of Magma, Differentiation of Magmas, Magmatic Petrotectonic Associations, Metamorphic Rocks and Metamorphism: An Overview, Petrography of Metamorphic Rocks: Fabric, Composition, and Classification, Metamorphic Mineral Reactions and Equilibria, Evolution of Imposed Metamorphic Fabrics: Processes and Kinetics, Metamorphism at Convergent Plate Margins: P–T–t Paths, Facies, and Zones and Precambrian Rock Associations.

SES3200 Industrial Attachment 60 Credits

The student shall normally be attached to an institution/company for a period of six months. He/she shall work under the direction and supervision of a supervisor from the institution/company and an academic supervisor from the university.

YEAR IV

SES 4101 Seismic Exploration Methods 10 Credits

The module explores the head wave, refraction profiles; Use of seismic reflection and refraction methods for petroleum and mineral exploration and environmental monitoring; introduction to seismic imaging, instruments for seismic data acquisition; interpretation of seismic data, Static and dynamic corrections; Velocity analysis and CMP Stacking, Elimination of multiples, Residual static -237 -corrections, Time to depth conversion, Seismic Imaging and Migration; Seismic reflection methods in engineering and environmental applications; Tomography, Inversion of velocity anomalies, Cross-hole tomography, mapping shallow reflectors, Interpretation of seismic data, Attributes, coherence analysis in 3D data sets; Application of seismic methods in mapping, exploration of hydrocarbons, geotechnical, groundwater, hazard analysis; Applications to environmental and engineering studies: Groundwater exploration, mapping fracture zones, delineating bedrock, detection of cavities, exploration of hydrocarbons and Fieldwork.

SES 4102 Borehole Logging 10 Credits

The module looks at description, application, interpretation-Large spacing core logging, electrical and dielectric logs; Induction measurements; description, application, interpretation; Nuclear well logging: Natural gamma; Density and Neutron log and their description, application, and interpretation; Acoustic well-logging, Dipmeter logging, Temperature logging, Sonic logs Seismic or geophone velocity survey, description, application and interpretation; Borehole gravity meter Measurements of Resistivity, Conventional Resistivity Logs, Dual Induction, Dual Laterolog Micro Spherically Focused Log, Measurements of Porosity, Density Log; Measurements of formation Dips; Log interpretation, correlation, lithology identification, porosity determination, location of permeable beds, identification of hydrocarbon saturation; Geological applications of well logs, stratigraphy and sedimentology from well logs, compaction, volcanic rocks; Fracture detection, fault detection, well logging methods for rock mechanics, Well Logging for Mining and fieldwork.

SES 4103 Groundwater Modelling and Management 10 Credits

This module explores numerical modelling as a tool of managing aquifer systems; General concepts of numerical modelling, Flow nets, Analytical methods, Method of images (Flow near boundaries) in aquifer characterization; Well design, development, and construction, Finite difference, Finite element, Boundary element, Green element methods; Artificial recharge as a management tool: Methods of artificial recharge; Groundwater pollution and control; Introduction to contaminated land, threshold values, source-pathway-target framework, remediation; Protection zoning; Investigation of contaminated land; qualitative risk assessment; Landfills; waste degradation, dilute and disperse, modern landfills, barriers, site selection, monitoring and fieldwork.

SES 4104 Geographical Information Systems (GIS) 10 Credits

The module has an introduction to GIS and spatial data types, Data processing systems, Determining and mapping position – data quality, spatial referencing, measures of location error on maps, satellite based positioning: GPS; Data entry and preparation – spatial data input, data preparation, point data transformation, advanced operations on continuous fields; Spatial data analysis – classification of analytical data capabilities, overlay function, neighbourhood functions, network analysis, error propagation in spatial data processing; Data visualisation – GIS and maps, the visualisation process, the cartographic toolbox, map cosmetic, map dissemination; Geologic and hydrologic applications: Fault-line Analysis and Patter Recognition, Spectral Discrimination of Rocks and Soils, Geobotany and Mineral/Metal Exploration, Hydrologic Studies of Watersheds as well as laboratory work and fieldwork.

SES 4105 Structural Geology 10 Credits

The module examines the measurement of altitude and location, interpretation and construction of contour maps, geometric methods: Altitude calculations, dimension calculations normal, thrust and strike-slip faults; Introduction to stereographic projections, stereographic poles and rotations, structural analysis; Interpretation of geologic maps, stress; analysis of data from rock-deformations; Techniques and assumption used in the construction of structural cross sections; Analysis and interpretation of natural deformation; The fault, fold and ductile flow systems accompanying deformation of the earth's crust; Description of macroscopic structures, fold mechanisms; Analysis of fracture array geometry, faults, shear zones and unconformities, folds in cross-sections, Primary and Secondary geological structures, rock types - sedimentary, igneous, metamorphic rocks, rock forming minerals; Introduction to cross-section balancing; Two dimensional finite strain analysis; Scale modelling of structures and fieldwork.

SES 4010 Research Project 10 Credits

Students undertake a research project on a topic approved and supervised by the department. Industrial supervision may also be acceptable for projects linked to where students were attached during industrial attachment. The project report shall comprise the honours thesis of the Programme. The research project shall be equivalent to two modules.

SES 4201 Climate Dynamics 10 Credits

The module has an overview of Climate Variability and the Science of Climate Dynamic; Basics of Global Climate; Physical Processes in the Climate System; El Niño and Year-to-Year Climate Prediction; Climate Models: Constructing a Climate Model; Numerical representation of atmospheric and oceanic equations; Parameterization of small scale processes; The hierarchy of climate models; Climate simulations and climate drift; Evaluation of climate model simulations for present day climate; The Greenhouse Effect and Climate Feedbacks; Climate Model Scenarios for Global Warming; Greenhouse gases, aerosols and other climate forcings; Global-average response to greenhouse warming scenarios; Spatial patterns of warming for time-dependent scenarios; Climate response time in transient climate change; extreme events; Climate change observed to date; Emissions paths and their impacts; Downscaling techniques, Palaeoclimates as well as the use of fossils to reconstruct environments and climates.

SES 4202 Environmental Geoscience and Impact Assessment 10 Credits

This module highlights the Geo-Environmental applications- Pollution and contamination; leachate, pollution and groundwater, geophysical “detectability” of pollutants, pollution pathways, detection, monitoring and remediation, rising groundwater levels, abandoned mine workings; Landfill sites; surveys of landfills, characterising landfill sites, investigative methods, pollution near landfills, compaction and consolidation of landfill material, anthropogenic gases; Radioactivity and radioactive waste; Geological appraisal for radioactive waste storage and the protection of groundwater quality. It also looks at concepts and issues in environmental planning and ecological conservation; Objectives of and statutory provisions for EIA's in Zimbabwe; EIA techniques and analyses; mitigatory measures; project implementation; The EIA report; draft EIA review (assessing the quality of draft Environmental Impact statement etc;); project implementation; decommissioning; Case Studies such as EIA of water resource, energy development, mining, etc and field work.

SES 4203 Geotechnical Investigations 10 Credits

The module outlines delineating geological boundaries; Depth to bedrock, near-horizontal bedrock, varying depth bedrock, weathered bedrock, buried valleys including potentially hazardous fracture zones and faults, cavities and mine shafts; Evaluation of ground conditions; soil corrosivity, soil stiffness profile, Rock mass and fracture state, rock mass deformability, rippability, diggability, trenchability and liquefaction potential; Foundations of structures- Strength profile, settlement estimation, response to dynamic loading, subsidence risk; Dams and Reservoirs- Site location and appraisal, investigations of dam foundations, Leakage, Ground treatment; Surface excavations- method, groundwater, slope stability; investigations from within subsurface excavations; Route surveys- route appraisal and fieldwork.

SES 4204 Quality Assurance and Project Management **10 Credits**

The module is on general and personnel management; Management control and Marketing Strategies; Business and Finance; Quality control plans for factories with special reference to physics equipment; Cost Effective Product Development; ISO standards; Research and Development Strategies in factories; Quality and reliability; Policies, programmes and projects; Project Management Concepts; Project Planning: Mobilization, project scope, project quality, scheduling, critical path method, staffing, budgeting, risk management; Project directing and leading Project controlling; Project evaluation, Cost Benefit Analysis and activity based costing.

SES 4205 TIME SERIES ANALYSIS AND SIGNAL PROCESSING **10 CREDITS**
SES 4205 Time Series Analysis and Signal

The module is on the time series, Z-transform, 1D Fourier Transform, Properties, FFT, Design of digital filters, stability and accuracy, Linear systems and convolution, Design of deconvolution operators for 1D time series, Causality and stability, Deconvolution in the time and in the frequency domain, Deconvolution of noisy data, determination of trade-off parameters Predictive de-convolution and FX SNR enhancement filters; Non-Parametric spectral analysis, The autocorrelation function, the periodgram, tapering, variance versus bias, Parametric spectral analysis: MA, AR and ARMA models and their spectral representation, Maximum Entropy Spectral Analysis, Multichannel analysis: para-metric and non-parametric; The 2D discrete Fourier Transform, properties, symmetries, 2D deconvolution and filtering, The Hartley transform, Eigen images, The Radon transform, Eigen-structure based coherence measures, Spectral estimators based on eigen-coherence measures, Wave-number estimation in seismic data as well as time-frequency analysis.

MASTERS DEGREE PROGRAMME SPECIAL REGULATIONS

MASTER OF SCIENCE DEGREE IN GEOPHYSICS

1.0 Degree Profile: **Master of Science Degree in Geophysics**

Institution:	National University of Science and Technology
Type of Degree:	Masters

Credit Load:	400 credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s)	Zimbabwe Council for Higher Education

PROGRAMME CHARACTERISTICS

Objectives	The programme is designed to provide an overview of both the theoretical background and the applications of geophysical methods to young scientists intending to make geophysics their career in Zimbabwe and within the region. It is designed for students planning for employment in fields of Applied Geophysics such as, earthquake hazard analysis, mineral exploration, oil and gas exploration, environmental geosciences, and geotechnical investigations. It aims at producing theoretically grounded professional expert in Applied Geophysics.
Orientation:	Research, teaching and learning are professionally oriented and focused on real life problems

Employability:	Our graduates can be employed as exploration geophysicists, geotechnical managers, hydro-geophysicists, mineral resource surveyors, meteorologists and climate scientists, research scientists, water resource managers, Seismic analysts and researchers.
Further Studies:	Doctoral studies in Applied Geophysics related disciplines such as Exploration Geophysics, Reservoir Geophysics

PROGRAMME DELIVERY

Teaching and Learning:	Lectures, tutorials, field work and practicals, seminars, group work, industrial visits, industrial attachment, research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, seminar presentations, industrial attachment report, final year research project report, continuous assessments
Distinctive Features:	Solving problems from many branches of applied Geophysics so as to develop new technologies and scientific based approaches that enable sustainable resource utilisation of natural resource and Application of several methods in geotechnical safety analysis.

Programme Competences

Generic:

- Multidisciplinarity: Ability to use Geophysics principles to analyse and solve problems from multiple natural resource exploration disciplines.
- Quantitative and innovative reasoning: Capacity to design and carry out fieldwork, experiments and simulations that helps us to solve real life problems.
- Communication skills: Ability to communicate effectively and to present information orally and in writing and using available technology to both expert and non-expert audiences.
- Analysis and synthesis: Capacity for analysis using simulations and mathematical modelling and ability to synthesise the outcomes using logical arguments and proven facts.
- Ethical commitment: Professional integrity and awareness of impact Geophysics on society, economy and the environment.
- Entrepreneurial skills: Capability to identify key discoveries and develop them into bankable projects and create new business ventures based on knowledge and new thinking paradigms

Discipline specific:

- Deep knowledge: Ability to analyse data in terms of underlying principles and phenomena and use appropriate mathematical and field tools to explain and solve problems.
- Production skills: Ability to design and carry out field investigation to better understand the real world for sustainable development.
- Technology development skills: Ability to develop new technologies in Geophysics with a view to enhance production efficiencies and outputs in industry.
- Problem-solving skills: Ability to solve a wide range of problems in Geophysics by identifying their fundamental aspects and using both theoretical and practical methods
- Analytical and computational skills: Ability to use filed based and experimental results to analyse various phenomena and technological issues using appropriate computer packages

Intended Learning Outcomes

- Ability to approach problems in an analytical and rigorous way, formulating theories and applying them to solve problems in business, engineering, the sciences, and other fields;
- Ability to analyse and interpret data, finding patterns and drawing conclusions to support and improve business decisions;
- Ability to analyse complex systems into simple and understandable components;
- Ability to use mathematical and statistical packages to model and solve problems in Geophysics disciplines.
- Ability to deal with abstract concepts and to think logically;
- Ability to present mathematical arguments and conclusions with accuracy and clarity;
- Ability to identify problems in industry and the community and develop appropriate solutions;

- Develop mathematical models to solve current practical problems;
- Communicate effectively and present information methodically and accurately using multi-media.

2.0 REGULATIONS

These regulations should be read in conjunction with the University General Academic Regulations for Masters Degrees by module-work (hereinafter referred to as the General Regulations).

2.1 Entry Requirements

2.1.2 The normal entry qualification shall be an Honours Degree with at least a 2.2 classification in Applied Physics, Earth Sciences or Geology.

2.1.2 Applicants with a BSc Degree with a minimum classification of 2.1 in Geology may be considered for admission by the Departmental Board subject to approval by the Senate, if they have a strong mathematical background,

2.1.3 Any other equivalent qualifications obtained from recognised institutions in Zimbabwe or elsewhere may be considered for admission by the Departmental Board subject to approval by the Senate.

3.0 PROGRAMME DURATION

3.1 The programme is offered on full-time and runs over a period of twenty-four (24) months comprising four semesters.

3.2 When the programme is offered on part-time basis, it runs over thirty-six (36) months comprising six semesters.

4.0 PROGRAMME STRUCTURE

4.1 Full-time Programme:

4.1.1 Part I consists of module-work over two semesters.

4.1.2 Part II consists of elective modules and a research project work leading to a dissertation.

4.1.3 The research project may commence any time after the second semester examinations. It may be undertaken within the Department, at any industry or any other institution approved by the Departmental Board. The dissertation report shall normally be submitted to the Department at least one month before the end of the fourth semester (Part II) of the Degree programme.

4.2 Part-time Programme:

4.2.1 Students on Part-time shall normally take two modules per semester over a period of six semesters (3 years).

4.2.2 The research project may commence at any time after the fourth semester examinations. It may be undertaken either in or at any industry or any other institution approved by the Departmental Board. The dissertation report shall normally be submitted to the Department at least one month before the end of the sixth semester

4.2.3 Full-time students must complete and pass a minimum of ten (10) modules. Students shall be required to choose a minimum of two modules from the list of elective modules subject to the availability of expertise and equipment in the Department.

4.2.4 Part-time students shall propose their project titles at the end of the fourth semester and start working on their projects by the beginning of the fifth semester (third year of the programme).

4.2.5 Projects are compulsory and shall be chosen in the area of geophysics. All students shall be required to actively participate in field-trips / excursions and camp-outs which shall be organised during the module-work duration. Participation in the field-trips (etc.), shall count towards the continuous module-work assessment for the students in the particular module(s).

5.0 MODULE EVALUATION

5.1A taught module shall be assessed normally by a three-hour examination at the end of the semester. The final grade in the module-work shall normally be based on 25% of continuous assessment and 75% of final examination.

5.2 To pass a module a student must obtain an overall mark of 50% and must obtain at least 45% in the final examination. A student shall be expected to obtain a minimum mark of 50% in the Masters project assessment. The dissertation shall contribute 40% of the mark for the degree classification.

6.0 DETERMINATION OF RESULTS

6.1 Award of the degree

6.1.1 The pass mark in each module and in aggregated part or programme marks shall be 50%.

6.1.2 The determination of the overall degree programme aggregate including the dissertation component shall be:

Taught modules	60%
Dissertation	40%

6.1.3 In determining the overall degree programme aggregate, the following part weightings shall be used:

Part I	50%	(200 Credits)
Part II	50%	(200 Credits)

6.1.4 A student must earn a minimum of 400 credits to be awarded the Degree and the degree classification shall be in accordance with the General Regulations.

7.0 PROCEED AND DISCONTINUE

7.1 To proceed to Part II, a student must pass all modules.

7.2 A student who fails 50% or less, of the modules in Part I, may be allowed to repeat the failed modules before proceeding to Part II, else, he / she shall discontinue the programme; and a student who fails a part of the programme more than once, shall withdraw from the programme.

7.3 A student who is not allowed to proceed to Part II, but has passed at least six (6) taught modules may request to proceed to carry out a dissertation and opt for the award of a Post-graduate Diploma at the end of his studies.

7.4 For a student to be awarded either a Post-graduate Diploma or a Master of Science Degree in Geophysics, he / she should satisfy the examiners in the Dissertation. The dissertation shall be compulsory for any award on this programme.

PROGRAMME SUMMARY

PART I

SEMESTER I

Module Code	Module Description	Credits
MAPH 5131	Seismic Theory and Fundamentals	25
MAPH 5132	Time Series Analysis and Inverse Theory	25
MAPH 5133	Structural Geology	25
MAPH 5134	Global Tectonics	25

SEMESTER II

MAPH 5236	Geophysical Inverse Theory	25
MAPH 5237	Geoelectric And EM Methods	25
MAPH 5238	Gravity and Magnetic Exploration	25
MAPH 5239	Refraction and Reflection Seismology	25

PART II

SEMESTER I

	Elective	25
	Elective	25
MAPH 6040	Research Project	50

Electives

MAPH 6121	Hydrology and Contaminant Processes	25
MAPH 6140	Seismic Hazard Assessment	25
MAPH 6122	Remote Sensing I	25
MAPH 6141	Remote Sensing II	25
MAPH 6123	Reservoir Geophysics	25
MAPH 6142	Ground Investigation	25

SEMESTER II

MAPH 6040	Research Project	100

MODULE SYNOPSES

YEAR I

MAPH 5131 Seismic Theory And Fundamentals 25 Credits

The module explores the time series, Z-transform, 1D Fourier Transform, Properties, FFT, Design of digital filters, stability and accuracy, Linear systems and convolution, Design of deconvolution operators for 1D time series, Casuality and stability, Deconvolution in the time and in the frequency domain, Deconvolution of noisy data, determination of trade-off parameters Predictive de- convolution and FX SNR enhancement filters. It also looks at Non-Parametric spectral analysis, The autocorrelation function, the periodogram, tapering, variance versus bias, Parametric spectral analysis: MA, AR and ARMA models and their spectral representation, Maximum Entropy Spectral Analysis, Multichannel analysis: para- metric and non-parametric. The module also covers the2D discrete Fourier Transform, properties, symmetries, 2D deconvolution and filtering Deconvolution with positivity constraints; Other transformations: The Hartley transform, Eigen images and the KL transform, The Radon transform, Eigen-structure based coherence measures, Spectral estimators based on eigen-coherence measures, The Pisarenko estimator, Wave-number estimation in sonar and seismic data; Time-frequency analysis and the wavelet transform, Continuous and discrete wavelet trans- form, The Gabor transform, Matching pursuit techniques; Introduction to higher order statistics, Third and fourth order cumulants, The bispectrum and trispectrum.

MAPH 5133 Structural Geology 25 Credits

This module examines the measurement of altitude and location, interpretation and construction of contour maps, geometric methods: Altitude calculations, dimension calculations normal, thrust and strike- slip faults; Introduction to stereographic projections, stereographic poles and rotations, structural analysis; Interpretation of geologic maps, stress; analysis of data from rock-deformations; Description of mesoscopic structures and fold mechanisms. This module also has an analysis of fracture array geometry, faults, shear zones and unconformities, folds in cross- sections, Primary and Secondary geological structures, rock types - sedimentary, igneous, metamorphic rocks, rock forming minerals; Introduction to cross-section balancing; Two-dimensional finite strain analysis; Scale modelling of structures; Regional geology and geology of Zimbabwe.

MAPH 5134 Global Tectonics 25 Credits

The module outlines the continental drift theory, continental reconstructions, palaeoclimatology and palaeontological evidence of continental drift; Palaeomagnetism, seafloor spreading, oceans, ridges and continental rifts, the geosynclinal theory and impact of tectonics; Transform and transcurrent faults; Divergent, convergent and transform boundaries; Subduction zones, mountain ranges, mechanism of plate tectonics and implications of plate tectonics; The nature and origin of large sedimentary basins and igneous provinces; Earthquake seismology, seismic waves, earthquake location, earthquake mechanisms and sources, seismic tomography, velocity structures and composition of the earth; The crust, ophiolitites, differences between continental and oceanic crusts, the mantle, the core, deformation in the crust and mantle; Isostasy, lithosphere and asthenosphere and terrestrial heat flow.

MAPH 5238 Gravity And Magnetic Exploration 25 Credits

This module highlights the relative costs of geophysical data acquisition, Role of gravity and magnetics in exploration; Conservative forces, Central force fields, Value of a scalar potential, Divergence theorem, Poisson's and Laplace's equations, Spherical Harmonic Analysis: general solution, solution for rotating Earth, significance of terms, International Gravity Formula, History of the gravity method, Absolute and relative gravity measurements, Gravity instruments, Data acquisition, land gravity data, marine gravity data, airborne gravity data, satellite methods, Reduction of gravity data, instrument, tidal and drift corrections, free air correction, Bouguer correction, borehole gravity, isostasy: free air vs; Bouguer anomalies, Eotvos effect, terrain (topographic) correction as well as FAA, BA, CBA and IA. The module also looks at anomaly separation and filtering: smoothing, gridding, least squares, Fourier filtering, Interpretation of gravity data, uniqueness problem, direct approach, indirect methods, rock densities, gravity due to simple bodies, solid angle method, line-integral method, chart methods, computer-aided interpretation; History of magnetism, similarities and differences with gravity, basic definitions, the Earth's magnetic field: the main field, source, distribution, secular variations, external field, Inter- national Geomagnetic Reference Field; Rock magnetism, susceptibility, remanance: TRM, CRM, DRM, paleomagnetism and effect on present-day field. The module also covers acquisition of magnetic data: measuring susceptibility and magnetism, land magnetic data, marine magnetic data, airborne magnetic data, Reduction of magnetic data: diurnal correction, drift correction, regional correction; Anomaly separation and filtering: filtering, reduction to pole, downward and upward continuation;
Interpretation of magnetic anomalies: Poisson's formula, magnetic field due to simple bodies, solid angle method, basement depth determinations and computer-aided interpretation.

MAPH 5236 Geophysical Inverse Theory 25 Credits

This module looks at the Ill-posed and well-posed problems, Dealing with non-uniqueness, Physically feasible and non-feasible solutions, Data space, Model space and observational noise, Review of Linear Algebra: Linear vector spaces, Matrices, Matrix inverses, Eigen-values and Eigen-vectors, Singular value decomposition, Generalized inverse, Null Space, Model and data resolution matrices. It also looks at Linear Inverse Problems with accurate data: Minimum norm construction, Weighting functions in model space, Smoothing with derivatives; Linear Inverse Problems with inaccurate data: Gaussian errors and least-squares methods, Damped least-squares, Trade-off curves, SVD solution, truncation of singular values; Numerical solutions of large linear inverse problems: Iterative and semi-iterative solutions, Conjugate gradients, LSQR, Lanczos bi-diagonalization; Inversion with the Lp norm: Robust inversion, Iterative re-weighting least-squares, L1 solution; Bayesian methods: A priori and A posteriori probabilities, Non-informative priors, Maximum entropy principles, Frequentist vs Bayesian analysis;

Non-linear inverse problems: Multi-modality, Linearized inversion, Gauss methods, steepest descent and conjugate gradients; Global optimization: Simulated annealing as well as genetic algorithms.

MAPH 5237 Geoelectric And EM Methods 25 Credits

This module looks at the factors affecting current flow - resistivity, permittivity, permeability, isotropic and anisotropic media; Self-potential method; Mechanisms of producing natural ground potentials; Fixed and moving source resistivity methods; Apparent resistivity, field layouts, Data interpretation/curve matching; Electrical tomography; Quantitative solutions for layered media; Induced Polarisation -physical basis of the electro-magnetic (EM) technique, Frequency and time domain induced polarisation; The pseudo-sections; Case studies; Generation of Induced EM fields; Propagation of EM waves in the ground; Time domain and frequency domain techniques; Dip angle measurement, AFMAG/Audio-frequency, HLEM, VLF, Airborne EM systems; Telluric and magnetotelluric methods of surveying and a number of case studies.

MAPH 5239 Refraction And Reflection Seismology 25 Credits

This module explores the head wave, refraction profiles; use of seismic reflection and refraction methods for petroleum and mineral exploration and environmental monitoring; introduction to seismic imaging, instruments for seismic data acquisition; interpretation of seismic data, Static and dynamic corrections; Velocity analysis and CMP Stacking, Elimination of multiples, Residual static corrections, Time to depth conversion, Seismic Imaging and Migration; Seismic reflection methods in engineering and environmental applications; Tomography, Inversion of velocity anomalies, Cross-hole tomography, Mapping shallow reflectors, Interpretation of seismic data, Attributes as well as coherence analysis in 3D data sets.

YEAR II

MAPH 6121 Hydrology And Contaminant Processes 25 Credits

This module deals with basic concepts in soil genesis, land degradation and water contamination; Water cycle, aquifers, Darcy's law, hydraulic conductivity, transmissivity, storativity, methods of permeability, measurement; fluid potential and Bernoulli equation; Flow nets and maps; Deriving transmissivity and storativity from well pumping tests; Aquifer properties, heterogeneous systems and representative volumes, dual porosity systems, groundwater sampling; Well hydraulics, practical interpretation of well pumping tests and log test data, failing head test, packer tests; Groundwater modelling - water balance methods, flow models; Aquifer assessment; uniform and non-uniform flow; radical flow to a well; aquifer pumping test analysis; image well theory, multiple well fields, salt water encroachment; Using Aquifer software package; Groundwater chemistry; inorganic reactions, pH buffers, mineral dissolution, ion exchange; bacterially mediated reactions, electron acceptors; seawater intrusion, Ghyben-Herzberg relation, remediation of marine incursion; Water quality and use, water balance, water resource management, conjuctive use; artificial recharge, case histories; Introduction to contaminated land, threshold values, source-pathway-target framework, remediation; Investigation of contaminated land; desk study; sampling design and methods; analytical strategy, qualitative risk assessment; Landfills; waste degradation, dilute and disperse, modern landfills, barriers, site selection, monitoring; Contaminant process; introduction to ground- water contamination, historical incidents, advection, dispersion, diffusion, biodegradation of groundwater contamination; Infiltration, run off as well as evapotranspiration.

MAPH 6140 Seismic Hazard Assessment 25 Credits

This module examines the seismic hazard analysis - hazard versus risk, the law and regulations, instrumental seismicity, importance of historical data, seismotectonic sources, maximum earthquakes, ground motion and site effects; Soil liquefaction and liquefaction potential, reliability of liquefaction analysis potential, reliability of liquefaction analysis potential evaluation, groundwater and its damaging effects, landslides and slope stability under seismic action; Probabilistic seismic hazard analysis, The deterministic approach to hazard analysis; Strong motion measurement and characteristics, measurement of strength of ground motion using peak parameters, spectral methods, response spectra, Fourier spectra, energy methods, statistical models of strong ground motion; Effects of magnitude, distance and local site conditions; The engineering design problem-elements of structural dynamics SDOF systems, materials and elements under seismic loads; Determination of seismic loads together with probability - theory methods in problems of seismic resistance.

MAPH 6122 Remote Sensing I 25 Credits

This module is on definition and Applications of Remote Sensing, Basic Remote Sensing Elements and Systems; Types of sensors: Visible, Near-Infrared, Thermal Infrared, Microwave (Radar), Imagers (Aerial Photo Cameras, Multispectral Scanners), Spectrometers, Radiometers, Profilers, Sensor Calibration, Comparison of Sensor Performance, Aerial Photography: Vertical, Oblique, Stereo Photography, Camera, Lens, Film and Filter Selection, System Trade-Offs: Resolution vs; Coverage, Exposure, Image Motion Compensation, Sun Angle, Scene Contrast, Resolution Limits, etc; Satellites and data sources: Remote Sensing Satellite, Orbits, Sensors, Landsat, SPOT, NOAA/ AVHRR, etc; Hyperspectral, High Resolution Systems, Satellite Data Products and Sources; Image pre-processing and enhancement: Image Statistics and Histograms, Image Rectification and Restoration, Image enhancement (Colour Density Slicing, etc;), Contrast Manipulation (Edge Enhancement etc;), Image Transforms (Principal Component Analysis, etc;) Multispectral analysis and classification: Multi-Image Manipulation (Spectral Pattern Recognition), Image Classification (Maximum Likelihood, etc;) Supervised and Unsupervised Classification (Training) and the Classification Accuracy Assessment (Errors of Omission and Commission).

MAPH 6141 Remote Sensing II 25 Credits

The module covers topics such as remote sensing of vegetation: Spectral Signatures of Plant Species, Plant Reflectance Models, Forest and Agricultural Crop Inventories, wetlands Mapping and Productivity Assessment, Detection of Plant Stress (Insects, Disease, Drought, etc;), Land use/Land cover mapping: Land Use Mapping with Landsat

TM and SPOT, Land Cover Change in Coastal Watersheds, Environmental Impact Assessment (Coastal Erosion, etc;) Predictive Models for Archaeology and Highway Planning, Urban Applications of Remote Sensing; Geographic information systems (GIS): Introduction to GIS and Georeferenced Data, Data Input (Conversion from other records etc;) Data Output (Formatting, Hardcopy/Softcopy, etc;) Data Management (Data Base, Spatial Data Models, etc;) GIS Analysis Functions (Integrated Analysis of Spatial and Attribute Data); Geologic and hydrologic applications: Fault-line Analysis and Patter Recognition, Spectral Discrimination of Rocks and Soils, Geobotany and Mineral/Metal Exploration, Hydrologic Studies of Watersheds, Riparian Buffers in Coastal Watersheds; Detection of particulate/dissolved substances in water: Optical Properties of Water: Scattering and Absorption, Spectral Discrimination of Particulate and Dissolved Substances, Mapping Suspended Sediment and Chlorophyll Concentrations, Regression and Neural Network Models, Ocean Colour Sensors and Data Products (SeaWiFS). The module also covers water circulation-a pollutant dispersion: Data for Watershed Hydrology and Flood Analysis, Current Measurement with Dyes and Drogues (Langrangian Techniques), Coastal Current Circulation, Fronts and Upwelling, Predicting and Tracking Oil Slick Drift and Dispersion, Modelling and Monitoring Ocean Dumped Waste Dispersion; Thermal infrared techniques: Thermal Infrared Sensing (Theory, Sensors, Techniques, etc;), Mapping Sea Surface Temperature (Currents, Effluents, Fronts, etc;) Polar Meteorological Satellites (NOAA/AVHRR, etc;), Geosynchronous Satellites (GOES, etc;); Laser Applications: Laser Fundamentals, Ocean Depth Profiling (Bathymetry) Ocean Wave Profiling, Oil and Chlorophyll Fluorescence Mapping, Radar applications: Radar Satellites (RADARSAT, ERS-1, et;), Ocean Surface Observation, Spatial Filtering and Pattern Recognition, Analysis of Surface and Internal Wave Spectra.

MAPH 6123 Reservoir Geophysics 25 Credits

This module explores the basic concepts of energy, exploitation of thermal energy, geology of geothermal fields, hydrogeology of geothermal areas; Geochemical and geophysical methods for investigating geothermal reservoirs; Well logging methods; Resistivity; spontaneous potential (SP); porosity logs (sonic, whole-waveform, formation- density, neutron); Natural gamma-ray logs; determination of porosity and lithology; checkshot surveys and vertical seismic profiles (principles, wave types, acquisition, processing, modern developments); attenuation measurement and its uses; Reservoir engineering; Potential evaluation methods and some case studies.

MAPH 6142 Ground Investigation 25 Credits

This module highlights the classification and properties of soils; effective stress, pore pressure parameters, applications: soil testing: triaxial, shear box, ring shear, strength parameters; Earth pressures, active and passive; Soil stress; seepage and flow; earth dams and embankments; Stability analysis; flow slides, liquefaction; Bearing capacity; types of foundation; settlement of foundations; Earth retaining structures; sheet piling, reinforced earth; The importance of geology in engineering: Engineering properties of geomaterials, stresses and strains, engineering classification of soils and rocks; engineering classification of weathering, rock weathering time; Understanding the ground: Building a geotechnical model of the ground, desk study; Uncertainty and risk in engineering geology; Terrain analysis: Terrain Investigation, remote sensing and air photography interpretation, multispectral versus visible remote sensing methods, airborne and satellite remote sensing, choosing remote sensing data to suit ground conditions, characterising the ground conditions, geomorphological mapping and walk-over surveys, terrain evaluation and hazard mapping; Site Investigation: Site investigation and BS5930, invasive techniques for boreholes and coring, sampling, laboratory and in situ testing methods before, during and after construction, instrumentation and monitoring.

MAPH 6040 Research Project **150 Credits**

Students shall be encouraged to come up with research topics of their choice for their research projects. Such projects shall be approved by the Department before they embark on them. Students are encouraged to select projects that can be done in collaboration with the industry and or for the direct benefit of the industry. Field trips, camp - outs and/or excursions that are a requirement of the degree programme are not necessarily a part of the Research project.

MASTER OF SCIENCE DEGREE IN LASERS AND APPLIED OPTICS

1.0 DEGREE PROFILE: Master of Science Degree in Lasers and Applied Optics	
Institution:	National University of Science and Technology
Type of Degree:	Masters
Credit Load:	400 credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	Accredited by ZIMCHE 2018

PURPOSE OF THE PROGRAMME

The programme is designed to enhance
(a) scientific manpower trained to participate in the technological development of Zimbabwe
(b) creativity and innovation so that students can pursue further research work in appropriate fields of lasers and applied optics.

2.0 PREAMBLE

The Department of Applied Physics offers both Undergraduates and Post-graduate Degrees programmes. The BSC Honours programmes are in two main areas of specialization, namely Applied Physics and Radiography. The undergraduate degrees are categorized as follows, BSc (Hons) in Applied Physics, BSc (Hons) in Radiography, BSc Special (Hons) in Radiography. The Masters programmes are offered either as taught modules (on full time basis or on block release basis) or through research (MPhil). The different areas of specialization include MSc in Lasers and Applied Optics, MSc in Geophysics, MSc in Medical Physics and MSc in Radiography. We are looking for dedicated PhD research candidates. The department has therefore been motivated by the recent technological advances and the need by people to equip themselves with the relevant knowledge, to amend its programmes to address the need. The department has therefore amended some of its programmes to be offered on both full time and block release basis to train the required scientific manpower. The block release programme shall cater for those candidates who may not be able to study on full time basis due to work and other related commitments. The current, MSC in lasers and applied optics programme was designed to embrace candidates with a broader technological understanding of recent advanced industrial applications of lasers, with special emphasis on the telecommunication industry (optical communication). The main programme regulations however remained unchanged.

3.0 REGULATIONS

These regulations should be read in conjunction with the University General Academic Regulations and the Faculty of Applied Science regulations for Masters Degrees by module-work.

4.0 ENTRY REQUIREMENTS

4.1 Applicants shall normally hold an Honours Degree in Applied Physics with a 2.2 degree class to be eligible for admission into the programme.

4.2 Any other equivalent qualifications obtained from recognised institutions in Zimbabwe or elsewhere may be considered by the Departmental Board subject to the approval by the Senate.

4.3 For an applicant who does not hold an Honours Degree in Physics or Applied Physics and / or does not hold a 2.2 degree class, the Departmental Board shall determine the level of Physics background the applicant holds and decide if it be adequate and may recommend the applicant to the Senate for admission.

5.0 DURATION

The programme shall normally be offered over a period of twenty-four (24) months on full-time study or on block release basis in two Stages over a period of twenty-four (24) months. Each Stage shall consist of two blocks.

6.0 MODE OF STUDY

6.1 Full-time study

The programme, when offered on full-time basis, shall comprise four semesters (i. e. two years).

6.1.1 Year I shall consist of class and laboratory work for two semesters while Year II shall consist of two taught modules and a research project leading to a dissertation.

6.1.2 The research project may commence at any time after the Second Semester written examinations. It may be undertaken either in the Department, at any Industry or any other Institution approved by the Departmental Board. The Dissertation report shall normally be submitted to the Department at least ***one month*** before the end of the Second Semester of Part II of the programme.

6.2 Block release programme

6.2.1 When the programme is offered on Block Release basis, it shall be in two Stages, with a total of four Blocks over a period of two years. Stage I comprises of Block I and Block II while Stage II comprises of Block III and Block IV.

6.2.2 Stage I (Block I and Block II), comprise two intensive, three-weeks blocks of class and laboratory work; Stage II shall consist of one, three-weeks block for class-work in Block III and a Research Project, leading to a Dissertation in Block IV. Laboratory work shall proceed between Block I and Block II.

6.2.3 The Research Project may commence at any time after Block II, Stage I examinations. The dissertation report shall normally be submitted to the Department at least one month before the end of Block IV, Stage II.

6.3 A student shall require a minimum of 400 credits to successfully complete the programme.

7.0 ASSESSMENT

7.1 A taught module shall be assessed normally by a four hour examination at the end of each Semester / Block.

7.2 The final grade in a taught module work shall normally be based on Continuous Assessment (25%) and a final written examination (75%). The Seminar and Laboratory work Module shall be assessed wholly (100%) by Continuous Assessment.

7.3 To pass a module, a student must obtain a minimum overall mark of 50% and must have obtained at least 50% in the final written examination

7.4 The overall classification of the degree shall be done in accordance with the General University Regulations.

8.0 PROCEED AND DISCONTINUE

8.1 To proceed from Year I to Year II a student must have earned a minimum of 150 credits with 50 credits having been earned from the Seminar and Laboratory work modules.

8.2 A student who fails four or more of the taught modules shall be required to discontinue.

9.0 AWARD OF DEGREE

To be awarded the Degree, a student must have satisfactorily earned 400 Credits from the programme. The Degree Classification shall be in accordance with the University General Regulations.

10.0 AWARD OF POSTGRADUATE DIPLOMA

10.1 A student who passes all the ten taught modules but fails to complete the project work ***may*** be awarded a Postgraduate Diploma.

10.2 A student who passes at least six of the taught modules and successfully completes the project work ***may*** be awarded a Postgraduate Diploma.

10.3 The overall classification of the Postgraduate Diploma shall be done in accordance with the University General Regulations.

PROGRAMME SUMMARY

	Semester and Block	Module Code Module description	Credits
		MAPH 5131 Mathematical Methods	25
Year I	Semester I / Block I	MAPH 5071 Advanced Quantum Mechanics	25
		MAPH 5031 Physical and Geometrical Optics	25
		MAPH 5112 Seminar and Laboratory Work	25
	Semester II /Block II	MAPH 6033 Fibre Optics and Non Linear Optics	25
		MAPH 5032 Physics and Technology of Lasers	25
		MAPH 6036 Optical Communication	25
		MAPH 5112 Seminar and Laboratory Work	25
	Semester I / Block III	MAPH 6092 Optical Instrumentation and Measurement	25
Year II		**Elective module**	25
		MAPH 6112 Research Project	50
	Semester II/ Block IV	MAPH 6112 Research Project	100
	Total credits		**400**

LIST OF ELECTIVES

A student can choose any one elective out of the modules listed below. The electives shall be offered depending on availability of staff, facilities and number of students who opt for it.

Elective	Credits
MAPH 6040 Optical Technology	25
MAPH 6035 Optical Properties of Materials	25
MAPH 6034 Laser Spectroscopy	25
MAPH 6037 Industrial Applications of Optics	25
MAPH 5072 Quantum Electrodynamics	25
MAPH 5113 Computer Applications and Interfacing	25

MODULE SYNOPSES

YEAR I

MAPH 5131 Mathematical Methods 25 Credits

This module looks at complex Analysis: Multi-valued functions; Branch Points and cuts; Evaluation of Integrals; Singularities of functions; Dispersion relations; Fourier Series and Integral Transforms: Fourier series and Fourier analysis; Orthogonality, random process probability; Time-frequency domain; Signal processing; Fourier and Laplace transforms; Fast Fourier and Z transformation; Convolution and De-convolution; Auto and cross co-relation. It also looks at differential Equations: Higher order differential equations with constant and non-constant coefficients; Partial differential equations; Integral transform and Green function methods; Special Functions: Sturm-Lioville Theory; Legendre, Lagurre; Hermite and Bessel functions; Group Theory: Definition and examples of groups, the action of a group on a set; Theory of finite groups; Small oscillations and group theory; Compact and Lie groups; Applications of groups in quantum mechanics and spectroscopy.

MAPH 5071 Advanced Quantum Mechanics 25 Credits

This module explores angular momentum and spin in Schrondiger Equation; Spin-spin, spin-orbit interactions; Thomas-Fermi model; Angular distributions from decay and collisions; Generalised Pauli principle; Properties of symmetry of states, Notion of Parity; Time reversal and charge conjugation.

MAPH 5031 Physical And Geometrical Optics 25 Credits

This module highlights gaussian approximation; The matrix formulation of the Guassian optics; Cardinal points; Monochromatic and chromatic aberration; Geometrical image evaluation; Fresnel Diffraction and X-ray microscopy; Fraunhofer diffraction and Fourier transforms; Coherence and interference design; Two beam and multi-beam interferometers and evaluation of interferograms.

MAPH 5113 Computer Applications And Interfacing 25 Credits

This module is on Programming C++, scope and principles; Use of wide range of computer packages e ;g; Excel - 3; Auto cad, smart work; Basic simulation and modelling methodology, sampling data collection, analysis and visual output; Interforce applications in control systems and instrumentation.

MAPH 5032 Physics And Technology Of Lasers 25 Credits

This module is on Density Matrix formulation of interaction of radiation with matter; Threshold condition, Lamb dip; Unstable resonators; Active and passive Q switching, mode locking; Cavity dumping; Design of gas lasers, solid state lasers, semiconductor lasers and dye lasers; Techniques for measuring the spectral and temporal properties of laser beams.

MAPH 5072 Quantum Electrodynamics **25 Credits**

This module explores the quantum electric dipole; Dipole oscillators Electromagnetic fields and their quantization; Quantum Electrodynamics; Recapitulation of elementary quantum mechanics; Virtual oscillators; Dirac's and Jordan's quantization; Jordan's Pau relativistic quantization of charge free electromagnetic fields; Negative energy states; Electromagnetic fields and their quantization; Electromagnetic Waves in Anisotropic crystals; The index ellipsoid; The quantization of radiation field; The lens Waveguides, the wave equation in quadratic index media; Elliptic Gaussian beams; Density Matrix derivation of the Atomic Susceptibility; Quantum well laser and the free electron laser.

MAPH 5092 Optical Instrumentation And Measurement **25 Credits**

This module has a review of Electronic Instrumentation and measurement; Fibre optic sensors; Measurement of pressure, temperature, magnetic and electric field based on intensity, phase, polarization, frequency and wavelength; Sensor design; Optical time domain refectometer spectral analyser, ellipsometer, beam view analyser and diagnostics; Electro-optic, magneto optic and acoustic devices and their applications.

YEAR II

MAPH 6033 Fibre Optics And Non Linear Optics **25 Credits**

This module examines materials and fibre preparations; Propagation of 'EMR' in optical fibres; Optical waveguides cable connectors, detectors and measurement techniques; Modal analysis for step index fibres; Pulse dispersion, attenuation and splice loss, grating compression; Raman optical amplifiers; Non-linear optical susceptibility; Phase matching and harmonic generation; Parametric excitation; Photon echo, self-induced transparency, damage effects and optical bistability.

MAPH 6032 Applications Of Lasers **25 Credits**

This module is on holography; Principles of wave front reconstruction; Types of holograms; Multiplexing, non-destructive material testing, storage and optical processing; Holographic optical elements; Medical diagnostic, surgery, cancer treatment, bloods coagulation molecular biology; Laser remote sensing and environmental pollution measurement and monitoring and Industrial applications of lasers.

MAPH 6038 Optical Technology **25 Credits**

The module explores the generating of optically flat, spherical and aspherical surfaces; Various theories of polishing; Surface finish and polishing quality; Holographic testing; Design of optical processing unit; Production of lenses and prisms; Computer simulation of lens design and prisms; Semiconductor and metallic films, design methods of multilayer interference filter coatings; Guided waves in dielectric films and Devices for integrated optics.

MAPH 6035 Optical Properties Of Materials **25 Credits**

The module outlines optical properties of glasses, plastics, amorphous synthetic quart (Vitreous silica) artificial crystals, metallic materials; Photo refractive crystals; Materials for thin fi lm reflection and Anti-reflection coatings; Materials for optical fibres; Fabrication and statistical tolerances for different components.

MAPH 6034 Laser Spectroscopy **25 Credits**

This module looks at the tunable coherent light sources; Doppler limited absorption and fluorescence spectroscopy; Laser Raman and Brillouin spectroscopy and time resolved Laser Spectroscopy.

MAPH 6036 Optical Communication **25 Credits**

This module covers semiconductor injection lasers, Modes, characteristics and efficiency; LED driver circuits; Receiver structure; High performance receivers; Optical receiver circuits multiplexing strategies; Optical amplifiers; Modulation and demodulation formats; Multi-carrier systems and network concepts; Information theory, entropy information rate, coding to increase average information per bit; Shannon's theorem and channel capacity.

MAPH 6037 Industrial Applications Of Optics **25 Credits**

This module is on surface finish testing; Monitoring on line diameter of threads, wires, etc; Laser alignment techniques; Laser drilling, cutting, welding, heat treatment, glazing, alloying, cladding hardening of surfaces, semi-conductor annealing and trimming; Processing of micro-electronic components; Industrial lasers; Surveillance and range finding; Applications of Fourier optics in character recognition and cross correlation.

MASTER OF SCIENCE DEGREE IN MEDICAL PHYSICS

1.0 Degree Profile: Master of Science Degree in Medical Physics

Institution:	National University of Science and Technology
Type of Degree:	Masters
Credit Load:	340 Credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s):	Zimbabwe Council for Higher Education

Period of reference: Accredited by ZIMCHE 2018

Purpose of the Programme

- Provide an education framework in the university and clinical environments leading to professional competence in medical physics
- Lay appropriate underpinning scientific knowledge leading to high levels of competence and interest in new technology and efficient practice in the highly dynamic environment of radio therapeutic and diagnostic imaging
- Inculcate in students research mindedness and awareness and prepare students to engage in research related to medical physics and the broad environment in which it is practiced
- Ensure students appreciate patients' needs and provide informed, appropriate and compassionate health care

Programme Characteristics

The programme has two distinct components which are aimed at producing a medical physicists that is educated and clinically orientated and therefore fit to practice on completion of the degree Clinical practice component enables the student to build, reinforce and consolidate on theory and clinical learning. The clinical component shall follow recommendations for Medical Physics Education in AFRA Member States endorsed by the Federation of African Medical Physics Organisations (FAMPO). This is based on three IAEA Medical Physics Clinical Training Series Handbooks namely TCS 37, TCS 47 and TCS 50. Students shall be required to compile a logbook or portfolio which reflects the competencies attained during their clinical training. A detailed outline of the clinical programme is shown in Appendix 1. A formal, independent assessment of the students shall take place at the end of the training programme to confirm successful completion of the clinical training programme.

Specialist Focus: It is designed to provide an overview of both the theoretical background and applications of physics in the medical field. It is the intention of this programme to address some of the pertinent issues in medicine today, the availability of personnel to monitor and maintain quality in the equipment and procedures used in medicine, and also to carry out sustained research.

2.0 REGULATIONS

These regulations should be read in conjunction with the Faculty of Applied Science and the NUST General Academic Regulations**.**

2.1 **Entry requirements**
A Bachelor's Degree in Physics, Biophysics, Radiography or relevant Engineering with a minimum grade of 2.2 or equivalent. Preference will be given to those who are already working in the Health Delivery Sector.

2.2 **Duration**
The programme runs on a full-time (or block release) over a period of two (2) years.

2.3 **Structure**

2.3.1 PART I consists of module work running for two semesters. Part II shall consist of clinical practice and a research project work leading to a dissertation and a portfolio.

2.3.2 The Research Project may commence at any time after the Part I Second Semester examinations. It may be undertaken in any relevant industry or any institution approved by the Departmental Board. The dissertation report shall normally be submitted at least one month before the end of the fourth semester (Part II).

2.3.3 A student is required to pass a minimum of eight taught modules and shall be required to choose at least one module from the list of elective modules.

2.3.4 A minimum of 340 credits shall be required for the Award of the Degree.

3.0 MODULE EVALUATION

3.1 A taught module shall be assessed by a four hour written examination at the end of each semester.

3.2 The final grade in the module work shall be based on 25% from continuous assessment and 75% from the final written examination.

3.3 To pass a module a student must obtain an overall mark of 50% from both continuous assessment and the final written examination.

3.4 A student shall be expected to obtain a minimum of 50% in the Master's Thesis project work and 50% in the Clinical Placement portfolio. The thesis and clinical placement portfolio shall contribute on equal weighting, 40% of the overall mark of the degree classification.

4.0 PROCEED AND WITHDRAW

4.1 A student who obtains a minimum of 80 Credits in Part I and is not allowed to proceed to Part II may be allowed to repeat the Part provided he / she scored an overall aggregate of 50%. A student who is not allowed to proceed to Part II because he/she could not earn a minimum of up to 80 Credits shall withdraw from the Programme.

4.2 A student may be allowed to proceed to Part II while carrying a Part I module, provided he/she has earned a total of 120 Credits in that Part. Such modules shall normally be examined at the next regularly scheduled examinations. A student may not be allowed to carry-over a Module for more than one year. Such a student shall be required to withdraw from the programme.

5.0 AWARD OF DEGREE

5.1 A student who has satisfied the examiners in the modules studied by earning a minimum of three hundred and forty (340) Credits shall be awarded the Master of Science Degree in Medical Physics.

5.2.1 A student who passes eight (8) of the taught modules, successfully completes the Clinical Practice but fails to complete the Research project work, may be awarded a Post-graduate Diploma.

5.2.2 A student who fails to complete the programme but has passed at least six (6) of the taught modules and successfully completed both the Clinical Practice and the Research project, may be awarded a Post-graduate Diploma.

PROGRAMME SUMMARY

PART ISEMESTER I

Module Code	Module Description	Credits
MAPH 5113	Human Anatomy and Physiology	20
MAPH 5114	Physics and Biology of Ionising Radiations	20
MAPH 5115	Medical Imaging	20
MAPH 5116	Radiotherapy Physics	20
Total		**80**

SEMESTER II

MAPH 5220	Safety and Quality Management	20
MAPH 5221	Physics of Non-ionising Radiation	20
MAPH 5222	Medical Electronics and Instrumentation	20
	Elective*	20
Total		**80**

LIST OF ELECTIVES

MAPH 5223	Magnetic Resonance Imaging	20
MAPH 5224	X-ray Imaging	20
MAPH 5225	Nuclear Medicine	20
MAPH 5226	Medical Ultrasound	20
MAPH 5227	Introduction to Bioengineering	20
MAPH 5228	Bioelectricity	20
MAPH 5229	Audiology and Audiometry	20
MAPH 5230	Mathematical Techniques	20

PART II

SEMESTER I

MAPH 6000	Clinical practice
MAPH 6010	Research Project

SEMESTER II

MAPH 6000	Clinical practice	90
MAPH 6010	Research Project	90
Total credits for the year		**180**

MODULE SYNOPSES

YEAR I

MAPH 5113 Human Anatomy And Physiology 20 Credits

This module covers the relevant anatomy and physiology of each of the major body systems; Nervous system; Thermoregulation; The skeletomuscular system; Endocrine system; Reproduction; Genetics; Cardiovascular system; Respiratory system; The kidney; Gastrointestinal system; Introduction to disease classification; Principles of diagnosis testing and decision-making in medicine as well as malignant disease.

MAPH 5114 Physics And Biology Of Ionising Radiations 20 Credits

The module looks at the interaction of photons, charged particles and neutrons with matter, essential properties of atomic nuclei, quantities and units according to the International Commission on Radiological Units and Measurements (ICRU), radiation measurement and detection; Physical basis of dosimetry, introduce different theories and describe the principle of operation of the various types of dosimeters; Overview of medical applications of ionising radiation; Radiobiology and laboratory work.

MAPH 5115 Medical Imaging 20 Credits

The module looks at the theory of Image Formation; Image Production; Images and Information; Fourier Transforms, FFT, Tomographic Image Reconstruction/Filtered Back projection, k-space representation; Quality Assurance; ROC Analysis; Image display and Storage; Picture Archiving and Communication Systems and an overview of medical imaging modalities.

MAPH 5116 Radiotherapy Physics 20 Credits

The module explores the basic Concepts; External Beam Therapy - Introduction: radiotherapy versus chemotherapy or surgery; Effects of radiation on cells, cell survival curves; External-beam therapy: linear accelerators, photon and electron beams; Cobalt units: source production, decay schemes; Kilovoltage: circuits, dose distribution, Beam characteristics: percentage depth dose, beam-data measurement; Treatment planning: wedged fields, beam blocks, treatment simulators; Quality control: Radiation dosimetry and detectors; Brachytherapy - Historical development; Types of treatment: Interstitial, intracavitary, intraluminal, moulds; Brachytherapy sources: characteristics, production, specification, apparent activity, AKR; Units: exposure, AKR and dose; Dose calculations: source geometry, self-absorption, capsule attenuation, tissue attenuation and scatter, dosimetry systems (Manchester, Paris); Measurement: activity, dose; Unsealed source therapy: Iodine-131, typical doses, other isotopes (P-32, Y-90, SR-89) and radiation protection in radiotherapy.

MAPH 5220 Radiation Protection, Safety And Quality Management 20 Credits

This module examines ionising radiation safety; Ultrasound safety; Electrical safety; Laser safety; Microwaves, radio-frequency and magnetic fields; Ultraviolet radiation; Chemical safety; Biological hazards; Mechanical workshop safety; Finance and Management of Medical

Physics; Personnel and Management in a Hospital; Medical Research; Quality Management System and code of ethics.

MAPH 5221 Non-Ionising Radiation 20 Credits
The module examines ultrasound; Interaction of ultrasound with tissue; thermal effects; physiotherapy; interaction with red cells; attenuation; absorption; reflection and refraction; velocity; lasers; Interaction of laser light and tissue, coefficient; classification of lasers, safety, therapeutic uses of lasers; surgery; ophthalmic; photodynamic therapy; Microwaves; UV and infrared.

MAPH 5222 Medical Electronic And Instrumentation 20 Credits
This module outlines electronic circuits for medical imaging, Nuclear Instrumentation standards, Microprocessor technology in health care delivery, Artificial Intelligence, computer interfacing, Image reconstruction and spectral analysis.

MAPH 5223 Magnetic Reasonance Imaging 20 Credits
This module looks at the introduction to Nuclear Magnetic Resonance; Nuclear Magnetism; Nuclear Magnetic Resonance: Properties in Matter; NMR in tissue; Imaging Sequences; - spin echo, multi echo spin echo, fast spin echo; Spatial encoding - k-space and the MR image; Frequency encoding; Phase encoding Half Fourier imaging; STIR; Ultrafast imaging; 3D image acquisition; MRI artefacts and MRI equipment.

MAPH 5224 X-Ray Imaging 20 Credits
This module looks at the X-Ray Image Formation: Analogue and Digital Detectors; Conventional X-Ray diagnosis; Image Quality (Noise, Contrast, Spatial Resolution); Noise and Image Perception; Imaging Systems; Mammography; Fluoroscopy; Computed Tomography; Digital Subtraction Radiography and Angiography.

MAPH 5225 Nuclear Medicine 20 Credits
The module examines tracer studies, Roentgen, Becquerel, Hevesy; Instrumentation: Thyroid uptake counter, rectilinear scanner (resolution, sensitivity, dose); Gamma camera: Anger camera, technetium, camera uniformity (sensitivity) computers; Gamma camera: Construction, collimator, Anger's equations, dose utilisation, multi-head cameras, pharmaceuticals; Tracer techniques: red-cell volume, compartment models, I-131 uptake test, radiation dose form uptake test, requirements for imaging; Isotope generators: technetium, Krypton, transient/secular equilibrium, isotopes and pharmaceuticals used; Image assessment: aberrations/quality assurance, mechanical and thermal shock, functional studies; Other topics: statistics of counting, well counter, energy discrimination and elementary statistics of photomultiplier tube.

MAPH 5226 Medical Ultrasound 20 Credits
This module looks at physical sound of the Ultrasound Laboratory Room Requirements; Types of Equipment; Image Storage; Image Retrieval; Safety Considerations; Components of Ultrasound Equipment Pulse Echo Systems; Doppler Imaging; Colour Flow Imaging;

Continuous Wave Systems; Transducers; Computers; Film Archiving Performance and Safety Standards; Uses of Ultrasound in the Body; Correlative Imaging Angiography; Digital Radiography; Computerized Tomography; Magnetic Resonance Imaging Future Trends in Medical Imaging; Instrumentation A-Mode; Static B-mode; Bi-stable; Grayscale; Real-time; Mechanical sector; Linear array; Phased array; Annular array; Duplex (Doppler); M-mode; Scan converters; Test Objects; Test and Calibration Procedures Output Measurements and Biological Effects; Acoustic output measurements; Biological effects; Doppler Ultrasound: Doppler flowmeters; Doppler shift signals and Colour Doppler Imaging.

MAPH 5227 Introduction To Bioengineering 20 Credits

This module has an overview of structure and function of biological materials, implant materials and biocompatibility, materials for medical prosthetics, radiation effects on biomaterials; Mechanical stresses on limbs and joints; Augmenting and replacing body functions: corporeal devices, mechanical, fluid and electrical systems; power sources- drug delivery; safety-critical systems; examples (pacemakers, implanted defibrillatory heart-lung machine dialysis, joints); Functional evaluation and properties of materials.

MAPH 5228 Bioelectricity 20 Credits

This module explores the sources of physiological signals: electrical signals (generation of nerve action potential, propagation, velocity, circulating currents, muscles, smooth and striated, oscillators, trans-membrane potentials) - pressure (perfusion, hydrostatic dynamic); flow (blood, gas, food, urine); biochemistry (gas tension, pH, glucose concentration); Accessing physiological signals: (blood flow as a case study to illustrate different methods); images; electrodes (micro, needle, surface, calomel, ion-selective, chemfet); biomagmetism (SQUID); transducers (pressure, flow, ultrasound, temperature, force, displacement); invasive and non-invasive methods.

MAPH 5229 Audiology And Audiometry 20 Credits

The module examines basic anatomy and physiology; mechanisms of hearing- effects of excessive sound levels; pathology of hearing; genetic and age effects; basic psychoacoustic properties; Philosophy of audiometric testing; Role and types of audiometry; Pure tone, air and bone conduction audiometry; Physical basis of objective tests of middle ear function; Electrophysiological tests of hearing and optoacoustic emissions and speech audiometry.

MAPH 5230 Mathematical Techniques 20 Credits

This module is on mathematical techniques for system modelling, data analysis and data classification: similarities and difference between modelling classification and analytical techniques; Data - signals against time, 'XY' data and images; analogue and digital data, equivalence of representations, sampling theorem; Time and frequency domain analysis - duality of domains; Statistical properties of signals in relation to analysis; stationarity, ergodic hypothesis; Convolution, correlation and frequency transformation, methods of calculation, relationship between, applications of filtering; windowing and estimation techniques; Pattern recognition and data classification; similarities and differences; Pattern recognition - classical, syntactic, neural nets: applications of, problems with; classification techniques - cluster analysis, principal components, neural nets; Applications of techniques - problem identification, data validation, result validation; common pitfalls and errors.

YEAR II

MAPH 6000 Clinical Practice 90 Credits

This module looks at supervised clinical training in the physics aspects in radiation oncology, nuclear medicine, diagnostic radiology and radiation protection; Factors affecting patient care, personnel monitoring, regulatory controls, research and development, teaching, acceptance testing and commissioning of equipment; Monitoring equipment performance and calibration, quality control and professional awareness. Clinical practice shall be assessed by presentations, practical assignments, portfolio and oral assessments.

MAPH 6010 Research Project 90 Credits

This module provides the research component of the MSc programme. The research shall be carried out over a period of six months. Such projects shall be approved by the department before they embark on them. This shall be done in an industrial/clinical setting. The dissertation shall be assessed in part by an oral examination.

MASTER OF SCIENCE DEGREE IN MEDICAL ULTRASOUND

1.0 Degree Profile : Master of Science Degree in Medical Ultrasound	
Institution:	National University of Science and Technology
Type of Degree:	Masters
Credit Load:	300 credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	Accredited by ZIMCHE 2018

2.0 REGULATIONS

These Regulations should be read in conjunction with the Faculty of Applied Science Regulations and the General Academic Regulations.

3.0 ENTRY REQUIREMENTS

3.1 Candidates with a BSc Honours degree, minimum classification 2.2 in Radiography (Diagnostic or Therapeutic) who are registered with or are eligible for registration with the Allied Health Practitioner's Council of Zimbabwe will normally be eligible for admission into the programme.

3.2 Any other relevant qualification obtained from a recognised institution in Zimbabwe or elsewhere may be considered for admission by the departmental board subject to approval by the Senate.

3.3 Candidates should provide satisfactory evidence of having secured a clinical placement area.

4.0 DURATION OF THE DEGREE PROGRAMME

The minimum duration of the programme shall be eighteen months. It will be offered on a block release basis over three semesters.

5.0 MODE OF STUDY

The Programme will be by class contact on a block release basis (two blocks of three weeks in the first year and self-directed work-based study in between the blocks). The third semester is dedicated to the final Clinical Practice and Research.

The Research Project could commence during the second semester and may be undertaken in the department, industry or any other institution approved by the departmental board.

6.0 ASSESSMENT

6.1 The taught modules shall be assessed through continuous assessment and a four-hour final written examination at the end of each block. Continuous assessment shall comprise 25% and the written final examination shall comprise 75% for a taught module, and this shall aggregate to the final mark for the module.

6.2 To pass a module the student must have obtained an overall mark of at least 50% and at least attained a mark of 45% in the examination.

6.3 The clinical practice component shall be assessed by a continuous assessment from clinical supervisors, a prescribed logbook, case studies and a viva voce. To pass the clinical assessment the student shall present a prescribed logbook with the minimum number of examinations, prescribed case studies and a viva voce examination.

6.4 To pass this module, a student must obtain a minimum aggregated mark of 70% which is equivalent to 50%.

6.5 To pass the research project module a student must obtain a minimum mark of 50% in the project report and pass continuous assessment with a similar mark. Oral presentation shall constitute part of the continuous assessment. The research project shall constitute 25% of the overall mark for the degree classification.

7.0 DETERMINATION OF RESULTS

7.1 **Award of a degree**

A student who passes all six taught modules, the clinical practice component and the research project shall be awarded a Master of Science Degree in Medical Ultrasound.

7.2 **Award of a post graduate diploma**

7.2.1 A student who passes all six taught modules and the clinical practice component but fails to complete the research project module may be awarded a Post Graduate Diploma in Medical Ultrasound.

7.2.2 A student who successfully completes three taught modules, that is:
SMU 5103 Pelvic and Obstetrics Ultrasound I;
SMU 5201 Upper abdomen, Vascular and Small Parts Ultrasound;
SMU 5203 Pelvic and Obstetrics Ultrasound II;
SMU 6100 Medical Ultrasound Clinical practice module and the
SMU 6110 Research project
may be awarded a Post Graduate Diploma in Medical Ultrasound.

8.0 DEGREE CLASSIFICATION

8.1 The weighting of the components of the degree shall be;

Average of all taught modules	50%
Clinical practice component	30%
Research Project	20%

8.2 The overall classification of the degree shall be in accordance with university regulations.

9.0 PROCEED AND WITHDRAWAL

9.1 A student may proceed to do the research project module if he/she has completed at least three taught modules.

9.2 A student who fails more than three of the taught modules at the end of Part 1 shall be required to withdraw from the programme.

PROGRAMME SUMMARY

Part 1 – Semester I

Module Code	Module Description	Credits
SMU 5101	Ultrasound Physics and Instrumentation	25
SMU 5102	Ethics and Professional Practice in Ultrasound	25
SMU 5103	*Pelvic and Obstetrics Ultrasound I	25

Semester II

SRA 5102	Research in Healthcare	25
SMU 5201	*Upper Abdomen, Vascular and Small Parts Ultrasound	25
SMU 5203	*Pelvic and Obstetrics Ultrasound II	25

Part 2 – Last Semester

SMU 6100	Medical Ultrasound Clinical Practice	90
SMU 6110	Research Project	60

**Modules required for the post- graduate diploma with a research pathway.*

MODULE SYNOPSES

YEAR I

SMU 5101 Ultrasound Physics And Instrumentation 25 Credits

The module looks at waves, Electromagnetic waves and Sound waves. Properties of waves, Power and intensity, Interaction of ultrasound with matter, Ultrasound transducers, Beam characteristics, and current developments in ultrasound transducer designs. Principles of Ultrasound, Image display modes in ultrasound, Doppler principles and instrumentation, Doppler applications in medical imaging, Pulse echo instruments, Image manipulation in ultrasound; Principles of pulse echo imaging; Image quality in Ultrasound imaging; Artefacts; Image storage, display and transmission; Recent advances in image display; Recent advances in ultrasound imaging, Quality assurance in ultrasound imaging.

SMU 5102 Ethics And Professional Practice In Ultrasound 25 Credits

This module analyses ethics and accountability in ultrasound; Experimental biological effects studies, Guidelines and regulations; Litigation; Evidence based practice in ultrasound; Patient care; Communication; Psycho-social issues; Cultural issues; Intracavital techniques and ethics; Counselling, Professional practice in: Interventional Techniques, Emergency situations e.g. postural hypotension, medical emergency response, respiration and chemical spill as well as Bio-effects and safety.

SMU 5103 Pelvic And Obstetrics Ultrasound 1 25 Credits

This module is on anatomy, physiology, and pathology of the male pelvis and non-pregnant female pelvis; Sonographic appearances of normal and abnormal anatomical variants; Patient preparation and ultrasound scanning techniques of the pelvis; Pathology of the female and male pelvis and their sonographic appearances e;g; Fibroids, pelvic inflammatory disease, testicular torsion, prostate cancer and epididymo-orchitis; Spermatogenesis, spermiogenesis, hormonal interactions and the male puberty; The female reproductive cycle, ovulation, conception, implantation and female puberty; First trimester embryonic anatomy, physiology and pathology, normal appearances of a gestational sac, blighted ovum and common congenital abnormalities during the first trimester; Gestational age estimation parameters during first trimester; Complications during first trimester pregnancy and their ultrasonic appearances e;g; threatening miscarriage, Hydatid mole, ectopic pregnancy, retained products of conception; Role of other imaging modalities and clinical findings in complementing ultrasound imaging of the female and male pelvis.

SRA 5102 Research In Healthcare 25 Credits

This module is on evidence based practice, research methodology, research designs, data gathering techniques, validity and reliability, sampling techniques, statistics in research, data processing and scientific reporting, medical ethics and clinical trials.

SMU 5201 Upper Abdomen, Vascular And Small Parts Ultrasound 25 Credits
The module explores anatomy, physiology and pathology of the liver, gallbladder, kidneys, adrenals, spleen and pancreas; The retroperitoneum, lymphatic system, gastro-intestinal, diaphragm and lungs; Liver function tests and biopsies; Patient preparation and Scanning protocols and techniques for the abdominal organs; Sonographic appearances of pathological conditions of abdominal organs e;g; splenomegaly, hydronephrosis, cholelithiasis, cirrhotic liver disease and pancreatitis; Abdominal scanning in different user groups (Accident and emergency patients, obese patients, paediatric patients, etc); Role of other imaging modalities in complementing abdominal ultrasound findings; Cardiovascular general survey scanning, deep and superficial blood vessels and scanning techniques; Doppler scanning techniques; Musculo-skeletal system and scanning techniques e;g; tendons, trans-cranial neonatal scanning; Small parts ultrasound scanning techniques, e;g; neck, breasts, scrotum, penis, eyes and parotids.

SMU 5203 Pelvic And Obstetrics Ultrasound 11 25 Credits
The module explores scanning during second trimester and third trimester pregnancy stages and foetal development; Parturition and labour; Maternal and foetal vascular circulations and placenta scanning; Normal Congenital anomalies e;g; acrania, duodenal atresia, polyhydramnios, etc; Amniotic fluid volume and index and accompanying pathological conditions; Second and third trimester pregnancy complications e;g; intrauterine foetal demise, threatening miscarriage, complete and incomplete abortion; Doppler scanning in pregnancy; Complications in male pelvic pathology and sonographic appearances.

YEAR II

SMU 6100 Medical Ultrasound Clinical Practice 90 Credits
In addition to the between blocks clinical learning and practice, this is the clinical practice component where students will be attached to approved supervisors and will carry out a prescribed number of examinations and participate in quality management under supervision. Students will maintain a logbook of practice and attendance and a portfolio of achievement. Assessment shall be through Clinical attachment reports from supervisors, logbooks, prescribed case studies and finally a viva voce examination. Students will be required to present case studies. Students may be required to rotate in a number of clinical departments to fulfil their logbook requirements.

SMU 6110 Research Project 60 Credits
This module provides the research component of the MSc programme. Hence it is the component that establishes the programme at Masters level. The research will be carried out over a period of six months. Normally this will be done in a healthcare setting. The dissertation from the research will be assessed in part by an oral presentation and a full written report.

MASTER OF SCIENCE IN RADIOGRAPHY

1.0 Degree Profile: Master of Science in Radiography	
Institution:	National University of Science and Technology
Type of Degree:	Honours
Credit Load:	300 credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	Accredited by ZIMCHE 2018

2.0 Preamble

The Bachelor of Science Honours Degree in Radiography has been offered by NUST and UZ since 2002. Graduates from these programmes have found employment within Zimbabwe and abroad. However, any graduates that had wished to pursue further studies had to go abroad for such studies as there were no Masters Degree programme in both Universities. The Radiography programme also needed to develop staff to continue to service its programmes. Setting up an MSc programme within the university enabled staff development as well as provided the much needed professional development within Zimbabwe and nationwide. The target group for this programme are practising Radiographers and as such, it is provided on a Block Release schedule. The programme takes cognisance of the fact that prospective students have clinical experience and they are also within the clinical area where the other part of the learning takes place. Students after completing the core modules may opt for modules with an emphasis in either diagnostic, therapeutic, or any area of speciality in the clinical area.

The programme is designed to meet the development needs of radiographers currently working in diagnostic and therapeutic practice. The aim of the programme is to encourage continued research in the field of radiography and to enhance students' skills in both inquiry and practice. The programme shall enable students to critically evaluate a range of issues within the field as changes in technology and Health Care practice drive radiography forward at a considerable pace. This shall allow evidence based and reflective practice. The programme aims to promote continued professional development by giving radiographers the opportunity to expand their expertise in radiography. It provides a flexible approach, which permits radiographers to react to the diverse range of issues relating to modern practice. It is designed to integrate theory with practice.

It is the intention of this Master of Science degree programme to address some of the pertinent issues in radiography today: quality in patient care to meet the ever changing demands of the patient, radiation protection and technological changes, issues of quality control and quality assurance in radiation sciences and cultivate evidence based practice through research.

3.0 ENTRY REQUIREMENTS

Candidates with a BSc Honours degree in Radiography, with at least a lower second class or equivalent shall normally be eligible for admission into the programme. In addition, candidates must be registered or be eligible for registration with the Allied Health Practitioners Council.

4.0 DURATION OF THE DEGREE PROGRAMME AND MODE OF STUDY

The programme is run in synchronisation with other Block Release Programmes at NUST. The minimum duration of the programme is 18 months. It is offered as a Block Release Programme over three semesters. The Programme is by class contact on a Block Release basis (two blocks of three weeks in the first twelve months, work based study in between the blocks and a project over the last six months).

5.0 MODULE STRUCTURE

5.1 The program consists of eight modules that are offered in two blocks. A student shall be expected to register for four modules per block. Students are required to undertake all the core modules and then select from the given range of available modules in various fields to achieve the total required number. A specified minimum number of students shall be required for a particular module to be offered. Students however, have the option to take a negotiated module as an independent study.

5.2 Students shall be required to satisfy the examiners in a project dissertation. The research project may commence at any time after the second semester examinations. It may be undertaken either in the Department, Industry or any other institution approved by the Departmental Board. The dissertation report shall normally be submitted to the Department at least a month before the end of the third semester.

5.3 The programme comprises of two blocks of three weeks each spread over twelve months. On successful completion of Year I, students shall proceed to carry out their research project.

5.4 Students are required to pass all the eight modules and the dissertation. The dissertation shall be equivalent to three modules.

5.5 A minimum of 300 credits shall be required for the degree to be awarded.

6. 0 MODULE EVALUATION

6.1 Various parts of a module may be examined independently during the module of the studies. Both the continuous assessment which shall comprise 40% of the overall mark for that part, and the written examination (comprising 60%), for such a module shall aggregate to the final mark for the whole module. The module shall be assessed by a four hour written examination at the end of the semester.

6.2 To pass a module, a student must have obtained an overall mark of 50% and at least 45% in the final written examination.

6.3 To pass the Research Project Module, a student must obtain a minimum mark of 50% in the project report and must pass continuous assessment with at least 50%. Oral presentation marks shall constitute part of the Continuous Assessment. The Research Project Module shall contribute 30% of the overall mark for the degree classification.

7.0 SUPPLEMENTARY EXAMINATIONS

7.1 A student shall be allowed to supplement no more than three modules. To be eligible for a Supplementary Examination, a student must have failed with at least 45 % overall mark in that
module and should have passed at least 50% of the modules he/she had registered for. A student who fails to attain 45% in a module may apply to repeat the module.

7.2 A candidate who attains less than 40% in the final examination of a module shall not be granted a supplementary examination.

7.3 The maximum mark for a supplemented module shall be 50 %.

8.0 DETERMINATION OF RESULTS

8.1 To be eligible for the award of the MSc Degree in Radiography, a student shall be required to pass all the modules registered for and must have successfully completed all relevant practical work and the Research Project Module.

9.0 DEGREE CLASSIFICATION

9.1 The weighting of the components of the degree shall be:

Average of all taught modules	70 %
Research Project Module	30 %

NB; The overall classification of the degree shall follow university and faculty regulations.

10.0 PROCEED AND DISCONTINUE

10.1 A student may proceed to do the research project module if he/she has completed at least three modules.

10.2 A student who fails more than three of the taught modules at the end of the second semester shall be required to discontinue the programme.

10.3 A student who passes all taught modules but fails to complete the project work may be awarded a Post-Graduate Diploma.

10.4 A student who fails to complete the program, but has passed at least four of the taught modules and successfully completed the project, may be awarded a Post-Graduate Diploma.

PROGRAMME SUMMARY

Year I - BLOCK I

Module Code	**Module Description**	**Credits**
SRA 5101	Radiobiology and Radiation Protection	25
SRA 5102	Research in Health Care	25
SRA 5103	Applied Psychology and Sociology	25
SRA 5104	Clinical Practice I	25
Total		**100**

Year I – BLOCK II

SRA 5205	Management in Health Care	25
SRA 5210	Clinical Practice II	25
	Elective I	25
	Elective II	25
Total		**100**

Electives

SRA 5206	Diagnostic Radiography I*	25
SRA 5207	Radiotherapy and Oncology I*	25
SRA 5208	Diagnostic Radiography II*	25
SRA 5209	Radiotherapy and Oncology II*	25

* **Elective Modules**

Students may only select electives from the same discipline.

Year II

SRA 6110	Research Project Module	100
Total		**100**

MODULE SYNOPYSES

YEAR I

SRA 5101 Radiobiology And Radiation Protection 25 Credits

The module explores the nature and magnitude of hazards to patients in various health-care settings, techniques used to analyse the risks and to address the problems in order to reduce errors and create a safe patient-care environment, probabilistic risk assessment methods, failure mode and effects analysis, human factors analysis and error classification systems, and quality management, radiobiology, human anatomy, physiology and pathology and the biological effects of radiation, radiation protection; Safety standards: recommendations from agencies and continual quality improvement.

SRA 5102 Research In Health Care 25 Credits

The module has evidence based practice; Research methodology: research designs, data gathering techniques, validity and reliability, sampling techniques, statistics in research, data processing and scientific reporting; Medical ethics and clinical trials.

SRA 5103 Applied Psychology And Sociology 25 Credits

This module examines communication skills, Professional judgement and Decision making, Stress and burnout, interpersonal skills, Sociology of illness, psychology of illness, Personality and patient management; Gender and health, Abnormal psychology, Social Psychology-Interpersonal Attraction as a social behaviour Attitude and attitude formation; The influence of others on our behaviour, Decision making, personality theories, person perception and stereotypes, Sociology of the family, Culture and tradition, Stress, emotion and illness, Negotiation and bargaining.

SRA 5104 Clinical Practice I 25 Credits

This is an independent Study Module I- For this module students shall explore an area of their interest in the field of Diagnostic or Radiotherapeutic radiography, i;e; (in any of the following areas; Ultrasound, Radiotherapy Applications, Diagnostic and Computerised Tomography). The aim of the module is to enhance the student's clinical practice in either diagnostic or radiotherapy radiography. The student is expected to critically analyse the principles of operations to include the equipment, merits, demerits and alternative therapy making recommendations to improve service provision and customer satisfaction. The module shall be assessed through case study presentation, portfolio of achievement and reports.

SRA5205 Management In Health Care 25 Credits

The module looks at organisational behaviour and theory; Operations management, human resources management; Inter group conflict and conflict resolution, Professionalism and inter professionalism in the imaging and radiotherapy department, Managing risk,Design considerations in departments, Equipment selection and procurement, Equipment maintenance, Inventory control, Human resources in imaging departments, Organisational structure, Inter-departmental and Inter-professional collaboration; Principles of quality,

quality assurance tests on equipment, organisational quality, Evaluating quality, Quality and the Imaging /Radiotherapy department; Quality and the customer; Total Quality Management; Accidents and accident prevention; Theories of accidents; Leadership and power, Conformity and compliance as well as theories of motivation.

SRA 5206 Diagnostic Radiography I 25 Credits

The module highlights the recent Advances in imaging techniques, Interventional Techniques; Role Development in radiography, Shifts in patient health worker perspectives; Aids and health, Role of support organisations in health care; Health Education; Health sector reforms and the role of Radiography in patient management.

SRA 5207 Radiotherapy And Oncology I 25 Credits

The module explores the alternative Medicine in cancer management, Recent Advances in Radiotherapy treatments; Hyper fractionated treatment; Advances in stereotactic techniques; Role Development in radiography, Shifts in patient health worker perspectives; Aids and health, Role of support organisations in health care; Health Education; Health sector reforms and the role of Radiography in patient management.

SRA 5208 Diagnostic Radiography II 25 Credits

The module looks at image Analysis, Processing and Quality Assessment, Digital Imaging; Magnetic Resonance Imaging; principles, equipments, clinical applications, functional magnetic resonance imaging and clinical applications. It also looks at computerized Tomography: CT principles, gantry designs, clinical applications in diagnosis and radiotherapy; Nuclear Medicine: instrumentation and clinical applications, SPECT and PET; Medical Ultrasound: Ultrasound Radiation, interaction of ultrasound with tissue; Principles: A-Mode, Static B-mode, Doppler, M mode; Image display, equipment, transducers, image storage and retrieval, safety considerations; Basic Imaging: time gain compensation (TGC), Doppler Ultrasound, reflection and transmission at interfaces, acoustical properties of biological media, transducer operation and beam patterns, Techniques and clinical applications;

SRA 5209 Radiotherapy And Oncology II 25 Credits

This module looks at radiobiology, effect of radiation on cells, cell survival; Radiotherapy versus chemotherapy/surgery; Dosimetry: dose distribution, isodose curves and percentage depth dose (PDD); Beam modification Device: oblique incidence and body inhomogeneities; Brachytherapy and Unsealed Source Therapy: interstitial, intracavital, intraluminal; Nucletron Microselectron LDR, IDR, HDR sources, optimisation, clinical applications External-Beam Therapy: principles of acceleration, particle accelerators, linear accelerators, Linacs and Betatrons cyclotrons, synchrotrons, synchrocyclotron, linac, powering systems, clinical applications and patient care; Megavoltage Electron Beams: equipment and clinical applications, Neutron beam characteristics equipment and clinical applications; Stereotactic radiotherapy: equipment, clinical applications, recent advances in stereotactic techniques; Cobalt units: equipment and clinical applications; Treatment planning: equipment and simulation, Virtual and CT simulation, treatment planning, plan documentation; Conformal radiotherapy, Treatment using complex radiation fields, Portal Imaging and Quality Assurance (QA) in Radiotherapy

SRA 5210 Clinical Practice II 25 Credits

This is an independent Study Module II - For this module students shall explore an area of their interest in the field of radiography in any of the following areas; Magnetic Resonance Imaging, Radionuclide Imaging, Interventional Radiology, Radiotherapy Planning and Mould Room Techniques, Alternative medicine in cancer management, Chemotherapy in cancer management and interstitial techniques; i.e. other than those areas explode in clinical practice I. The aim of this module is to enhance the student's clinical practice in a wide range of sub areas in either diagnostic or radiotherapeutic radiography. The student is expected to critically analyse the principles of operations to include the equipment, merits, demerits and alternative therapy making recommendations to improve service provision and customer satisfaction. The module shall be assessed through case study presentation, portfolio of achievement and reports.

YEAR II

SRA 6110 Research Project Module 100 Credits

This module provides the research component of the MSc programme. Hence it is the component that establishes the programme at Masters Level. The research shall be carried out over a period of six months. Normally this shall be done in a Health Care setting. The dissertation from the research shall be assessed in part by an oral presentation and a final written report.

DEPARTMENT OF COMPUTER SCIENCE

Lecturer and Chairperson

Dr Thambo Nyathi, Ph.D. Computer Science, UKZN, SA, 2018, Post Graduate Diploma in Higher Education, NUST, Z'bwe, 2012, MSc Computer Science, NUST, Z'bwe, 2005, Beng Electronic & Information Eng, Aberdeen, UK, 1996

Lecturers

Dr Sindiso Mpenyu Nleya, Post Graduate Diploma in Higher Education (PGDHE) 2010, BSc (Hons) App. Physics 2003, MSc (Computer Science 2007 , NUST,Z'bwe), PhD (UCT) 2016

Mrs Sibonile Moyo, MSc. Computer Science NUST (2005); BSc. (Gen.), UZ (1991), Further Education Teacher's Certificate (Byo Poly) (2000)

Mrs Sibusisiwe Dube, Post Graduate Diploma in Higher Education (PGDHE) 2012, MSc. Computer Science, 2007 NUST 2007; BSc. (Hons.), MSU 2003

Mrs Samkeliso Suku Dube, Post Graduate Diploma in Higher Education (PGDHE) NUST 2011; MSc. Computer Science NUST 2009; BSc (Hons)Computer Science,NUST 2007

Mr Sibangiso Ngwenya, Post Graduate Diploma in Higher Education (PGDHE) 2010, MSc. Computer Science, NUST, Z'bwe, 2008, Bsc (Hons) Mathematics and Computer Science, Jose Varona University, Cuba (1996); Post Graduate Diploma in Higher Education, NUST, Z'bwe, 2010; Certificate in Research Methods, UB, 2012

Mr Khesani Richard Chilumani, Post Graduate Diploma in Higher Education (PGDHE), NUST 2010; MSc. Computer Science, NUST 2008; BSc. (Hons.) Computer Science, NUST 2005

Mr Kernan Mzelikahle, MSc. Computer Science, NUST 2011; BSc. (Hons.) Computer Science, NUST 2007

Mr Daniel Musundire, Post Graduate Diploma in Higher Education(PDGHE)2012 MSc(2011); BSc. (Hons.), Computer Science NUST' (2008)

Mr Khulekani Sibanda, Post Graduate Diploma in Higher Education(PDGHE)2012 MSc(2011); BSc. (Hons.), Computer Science NUST' (2008)

Mrs Siqabukile Sihwa, Post Graduate Diploma in Higher Education(PDGHE)2014, MSc(2013); BSc. (Hons.), Computer Science NUST' (2008), HND, Computer Studies (HEXCO)

Secretary

Technician

BACHELOR OF SCIENCE HONOURS IN COMPUTER SCIENCE

1.0 DEGREE PROFILE: BACHELOR OF SCIENCE HONOURS IN COMPUTER SCIENCE

Institution:	National University of Science and Technology
Type Of Degree:	Honours
Credit Load:	480 Credits
Level:	SADC-QF - Level 8
Accreditation Organisation(S):	Zimbabwe Council for Higher Education
Period Of Reference:	Accredited by ZIMCHE

PURPOSE OF THE PROGRAMME

To produce graduates capable of providing computing solutions to solve problems.

PROGRAMME CHARACTERISTICS

Areas of Study:	Software Engineering, Network Administration, Cyber Security, Digital Forensics,
Specialist Focus:	Information Communication Technology
Orientation:	Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects
Distinctive Features:	

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Programmer, Network Engineer, Security Expert, Software Developer, Database Administrator, Computer Hardware Engineer,

	Computer Systems Analyst, Computer Network Architect, Web Developer, Information Security Analysts, Computer Programmer.
Further Studies:	Masters in Computer Science, Masters in Information Systems

TEACHING AND LEARNING

Teaching and Learning:	Lectures, tutorials, laboratory classes, seminars, group work, farm-based activities, industrial visits, industrial attachment, research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, laboratory reports, seminar presentations, industrial attachment report, mini-research project report, final year research project report, continuous assessments

2. 0 REGULATIONS

These Regulations should be read in conjunction with the Faculty of Applied Science and the University General Academic Regulations.

3.0 ENTRY REQUIREMENTS

3.1 Normal Entry

An applicant must have passed at least Mathematics and either Physics or Computing at "A" level.

3.2 Special Entry

An applicant who has successfully completed a National Diploma in Information Technology or its recognized equivalent may apply for entry into Part I.

4.0 DURATION

The Programme runs over a period of four years.

5.0 PROGRAMME STRUCTURE

5.1 The Programme consists of thirty-six taught modules, an Industrial Attachment module in the third year that runs for 28 weeks. At the end of the Industrial Attachment period, a student is expected to present an oral examination on the work that he/she did as well as submit a written report. In Year IV, a student shall undertake a Research Project.

5.2 A student is expected to obtain a minimum total of 480 credits to be awarded the Degree.

6.0 ASSESSMENT

6.1 Continuous assessment shall constitute 25% and written final examination, 75% of the overall mark. The pass mark is 50% and above.

6.2 A student who has failed to satisfactorily complete a part of his/her programme may be allowed to proceed to the next part carrying the failed modules provided they are no more than 25% of the number of normally scheduled modules in a particular year.

PROGRAMMME SUMMARY

		Modules	Credits
Part I	Semester I	SCS1101 Introduction to Computer Science & Programming	10
		SCS1102 Mathematical Foundations for Computer Science	10
		SCS1103 Operating Systems Concepts	10
		SCS1105 Computational Research Methods	10
		SMA1101 Calculus I	10
		SMA1102 Linear Algebra	10
	Semester II	SCS1207 Structured Program Design	10
		SCS1202 Database Concepts	10
		SCS1204 Logic Design & Switching Circuits	10
		SCS1205 Software Engineering Concepts	10
		SCS1206 Visual Programming Concepts & Development	10
		CTL1101 Conflict Transformation & Leadership	10
Part II	Semester I	SCS2101 Computer Data Communications	10
		SCS2102 Computer Architecture	10
		SCS2103 Data Structures & Algorithms	10
		SCS2104 Systems Analysis & Design	10
		SCS2108 Object Oriented Software Concepts & Development	10
		SORS2107 Operations Research	10
	Semester II	SCS2201 Software Design Methodologies	10
		SCS2203 Advanced Mathematical Structures for Computing	10
		SCS2204 Internet & Web Design	10
		SCS2206 Societal Computing	10
		SCS2207 Computer Networks & Applications	10
		SCS2209 Computational Modelling	10
Part III		SCS3000 Industrial Attachment	120
Part IV	Semester I	SCS4000 Final Year Project	
		SCS4101 Artificial Intelligence	10
		SCS4103 Software Project Management	10
		SCS4108 Simulation & Modelling	10
		SCS4110 Information Systems Security & Auditing	10
		SCS4111 Enterprise Architecture Programming	10
	Semester II	SCS4000 Research Project	20
		SCS4203 Computer Graphics	10
		SCS4207 Expert Systems and Decision Support	10

	Systems	10
	SCI 4201 Digital Forensics	10
	SCS4201 Database Design & Management	10
	SCS4208 Distributed Computing	
TOTAL		**480**

MODULE SYNOPSES

YEAR I

SCS 1101 Introduction To Computer Science And Programming 10 Credits

The module explores information and Knowledge Societies, Evolution of Computers, Computer Organisation and Architecture: CPU; Memory; I/O, Number Systems and Conversions (Bin; Dec; Hex; Oct), Concepts of Computer Languages: high\low level languages; compiler; interpreter, Programming Techniques: grammar; recursion; Variables; Data types; Initialization; Comments; Keywords; Constants; Assignment, Programming constructs: branching; looping; recursion; Programming using data structures: arrays; lists; trees; hash tables; queues; stacks; files, Programming Algorithms for Problem Solving: Sorting; compression; numerical and encryption, Fundamentals of Operating System, Fundamentals of Databases and fundamentals of networks.

SMA1102 Linear Algebra 10 Credits

This module is on Vector Algebra: scalar and vector product. Collinear, coplanar vectors. Applications. Equations of lines and planes. Matrices: products, sums, echelon form, rank, inverse. Determinants: definition, properties, evaluation. Systems of Linear equations, Gauss's method, Cramer's rule, homogeneous systems. Vector Spaces: definition, linear independence, bases, subspaces.

SMA1101 Calculus 10 Credits

The module looks at Limits of functions; One-sided and infinite limits; Continuity; Differentiation: definition, basic properties, Rolle's theorem, mean value theorem, Cauchy's mean value theorem, Leibniz's rule, applications, Taylor series; Integration: definite integrals, antiderivatives, fundamental theorem of calculus, improper integrals, Gamma and Beta functions, definition of natural logarithm as integral of 1/x and exponential as inverse; Area, volume of revolution, arc length, surface area; Parametric equations: arc length, surface area; Polar coordinates; Graph sketching; Area in polar coordinates; Complex numbers; Algebra of complex numbers; DeMoivre's theorem and the exponential form.

SCS 1102 Mathematical Foundation For Computer Science 10 Credits

This module explores sets, relations, functions; Discrete probability; Combinatorics: Permutations and Combinations; Propositional logic; Logical Connectives; Truth tables; Normal forms; First order predicate logic; Reasoning about programs: axiomatic semantics, pre/post-conditions, loop invariants; Recurrence relations, Application to searching and sorting.

SCS 1103 Operating Systems Concepts **10 Credits**

The module is an overview of operating systems structures, Operating system organisation and Services, Computer design, the hardware and its interfaces, Device management; I/O management; Creating virtual device abstractions; Support for processes and threads; Job Scheduling, Disk scheduling, file systems; Process management, synchronisation and communication; Memory management: deadlock, virtual memory management and processing Synchronisation; File management; Filing systems, interface and implementation; Case studies drawn from Linux and mobile operating systems, android.

SCS1105 Computational Research Methods **10 Credits**

The module explores empirically-based design research, Typical approaches to empirically-based design research are: direct observation of the results of designing; surveys of designers' perceptions; and protocol studies of individual and collaborating designers designing; Axiom-based design research axiom-based research produces models of design through the identification of a set of axioms and the logical consequences of the axioms; this approach to design science research involves: (i) specifying relevant axioms (ii) deriving logical consequences of the axioms mapping the axioms and their consequences onto a particular domain to derive new results; Critical thinking and analysis; critical reasoning; scientific writing for computer science and the tools for presentation of research in computer science.

SCS 1201 Programming And Program Design **10 Credits**

The module looks at the concept and properties of algorithms, Programming process, Fundamental design concepts and principles: Divide-and-conquer strategies; Abstraction; Program decomposition; Encapsulation and information hiding, Separation of behaviour and implementation, Basic syntax and semantics of a higher-level language, relevant program representations: basic blocks; control-flow graphs; defuse chains; static single assignment and Jackson Structured programming.

SCS 1202 Database Concepts **10 Credits**

The module examines the database management systems (DBMS), Database Models: Entity-relationship Model; The relational model; The SQL language; Database design: ER to Relational mapping, the systems development lifecycle, the database lifecycle, Conceptual design, logical, physical design; Normalisation; Aspects of physical database access: Database Transactions: Distributed Databases: Client-server database systems; Higher-level and extended data Models: Object-oriented data models are introduced; SQL3 and the requirements of Multimedia database

SCS1203 Business Information Systems **10 Credits**

The module explores the Business Environments; Changing lives and businesses in the Information Era, Redesigning the organization with information systems Types of Information system: TPS; MIS; DSS; and Expert Systems; The Systems life cycle, the phases within it and the activities and documentation appropriate to each phase; Other development strategies, including 4GLs, Prototyping, and Evolutionary development; Building and managing information systems; IS project organisation and management Information System Security and Control the Internet and electronic business.

SCS1204 Logic Design And Switching Circuits 10 Credits

The module outlines the Binary logic functions, Set Theory and Venn Diagrams, Logic Gates, Karnaugh Maps, Combinatorial Circuits: - design procedure, adders, Subtractors, Integrated circuits; Sequential Circuits: - flip-flops, Equivalent Gates, Counters and Registers and Computer Aided Circuit Design Practical.

SCS 1205 Software Engineering Concepts 10 Credits

The module looks at the software development process, agile software development, requirements engineering, analysis and design, documentation, implementation strategies, system testing, validation and verification, software evolution, project management and software development life cycle.

SCS1206 Visual Programming Concepts And Development 10 Credits

The module looks at the structure and Nature Of Visual Applications, user interface Contexts (webpage; business applications; mobile applications; games), Canonical uses (GUIs; mobile devices; robots; servers) , Events and event handlers, Separation of model, view, and controller, Visual Design Elements :Object; Controls; Windows; Forms; Dialogues; Templates; Panels; Panes; etc;, user-centred development, interaction design: Physical capabilities; Cognitive models, Social models, Principles of good design and good designers, Accessibility, Principles of graphical user interfaces (GUIs), Elements of visual design, User interface standards, Functionality and usability requirements, Techniques for gathering requirements, Internationalisation, interaction styles and techniques, Representing information to users, Design, implementation and evaluation of non-mouse interaction.

SCS 1207 Structured Program Design 10 Credits

The module looks at basic syntax and semantics of a higher-level language variables and primitive data types (e;g; numbers, characters, Booleans), types, expressions and assignments, simple I/O including file I/O; structured decomposition; program decomposition techniques, top-down functional decomposition; Conditional and iterative control structures: sequence, selection, iteration; Functions and parameter declaration, returning values, pass by value and pass by reference, inline functions; Program design methodology: structured methodology, object-oriented methodology and design notation.

CTL 1101 Conflict Transformation & Leadership 10 Credits

The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

YEAR II

SCS 2101 Computer Data Communications 10 Credits
The module explores the type of media, transmission, modulation, network topologies, synchronous and asynchronous transmission data link protocol, network topologies, OSI model, TCP/IP suite, Transport layer, Addressing Network layer, Data link layer; Planning and cabling networks.

SCS 2102 Computer Architecture 10 Credits
The module covers the fundamentals and performance Technology trends, measuring CPU performance, Amdahl's Law and averaging performance metrics; Assembly level machine organisation Basic organisation of the von Neumann machine, control unit: fetch, decode and execution, components of instruction sets, RISC and CISC and example instruction sets, addressing modes; Interfacing and communication, I/O fundamental: handshaking, buffering, programmed I/O, interrupt –driven, Interrupt structures: vectored and prioritised, interrupt acknowledgement; External storage, physical organisation and drives; Buses: bus protocols, arbitration, direct memory access (DMA); Multimedia support; Analogue and digital devices; Memory system organisation and architecture Storage systems and their technology; Memory hierarchy: importance of temporal and spacial locality; Main memory organisation operations; Latency, cycle time, bandwidth, interleaving; Cache memories (address mapping, block size, replacement and store policy) embedded systems Microcontrollers, The C programming language, device drivers, and the device driver software environment.

SCS 2103 Data Structures And Algorithms 10 Credits
The module highlights problem solving, algorithms, Data structures - pointers, linked lists, queues, stacks, trees, priority queues, sets, maps, graphs and operations on them; Applications of data structures and algorithms. It also covers algorithms- Mathematical Principles of algorithm analysis to evaluate algorithm space/time trade-offs; Algorithm Design -divide and conquer (recursion), backtracking, dynamic programming, randomized algorithms sorting, searching, hashing and shortest path algorithm.

SCS 2104 Systems Analysis And Design 10 Credits
The module has an overview of systems development lifecycle, structured analysis and design, business systems and computer resources; Analysis phase and techniques used, SSADM, Outline of Version IV, DFDs, data dictionaries, DFDs; Database definitions; Object Oriented analysis and design Project planning and control, communication; Documentation and document standards; Prototyping and a Case study of practical systems project using structured approach to systems development.

SCS 2108 Object Oriented Software Concepts And Development 10 Credits
The module examines Object Oriented programming model: Software reusability concepts; Abstraction, Polymorphism; Objects, messages, encapsulation; Classes, inheritance, and class categories; Foundation and Collection Classes; Design and Implementation techniques; Object Oriented Programming and Databases; Java Basics: History, Design Goals, the Web, Java Programming; Java Virtual Machine: Java Compiler, Byte-codes, Interpreter, JIT

Compilation, Software Portability, Garbage Collection, Security; Java APIs: Abstract Window Toolkit, Java Foundation Classes, Commerce, JDBC; Java and the Internet: Applets, Communication, RMI, Client & Servers, Data Access and Network Computers.

SCS 2201 Software Design Methodologies 10 Credits

The module looks at Reliable System/Software Design Concepts and Development Methods: design management and development lifecycle phases; Object Oriented method: Object Oriented analysis and design; Prototyping, System maintenance, System dependability and security, Case Study/Project: design of a database retrieval system with OOD front –end and functional data-base design.

SCS 2203 Advanced Mathematical Structures For Computing 10 Credits

The module explores sample spaces and events; axioms and definitions; total and conditional probability; Bayes rule; Independence; Random Variables: - continuous and discrete; distribution and density functions; mean, variance and covariance definitions and properties; Special Distributions: - uniform, Poison, Normal – definitions and properties and examples; Mathematical logic, linear algebra and graph theory; Computer Aided Implementation using Mathematical tools like MATLAB or OCTAVE.

SCS 2204 Internet And Web Design 10 Credits

This module examines the fundamentals of networks and TCP/IP-Internet services Internet legal and privacy issues Internet commercialisation Internet societal impact, Home page programming using latest versions of tools such as HTML, CSS, javascript, and PHP Web Content Management using software systems such as Wordpress, Joomla and Drupal, Java Web services, XML and AJAX.

SCS 2206 Societal Computing 10 Credits

The module looks at ethics and ICT, computing applications that address social needs such as basic health, rural health issues, rural education needs, water and shelter needs; E-governance and e-government that improves democracy; Computer applications that address environmental concerns such as climate change as well as Policies and applications that can reduce the digital divide.

SCS 2207 Computer Networks And Applications 10 Credits

The module is a networking technology overview, Overview of the network data link protocol and networking layers; Introduction to routing and packet forwarding, Static and Dynamic Routing, Distance Vector Routing and Link State Routing; Router configuration including Wireless Router configuration, LAN design and switch configuration; VTP, STP and Inter VLan Routing Frame relay and Access control Lists.

SCS 2209 Computational Modelling 10 Credits

This is an introduction to computational modelling; Modelling methodologies; Modelling software tools; Data modelling, fitting curves and distribution to data; Pseudo code extraction; Stochastic and deterministic simulation; Algebraic application in modelling software tools; Data modelling, fitting curves and distribution to data; Pseudo code extraction; Stochastic and deterministic simulation as well as Algebraic application in modelling.

YEAR III

YEAR IV

SCS 4000 Research Project **20 Credits**

The project consists of implementing a major piece of software and involves report writing and verbal presentation; The specification and design of the software; The project may involve a large suite of software consisting of a mixture of rapidly prototyped software and 'near-market' quality software. The project may or may not involve traditional academic research and the re-use of existing software and algorithms is encouraged. The software (combined with the business plan) should convince potential investors that the project is worth further funding.

SCS 4101 Artificial Intelligence **10 Credits**

This is an overview of AI problems: Intelligent behaviour; The Turing test; Rational versus non-rational reasoning, Nature of agents, Agent architectures: Reactive; Layered; cognitive, Nature of environments, Uninformed search: breadth-first; depth-first; depth-first with iterative deepening, Heuristics and informed search: hill-climbing; generic best-first; A*, Problem spaces, Logic: Proposition and Predicate, Forward chaining, backward chaining, probabilistic reasoning, Bayes theorem, Machine learning: statistical-based learning; parameter estimation; ILP, State-of-the-art robot systems: sensors and sensor processing.

SCS4103 Software Project Management **10 Credits**

The module examines software project life cycle Team participation, Roles and responsibilities in a software team Role identification and assignment Individual and team performances assessment Team processes including responsibilities for tasks, meeting structure, and work schedule Team conflict resolution; Team organization and decision-making Risk - The role of risk in the life cycle; Risk categories including security, safety, market, financial, technology, people, quality, structure and process; Risk identification Risk tolerance (e;g;, risk-averse, risk-neutral, risk-seeking) Risk planning, removal, reduction and control principles of risk management Risk analysis and evaluation Project Scheduling and tracking project management tools Cost/benefit analysis, Software measurement and estimation techniques, Software quality assurance and the role of measurements.

SCS 4108 Simulation And Modelling **10 Credits**

This module is an introduction to Simulation and Modelling; Basic simulation and modelling methodology: sampling, data collection analysis and visual output; Modelling complexities and decision-making simulation; Basic simulation topics: random numbers, statistical functions, and experimentation; Applied statistical methods for analysis and modelling; Approaches to structuring simulations; Introduction to variance reduction; Focus on discrete simulation, but overview on Monte Carlo, continuous, and agent-based simulation.

SCS 4110 Information System Security And Auditing **10 Credits**

This module has the foundational Concepts in Security: CIA, ethics, terminology; Security Policy and Governance; Principles of Secure Design: least privilege and isolation, fail safe defaults, open design, end-to-end security, security by design, security composability; Defensive Programming: input validation and data sanitization, race conditions, security updates; Threats and Attacks: attacker types, malware, side and covert channels; Cryptography: terminology, cipher types, mathematical preliminaries, symmetric and public key cryptography, authenticated key exchange protocols; Network Security: security protocols (wired and wireless), secure architectures; Web Security and e-commerce: web security model, session management, client-server security, application vulnerabilities and defences; Platform security: code integrity and code signing, secure boot, peripheral threats, OS and embedded devices.

SCS 4111 Enterprise Architecture Programming **10 Credits**

The module looks at the Java Platform, Enterprise Edition (Java EE), Design Evaluation, Programming Paradigms, Cache Coherence, Memory Consistency, Threads and Synchronization, Java Mobility Technology, Interconnection Networks, Scaling Trends, GPUs (Graphics Processing Units), Smart Phones/Tablets Programming (e;g; Android), Programming for Data Centres/Supercomputers and JAVA Native Interfaces (JNI).

SCS 4201 Database Design And Management **10 Credits**

This module explores detailed examination of techniques used in the implementation of relational, Object-oriented and distributed database systems; Topics are drawn from: Query optimisation, transaction management and concurrency control, database performance tuning and query optimisation, business intelligence and data warehousing, database connectivity and web technologies.

SCS 4203 Computer Graphics **10 Credits**

The module explores the fundamentals of Computer Graphics: Applications of Computer Graphics, Digitization of analogue data, Human perception, Images formats, Colour models, Graphics display systems: raster and vector graphics systems, developing of graphical systems; GUI construction using a standard API: double buffering, vector and raster rendering; Basic Rendering (using API): rendering in nature, ray-casting and rasterization, basic radiometry, ray tracing, affine transformations, line generation algorithms, rendering of a polygonal surface (shading), graphics pipeline, visibility and occlusion, texture mapping, Phong reflection model, anti-aliasing; Computer Animation: forward and inverse kinematics, collisions, procedural animation, key-frame animations, camera animation; Visualisation: colour mapping, iso surfaces, and applications of visualization and principles of Computer vision.

SCS 4207 Expert Systems And Decision Support Systems **10 Credits**

The module covers the organization of expert systems; Knowledge acquisition; Knowledge representation in Expert Systems; Issues in knowledge representation, and languages; Representation schemes: logical procedural, network, structured; Objects, messages, and hybrid expert system design; A survey and application of expert system development tools; and limitations of expert systems

SCI 4201 Digital Forensics **10 Credits**

The module explores computer devices, Data collection, Evidence Collection, Extraction and preservation of evidence, Data Recovery, Evidence preservation, verification & authentication, Data Discovery & Identification, Data Analysis, Computer Forensics Tools, Data Hiding Techniques, Computer forensics and mobile forensics.

SCS 4208 Distributed Systems **10 Credits**

The module offers a detailed coverage of distributed systems, with a particular focus on concurrency programming using distributed computing architectures; Use of distributed architectures for big data processing and parallel computing; Distributed memory coherence; distributed file systems; distributed process management, including load sharing and process migration; concurrency control; fault tolerance, recoverability and distributed transactions; naming; industry standards and some case studies.

SCS 4109 Formal Languages And Automata **10 Credits**

This module is an introduction to the theory of formal languages; The Chomsky hierarchy of formal grammars and the corresponding automata; Finite state automata and regular expressions; Deterministic and nondeterministic finite state automata (FSA); Context-free grammars as a formal description device for programming language syntax; Context-free grammars and pushdown automata in parsing programming languages; Language translation systems and semantics.

SCS 4105 Comparative Programming Languages **10 Credits**

This module gives a brief history of programming languages; Comparing languages: programming paradigms, language features executive styles; (e;g; C, C++, Java and Perl); Language design issues, pointers and arrays, functions and procedures, memory allocation; Miscellaneous topics: machine dependencies, separate compilations and data hiding; Operator overloading; Single multiple inheritance and exceptions.

SCS 4205 Human Computer Interaction **10 Credits**

The module examines the definition of HCI, HCI principle and theories, the evolution of HCI, its challenges and goals; Components of HCI, conceptual model of HCI and its design, cognitive frameworks for HCI; Introduction to Cognitive psychology: memory, knowledge, learning, inference, skill acquisition, and procedural vs; declarative knowledge; Cognitive models of HCI: interface metaphors, I/O interactive styles; Information search and information visualization techniques Interactive design methods and techniques, HCI evaluation; and contract management; Project planning and management; Management of expectations, change, system evaluation and selection, vendors and consultants.

MASTERS DEGREE PROGRAMME

SPECIAL REGULATIONS

1.0 Master of Science in Information Systems

DEGREE PROFILE:	Master Of Science In Information Systems
Institution:	National University of Science and Technology
Type Of Degree:	Masters
Credit Load:	302 Credits
Level:	SADC-QF - Level 9
Accreditation Organisation(S):	Zimbabwe Council for Higher Education
Period Of Reference:	Accredited by ZIMCHE in 2012

PURPOSE OF THE PROGRAMME

The programme is aimed at equipping the graduates with the appropriate knowledge, skills and values to be effective in modern information technology-based business environments. Graduates should be able to recommend the use and uptake of modern information technologies in business organizations to solve identified information systems business needs, analyse the threats and opportunities of the use of technology in businesses to bring about a competitive advantage for those businesses utilizing information systems, as well as debate on the issues of ethics and social implications of the use of computing technology in the business environments.

PROGRAMME CHARACTERISTICS

Entry Requirements

- An Honors degree with a degree class of at least 2.2 in Computing (Computer Engineering, Information Technology, Information Systems, Computer Science, Software Engineering) or its recognized equivalent in Electronic Engineering.
- Relevant work experience (at least two (2) years) in an Information and Communications Technology related field will be an added advantage.
- Students that do not have any qualification in object-oriented programming will be required to take an Object-Oriented Programming module as an option during the First Block.

Duration of Study:

- The minimum duration of the programme will be 18 months, and it will be offered on a Block Release mode over three semesters. The first two semesters will be by lecture mode, and the last semester will be dedicated to a dissertation.

- Four (4) modules shall be taught per semester and elective modules will depend on the availability of expertise. Each semester shall comprise of one block which is one (1) month (four (4) weeks which may be split into two comprising 2 weeks each).
- Each module shall be 56 hrs.

Areas of Study:	Information Communication Technology
Specialist Focus:	Information Systems
Target:	Graduates that need to learn more about the utilization of information technology in business environments
Orientation:	Management of Information Systems
Distinctive Features:	Business integration with information systems

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Information Systems administrators, Business Analysts, Information Security Officers, Application analyst, Data analyst, Data scientist, Database administrator, Information systems manager, IT consultant, IT technical support officer, Systems analyst, Systems developer
Further Studies:	PhD in Information Systems
Teaching and Learning Methods:	Lectures, tutorials, laboratory classes, seminars, group work, industrial visits, research, dissertation, individual independent study
Assessment Methods:	Written and oral examinations, tests, laboratory reports, seminar presentations, industrial attachment report, mini-research project report, final year research project report, continuous assessments

2.0 REGULATION

These regulations should be read in conjunction with the Faculty of Applied Science Regulations and the General Academic Regulations for Undergraduate Degrees hereinafter referred to as General Regulations.

3.0 ASSESSMENT OF CANDIDATES

3.1 A candidate who fails a module may be allowed to proceed to the next part of the Degree programme whilst carrying the failed module. However, a student may be allowed to proceed carrying not more than 25% of the number of normally scheduled modules in a particular year of a programme.

3.2 A candidate on attachment shall be assessed through their project and attachment report. The report shall contain the attachment activities and details of the project. The continuous assessment, report and viva presentation shall be 50%, 40% and 10% of the overall mark respectively. The report is expected to contain a proposed final year project identifying a problem from industry and including the proposed solution.

3.3 Candidates shall be required to submit a project, which has a weighing of two modules during the final academic year for which they are registered. On submission of a satisfactory project the student will be required to defend his/her work before a panel of Departmental Examiners.

PROGRAMME SUMMARY

PART I

SEMESTER I

Module Code	Module Description	Credits
SCIS5102	Enterprise Database Systems	24
SCIS5103	e-Commerce	24
SCIS5104	Information System Strategy	24

(**Elective I refer to list below for list of electives*)

SEMESTER II

SCIS5203	Business Intelligence Systems	24
SCIS5204	Information System Security & Auditing	24
SCIS5205	Research Methods	24

**Elective II refer to list below for list of electives*)

PART II

SEMESTER I

SCIS 6101	Dissertation	110
TOTAL		**302**

***LIST OF ELECTIVES**

Elective I

SCIS 5101	Object Oriented Programming
SCIS 5105	Financial and Management Accounting

Elective II

SCIS5201	Computer Network Management
SCIS 5202	ICT Project Management

MODULE SYNOPSES

PART I
BLOCK I

SCIS 5101 Object Oriented Programming 24 Credits
The module explores principles of OOP vis-à-vis Structured Programming Principles, Object Orientation, Declarations and Access Control, Flow Control Exceptions and Assertions, Strings, I/O, Formatting, and Parsing, Coding Standards, Clarity and Maintainability.

SCIS 5102 Enterprise Database Systems 24 Credits
The module examines the ER model, Motivation for Complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two; Concurrency control and recovery management; Database security management; Distributed database functions and client-server architecture; Object-oriented concepts and OODDBMS architecture Web interfaces to the Web; Overview of XML; Structure of XML data, Document schema, Querying XML data and Storage of XML data.

SCIS 5103 E- Commerce 24 Credits
The module covers (IS) management in E-Commerce, IS planning for enterprise-wide e-Commerce, Competitive IS strategies for e-Commerce, Marketing and economic issues in Electronic Commerce for IS managers, Security Issues in e-Commerce, Organizational web sites and Intranets; Web Application options in Electronic Commerce, Business Process Integration for the IS professional, Content Management issues for e-Commerce sites, Organizational Control Strategies, Risk Management, Best Practice in Internal Control, Co-operate Fraud and Crisis Management.

SCIS 5104 Information Systems Strategy 24 Credits
The module outlines the information & techniques for providing information, Networks & Electronic Data interchange, Types of Information Systems, IT security requirements, Organizational Policy, IS and general audit responsibilities and Internal Controls.

SCIS 5105 Financial And Management Accounting 24 Credits
The module highlights the preparation of Financial Statements of Companies, Statements of Company Income, Statements of Changes in Equity, Statements of Financial Position Statements of Cash Flows, Notes to the Financial Statements, Use of Accounting Packages, Interpretation of Financial Statements, Legal and Regulatory Framework, Introduction to Management Accounts, Analysis and classification of costs, Absorption and Activity Based Costing, Cost volume profit analysis, Budgeting and Variance Analysis, Budgetary Control and Investment Appraisal.

BLOCK II

SCIS 5201 Computer Network Management **24 Credits**

The module covers network-Centric World Digital Transmission and Networking Fundamentals, Elements of Communication Networks and Services, Local Area Networks and Medium Access Control, Applications and Layered Architectures, Advanced Network Architectures, Network Security Protocols, Network Management Protocols and Next Generation Networks.

SCIS 5202 ICT Project Management **24 Credits**

The module explores Project rationale, Project scope, Budgeting and scheduling issues, managing project risk, Project quality management, Managing organizational change, Leadership & Conflict management and Leadership theories.

SCIS 5203 Business Intelligence Systems **24 Credits**

The module is an introduction to DSS, Modeling, Application Development, Data analysis and display, DSS development, Decision Analysis, Optimization, Queuing and Inventory Modeling, Advanced DSS development topics and Simulation.

SCIS5204 Information Systems Security And Auditing **24 Credits**

The module is about developing an Information Security Policy, Physical Computer Security, Biometrics and Digital Signatures, Network Intrusion Detection and Prevention System, Wireless and Mobile Network Security, E-commerce Security, Risk Management & Analysis, Biba Integrity Model, Nature of IS Audit, Audit responsibilities against fraud, IS audit guidelines and standards.

SCIS 5205 Research Methods **24 Credits**

The module covers Research Planning and Design, Proposal writing, Data Collection, Literature Review, Research Techniques, Sampling and Sampling Techniques, Validity and Reliability, Research Report Writing, Ethical Issues in Information Systems Research, Measures of Central Tendency, Measures of Variability, Plotting and Displaying Data.

PART II

BLOCK I

SCIS 6101 Dissertation **110 Credits**

Candidates will be allowed to submit a dissertation only after successfully completing their taught modules.

MASTER OF SCIENCE IN COMPUTER SCIENCE

1.0 DEGREE PROFILE: MASTER OF SCIENCE IN COMPUTER SCIENCE

INSTITUTION:	National University of Science and Technology
TYPE OF DEGREE:	Masters
CREDIT LOAD:	302 Credits
LEVEL:	SADC-QF - Level 9
ACCREDITATION ORGANISATION(S):	Zimbabwe Council for Higher Education
PERIOD OF REFERENCE:	Accredited by ZIMCHE in 2014

PURPOSE OF THE PROGRAMME

To develop knowledge, skills and competences in the field of Computing Technology. To provide a foundation for advanced research in Computer Science.

PROGRAMME CHARACTERISTICS

Entry Requirements:	An honours degree (2.2 or better) in Computer Science
Areas of Study:	Software Engineering, Network Management, Data Science, Computer Security, Database Management, Artificial Intelligence, Image Processing.
Specialist Focus:	Programming, Application Development, System Design and Implementation, Network Administration, Artificial Intelligence
Orientation:	Research and innovation oriented
Distinctive Features:	Network administration, ICT management

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Network Administrator, Academic, Software Engineering, Systems Administration, Network Engineer, Games Developer, Information Systems Manager, IT Consultant, Multimedia Programmer, Network Engineer, Systems Developer
Further Studies:	PhD in Computer Science, PhD in Information Systems

TEACHING AND LEARNING:

Teaching and Learning:	Lectures, tutorials, laboratory classes, seminars, group work, farm, research project, individual independent study
Assessment Methods:	Written and oral examinations, tests, seminar, Presentations, mini-research projects, final year

research
project report, continuous assessments

2.0 REGULATIONS

These regulations should be read in conjunction with the Faculty of Applied Science and the General Academic Regulations.

3.0 ENTRY QUALIFICATION

A student must have passed an (Hons) Degree (2.2 or better) in Computer Science.

4.0 DURATION

4.1 The Programme shall normally run over a period of eighteen (18) months for full-time study.

4.2 When running on Block Release, the Programme shall be offered over a period of twenty-four (24) months.

5.0 MODE OF STUDY

5.1 Block Release

A student on Block Release shall normally be required to register for three (3) modules per Block. Stage I and Stage II shall each consist of two Blocks. Block II of Stage I and Block I of Stage II shall consist of two (2) modules and one (1) elective module each. Block II of Stage II shall consist of the Dissertation.

5.2 Full-time

A student on full-time is normally required to register for three (3) modules plus 1 elective per semester in Part I. Part II shall consist of the Dissertation. In order to proceed from Part I to Part II a student must pass all modules he/she would have registered for.

6.0 ASSESSMENT

6.1 A taught module shall be assessed by a three hour written examination at the end of each semester.

6.2 The final grade in the module work shall be based on 25% from continuous assessment and 75% from the final written examination.

6.3 To pass a module a student must obtain an overall mark of 50% from both continuous assessment and the final written examination.

6.4 A student shall be expected to obtain a minimum of 50% in the Master's Thesis project work and 50% from Part I.

7.0 PROCEEDING TO THE NEXT PART

A student is expected to pass all his/her registered modules before proceeding to Part II.

PROGRAMME SUMMARY

PART I

SEMESTER I

Module Code	Module Description	Credits
SCS5107	Advanced Enterprise Architecture Programming	24
SCS5110	Computational Discrete Mathematics	24
SCS5109	Advanced Database and Data Mining	24

(*Elective I refer below for list of electives)*

SCS5205	Research Methods	24
SCS5208	Evolutionary Computing & Parallel Distributed Processing	24

SEMESTER II

SCS5210	Simulation & Modelling	24

(*Elective I refer below for list of electives)*

PART II

SEMESTER I

SCS 6200	Dissertation	110
TOTAL		**302**

List of electives

The student is expected to choose one module per semester

Electives I

SCS 5103	Pattern Recognition & Image Processing
SCS 5111	Interactive Computer Graphics
SCS 5112	Ontology Engineering

Electives II

SCS 5205	Software Methodology
SCS 5211	Digital Signals Processing

MODULE SYNOPSES

PART I

SCS 5107 Enterprise Architecture Programming **24 Credits**

The module has an introduction to application server programming and business logic programming; Transaction processing, concurrency control, Event-driven programming, asynchronous method invocation, job scheduling, Inter process communication; Deployment of software components in an application server; Business Interface development and deployment.

SCS 5109 Advanced Database And Data Mining **24 Credits**

The module looks at Data Models; The Enhanced Entity Relationship (EER) Model, EER Models to Relational Databases, Database Design and Implementation; design methodologies, implementation methodologies, Physical Database design and Tuning, Query processing and Optimization; Algorithms for Query Processing and Optimization, Transaction Processing, Concurrency Control Techniques; Database Security and Distribution, Distributed Databases, Mobile Databases Machine Learning and Pattern Recognition and Data Mining.

SCS 5110 Computational Discrete Mathematics **24 Credits**

The module explores Discrete models; Foundations; Basic concepts of sets and functions; Finite series; Logic; Propositional logic; Predicate logic; Combinational circuits; Induction; Finite probability space, events; Conditional probability, Bayes' theorem; Integer random variables; Expectations; Variance Analysis and verification; Searching algorithms; Recursive algorithms; Relations; Basic concepts; Properties of relations; Operations on relations; Undirected graph, Directed graph, weighted graph, Euler circuits and Hamiltonian cycles; Graph isomorphism and representations; Planar graphs; Trees; Different state machines; Input, Output, Initial state and Transition table.

SCIS 5205 Research Methods **24 Credits**

The module looks at Research, research types, Research planning and design, Project Proposal, Data collection techniques, Literature review, Research techniques, Methodology and Methods, Sampling techniques, Validity and reliability, Research report writing and Ethical issues in Information Systems Research.

SCS 5208 Evolutionary Computing And Parallel Distributed Processing **24 Credits**

The module examines fundamentals of genetic algorithms, genetic programming; Conceptual simplicity and broad applicability of genetic algorithms; Features of evolutionary computation, evolutionary strategies, evolutionary programming; Hybridization and Optimization techniques; Heuristic level: knowledge representation, inference strategies; Man-machine interfaces; Fuzzy set theory; Decision: Classical, nonstandard and fuzzy logic; Data representation; Network configurations: single layer non-recurrent networks; Multilayer non-recurrent networks; Recurrent networks; Application for artificial neural networks:

character and speech recognition, image analysis Parallel distributed processing; General framework; Distributed representation; Basic mechanisms and formal analysis.

SCS 5210 Simulation And Modelling **24 Credits**

The module looks at advances in simulation and modelling methodology; All students are expected to have completed an introductory module in simulation; Modelling complexities and decision-making simulation using system dynamics; Applied statistical functions, Experimentation, Applied statistical methods for analysis and modelling; Approaches to structuring simulations; Contrasting discrete, continuous and agent-based simulation.

PART II

SCS 6201 Dissertation **110 Credits**

ELECTIVES

SCS5103 Pattern Recognition And Image Processing **24 Credits**

The module is an introduction to pattern recognition; Fundamental problems in pattern recognition; Foundations of pattern recognition algorithms and machines, including statistical and structural methods; Data structures for pattern representation, feature discovery and selection, classification vs; description, parametric and non-parametric classification, supervised and unsupervised learning, use of contextual evidence, clustering, recognition with strings, and small sample-size problems biological object recognition and the Bayesian decision theory;

SCS 5205 Software Methodology **24 Credits**

The module is an overview of Software Engineering, the Software Development Process; requirements analysis and specification phase Design phase; implementation phase, maintenance; Engineering with a Programming Language; Software Engineering Paradigms; Engineering with existing software and Software Engineering Project;

SCS 5111 Interactive Computer Graphics **24 Credits**

The module explores the fundamentals of Computer Graphics: Structure of Images; Image formats, compression and dithering; Mesh Data Structures; shapes as vertices, edges and faces, using the indexed face set and the half-edge data structures; Transformational Geometry: Scale, rotation, translation, stretch and shear of a shape; Viewing; Perspective, the illusion of depth; Lighting; Rasterisation, convert mesh triangles to screen pixels; Texture Mapping; Visibility; GPU Programming; Colour Theory; Physical Simulation Animation; Parametric Surfaces; Implicit Surfaces; Quaternion Rotations; Skinning and shadowing.

SCS 5112 Ontology Engineering **24 Credits**

The module looks at ontology, Types of ontologies; An ontology engineering for the Semantic Web; Notion of ontology technology, Ontology Web Language to represent ontologies and basic aspects to develop ontologies; Top-down Ontology design and foundational ontologies and bottom-up design using non-ontological resources such as relational databases, natural language or thesauri and fundamental aspects of methods and methodologies and Application of ontology technologies.

SCS 5211 Digital Signals Processing 24 Credits

This module explores signals and their functional representations; Basics of Counting: Counting arguments (Set cardinality and counting; Sum and product rule); cross-reference AR/Digital logic and digital systems, Computer representation of data (Bits; bytes and words), Numeric data representation and number bases; Fixed- and floating-point systems; Signed and twos-complement representations; Representation of non-numeric data (character codes, graphical data); Representation of records and arrays, digital systems (Combinational vs; sequential logic), State Machines (Digital vs; Analogue and Discrete vs; Continuous Systems), Simple logic gates, Parallelism, synchronization, Multimedia Systems, Principles of digital forensics: Digitization (storage, interchange, digital objects, composites, and packages). The module has been aligned to the ACM/IEE curriculum. The topics that dealt with theoretical aspects of digital computer signal processing have been reviewed to reflect a solid approach rather than an abstract approach.

DEPARTMENT OF STATISTICS AND OPERATIONS RESEARCH

Lecturer and Chairperson

Dr P. Nyamugure. PhD. Statistics & Operations Research (University of Limpopo SA, 2017), MSc. in Operations Research (2000-2002), BSc. Hons. Applied Mathematics (1994-1998), PGDHE (2012-2013)(NUST)

Senior Secretary

S. Thenga, BComm. Human Resources Management (Lupane, 2017)

Senior Technician

T. Silongwe, BSc. Hons. Computer Science (MSU), MSc. Computer Science (NUST)

Professor

Professor B.C. Jones, PhD. Astrophysics (Sussex University 1979), BA Honours (First Class) in Natural Sciences - Theoretical Physics (Fitzwilliam College, Cambridge University, 1972), Certificate in Teaching in Higher Education (The Hatfield Polytechnic 1980)

Senior lecturers

A. Masache. MSc. Operations Research (NUST), BSc. Hons., Applied Mathematics(NUST)

Lecturers

P. Mdlongwa, MSc. Operations Research (NUST 2009), BSc. Hons. Mathematics (Midlands State University 2005), Post Graduate Diploma in Education (NUST 2011)

C.N. Mupondo, Msc. Operations Research (NUST), Bsc. Hons. Mathematics (MSU), Diploma in Education(UZ)

D. Mwembe, MSc. Operations Research (NUST), BSc. Special Hons., Operations Research and Statistics (NUST), BSc.(Gen) in Statistics and Mathematics

F. Ndlovu, MSc. Operations Research (NUST 2010), BSc. Hons. Mathematics (MSU 2004), Post Graduate Diploma in Education (NUST 2011)

P. Mlilo, MSc. In Biometry University Reading (U.K), BSc Hons (UZ), BSc Hons in Agric(West Indies St Augustine, Trinidad and Tobago).

H. Nare, BSc. Hons., Applied Mathematics(NUST), Msc. Operations Research(NUST), Post Graduate Diploma in Higher Education(NUST)

I. L Zulu, MSc. Operations Research (NUST), BSc Hons. Mathematics (MSU)

Bachelor of Science Honours in Operations Research and Statistics

1.0 Degree Profile: Bachelor of Science Honours in Operations Research and Statistics

Institution:	National University Of Science And Technology
Type Of Degree:	Honours
Credit Load:	486 Credits
Level:	SADC- of - Level 8
Accreditation Organisation(S):	Zimbabwe Council For Higher Education
Period Of Reference:	From 2018

PURPOSE OF THE PROGRAMME:

To develop knowledge skills and competences in the field of Operations Research and Statistics which are relevant to various career paths. To provide a foundation for further studies and research in Operations Research and Statistics.

PROGRAMME CHARACTERISTICS

Areas of Study:	Probability, Statistics, Optimisation, Statistical Modeling, Statistical Research Techniques and analysis, Survey and data analysis techniques, computational modeling, Statistical inference, Applied Statistics, Linear programming, Time series, Queuing Models, Case studies in Operations Research, Simulation and Modeling, Multivariate Statistics
Specialist Focus:	Application of necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from a large pool of data (data mining) and the use robust statistical analysis and mathematical modeling to solve an array of business and organizational problems, as well as improve decision-making.
Orientation:	Real problems solving, research and survey activities, teaching and learning oriented programme.
Distinctive Features:	Provide basic techniques in theory of Operations Research and Statistics and their applications to real-world problems by enhancing analytical skills to attack complex, large-scale optimization problems of both a deterministic and stochastic nature to make better decisions that impact society and the world positively.

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability:	Academia, Transport and logistics, Financial services, Biometricians, Data, Mining, research and Development, Treasury, Monitoring and evaluation, Mining and manufacturing, Health Information management, Bio-informatics, hydrology and Climatology
Further Studies:	Masters in Operations Research and Statistics, PhD

TEACHING AND LEARNING

Teaching and	Lectures, tutorials and seminars, computer practical classes, group

Learning Methods:	enquiry and/or problem based study, individual learning, research and research projects, field trips, orals tests
Assessment Methods:	Written and oral examinations, tests, seminar presentations, industrial attachment report, mini-research project report, final year research project report, continuous assessments

Aims of the programme
To enable students to:

- Develop the analytical skills required for formulating and solving problems encountered in industry, commerce and society at large,
- Learn to conduct research,
- Do further research in an industrial or scientific or commercial setting that may enable them to study for further qualifications (MSc, MPhil or PhD).

2.0 REGULATIONS
The these regulations shall be read in conjunction with the NUST General Academic Regulations.

3.0 ENTRY REQUIREMENTS

3.1 **Normal entry**

The minimum entry requirement is at least a pass in 'A' level Mathematics and a pass in any other science subject or any commercial subject.

5.0 DURATION OF THE PROGRAMME

This programme shall run for four years.

6.0 STRUCTURE OF THE PROGRAMME

6.1 The programme shall consist of thirty-three taught modules, including three electives, plus industrial attachment and a research project. A minimum of six modules shall be done per semester. Students shall do a research project in Part IV. The overall assessment shall be based on all modules. In the case that a student does more than thirty three taught modules, his/her overall assessment shall be calculated from his/her best thirty three taught modules, the project and the industrial attachment.

6.2 In determining the overall degree programme aggregate, the following part weightings shall be used:

Part I	10%	minimum 120 credits
Part II	30%	minimum 120 credits
Part III	20%	minimum 120 credits
Part IV	40%	minimum 120 credits

7.0 INDUSTRIAL ATTACHMENT

Students shall do their Industrial Attachment in their third year and submit the industrial attachment report at the end of academic year. The Department of Statistics and Operations Research shall be responsible for the co-ordination, supervision and evaluation of the Industrial Attachment programme as detailed in the University Regulations.

8.0 RESEARCH PROJECT

Students shall be required to submit a project, which is equivalent to three modules, during the last academic year for which they are registered. On submission of a satisfactory project a student shall also be required to defend his/her work before a Departmental panel of Examiners.

9.0 DETERMINATION OF RESULTS

One three-hour paper written at the end of the semester accounts for 75% and the continuous assessment counts for 25% towards the final mark. The continuous assessment is generally a result of assignments and at least two tests.

PROGRAMME SUMMARY

YEAR I

SEMESTER I

Module Code	Module Description	Credits
SMA1101	Calculus	10
SMA1102	Linear Algebra	10
SCS 1101	Introduction to Computer Science	12
SORS 1101	Introduction to Operations Research	10
SORS 1102	Operations Management	10
SORS1103	Introduction to Statistics	10

SEMESTER II

SMA 1201	Calculus of Several Variables	10
SMA 1204	Ordinary Differential Equations	10
SCS 1201	Programming and Program Design	12
SORS 1201	Applied Statistics	10
SCS 1203	Business Information Systems	12
CTL1101	Conflict Transformation and Leadership	10

YEAR II

SEMESTER I

SORS 2106	Monitoring and Evaluation	10
SORS 2101	Time Series Analysis	10
SORS 2102	Computer Packages	10
SORS 2103	Probability Theory	10
SORS 2104	Operations Research Techniques	10
SORS 2105	Linear Programming	10

SEMESTER II

SMA 2206	Numerical Analysis	10
SORS 2202	Design and Analysis of Experiments	10
SORS 2203	Optimisation	10
SORS 2204	Queuing Models	10
SORS 2205	Simulation	10
SORS 2206	Survey Methods	10

YEAR III **(120 CREDITS)**

SORS 3010	Industrial Attachment	120

YEAR IV

SEMESTER I

SORS 4101	Decision Analysis	10
SORS 4102	Statistical Inference	10
SORS 4103	Stochastic Processes	10
SORS 4104	Econometrics	10
SORS 4105	Case Studies In Operations Research	10
SORS 4010	Project	10

SEMESTER II

SORS 4207	Multivariate Analysis	10
SORS4010	Project	20

ELECTIVES(***choose any four*****)**

SMA4241	Financial Mathematics	10
SMA4213	Graph Theory	10
SORS 4201	Dynamic Programming and Stochastic Control	10
SORS 4202	Global Optimisation	10
SORS 4204	Advanced Probability Theory	10
SORS 4205	Non-linear Programming	10
SORS 4206	Nonparametric Statistics	10
SORS 4208	Statistical Quality control	10
SORS 4209	Risk Theory	10
SORS 4205	Non-linear Programming	10
SORS 4210	Official Statistics	10

SERVICES MODULES

SORS 2110	Introduction to Applied Statistics	10
SORS 2210	Applied Statistics for Biological Sciences	10
SORS 4106	Experimental Design and Multiple Regression	10
SORS 4108	Time Series Analysis and Simulation	10
SORS 4106	Experimental Design and Multiple Regression	10
SORS 4107	Queuing Theory and Stochastic process	10
SORS 4108	Time Series Analysis and Simulation	10

MODULE SYNOPSES

YEAR I

SMA1101 Calculus **10 Credits**

The module looks at limits of functions; One-sided and infinite limits; Continuity; Differentiation: definition, basic properties, Rolle's theorem, mean value theorem, Cauchy's mean value theorem, Leibniz's rule, applications, Taylor series; Integration: definite integrals, antiderivatives, fundamental theorem of calculus, improper integrals, Gamma and Beta functions, definition of natural logarithm as integral of 1/x and exponential as inverse; Area, volume of revolution, arc length, surface area; Parametric equations: arc length, surface area; Polar coordinates; Graph sketching; Area in polar coordinates; Complex numbers; Algebra of complex numbers; DeMoivre's theorem and Exponential form.

SMA 1102 Linear Algebra **10 Credits**

The module looks at Vector Algebra: scalar and vector product; Collinear, coplanar vectors; Applications; Equations of lines and planes; Matrices: products, sums, echelon form, rank, inverse; Determinants: definition, properties, evaluation; Systems of Linear equations, Gauss's method, Cramer's rule, homogeneous systems; Vector Spaces: definition, linear independence, bases and subspaces.

SCS 1101 Introduction To Computer Science **12 Credits**

The module explores information and Knowledge Societies, Evolution of Computers, Computer Organisation and Architecture: CPU; Memory; I/O, Number Systems and Conversions (Bin; Dec; Hex; Oct), Concepts of Computer Languages: high\low level languages; compiler; interpreter, Programming Techniques: grammar; recursion; Variables; Data types; Initialization; Comments; Keywords; Constants; Assignment, Programming constructs: branching; looping; recursion; Programming using data structures: arrays; lists; trees; hash tables; queues; stacks; files, Programming Algorithms for Problem Solving: Sorting; compression; numerical and encryption, Fundamentals Operating System, Fundamentals Data Bases and Fundamentals of Networks.

SORS 1101 Introduction To Operations Research **10 Credits**

The module gives a historical overview; Definition of Operations Research; Operations Research to problem solving; The process of quantitative modelling; Some quantitative techniques used in Operations Research; Methodology of Operations Research: The phases of an Operations research project, formulation of the problem, the components of a decision problem, state of nature or environment, the systems orientation of Operations Research, the team concept; An abbreviated Case study: Construction of a mathematical model, models as approximations, deriving a solution to the problem, sensitivity analysis, testing the solution for performance, problems of implementation, planning for implementation, controlling and maintaining the solution.

SORS 1102 Operations Management 10 Credits

The module is an introduction to Operations Management; Operations Strategy; Design; Facility locations and capacity planning; Production planning, types of production processes and criteria for measuring performance; Materials management, scheduling and control.

SORS 1103 Introduction To Statistics 10 Credits

The module looks at the basic Concepts of Statistics: Definition and scope of Statistics, Variables, Types of data, Measurement scales, Use of calculators and statistical computer softwares; Data Collection Methods: Data sources, Population and sample, Probability and non-probability sampling, Survey data collection; Data Presentations: Contigency and frequency tables, Pie charts, Bar charts and Histograms, Line graphs, Cumulative frequency curves, Stem and leaf plots, Box and whisker plot Index Numbers: Types of indices, Simple indices, Un-weighted aggregate index, Weighted Introduction to Probability Theory: Counting rules in probability, Sets and events, Outcome sets for random experiments, Experimental probability, Classical Probability, Theoretical Probability, General laws of probability; Introduction to Hypothesis Testing: Definition of a hypothesis, Procedure for testing a hypothesis, Z-test, t-test; Introduction to Nonparametric Statistics: Order Statistics, Tests concerning a single sample and the Chi-square test.

CTL1103 Conflict Transformation And Leadership 10 Credits

The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

SMA 1204 Ordinary Differential Equations 10 Credits

The module explores first order differential equations; Separable, linear, exact; Integrating factors; Existence, uniqueness and applications; Second Order Equations; Linear equations and linear differential operators; Linear equations and linear differential operators; Linear independence, Wronskian; Ordinary Linear Differential Equation with constant coefficients; Undetermined coefficients; Variation of parameters; Applications; Systems of equations; Phase plane portraits for Linear systems; Introduction to Non-linear systems; Predator-prey and Lotka - Volterra equations; Series solution of ordinary differential equations; Method of Frobenius; Legendre polynomials and Bessel functions.

SCS 1203 Business Information Systems 12 Credits

The module examines Business Environments; Changing lives and businesses in the Information Era, Redesigning the organization with information systems Types of Information system: TPS; MIS; DSS; and Expert Systems; The Systems life cycle, the phases within it and the activities and documentation appropriate to each phase; Other development strategies, including 4GLs, Prototyping, and Evolutionary development; Building and managing information systems; IS project organisation and management Information System Security and Control the Internet and electronic business.

SMA 1201 Calculus Of Several Variables **10 Credits**

The module explores the cartesian coordinates in three dimensions; Functions of several variables; Quadric surfaces; Curves; Partial derivatives; Tangent planes; Derivatives and differentials; Directional derivatives; Chain rule; Div, grad and curl; Maxima and minima; Lagrange multipliers; Double and triple integrals; Change of order; Change of variable; Polar and spherical coordinates; Line and surface integrals; Green' theorem in the plane; Divergence theorem; Stokes theorem and Applications.

SCS 1201 Programming And Program Design **12 Credits**

The module covers the concept and properties of algorithms, Programming process, Fundamental design concepts and principles: Divide-and-conquer strategies; Abstraction; Program decomposition; Encapsulation and information hiding, Separation of behaviour and implementation, Basic syntax and semantics of a higher-level language, relevant program representations: basic blocks; control-flow graphs; defuse chains; static single assignment and Jackson Structured programming.

SORS 1201 Applied Statistics **10 Credits**

The module is an introduction to Applied Statistics; Statistics: its definition and scope; Descriptive Statistics/Initial Data Exploration: summary statistics, measures of central tendency, mean, mode, median, measures of dispersion, range, variance, standard deviation, Graphical presentation of data, stem and leaf plots, histograms, box plots; Point Estimation/Tests of Hypothesis, interval estimation, $z-test$, $t-test$; Design and Analysis of Experiments, completely randomised designs, randomised complete block designs, Latin squares, factorial designs; Simple linear regression; Statistical computing.

YEAR II

SORS 2101 Time Series Analysis **10 Credits**

The module looks at smoothing techniques; Moving averages, Simple exponential smoothing, decomposition, identification of trend, seasonal, cyclic and irregular components; Additive and multiplicative models; ARIMA and ARMA models: Model building strategy, models for stationary time series, models for non-stationary time series, parameter estimation, model diagnostics, model specification and forecasting.

SORS 2106 Monitoring And Evaluation **10 Credits**

The module is an introduction to monitoring and evaluation: Terms and concepts applied in M & E Processes, difference between M & E, M & E in projects implementation, types of for your project, M & E in the Project Cycle Management, M & E plan, M & E framework Introduction to Monitoring and Evaluation Plan: functions of an M&E plan, elements of an M&E Plan, standards for an M&E plan, complexities of M &E Plan, overview of M&E plan implementation modalities, data Collection/Capture/Data Quality Checks, types of data collection tools, type of tools at each M &E level; Gathering Performance Data: Data collection methods, choosing the data collection method, preliminary decisions in questionnaire design, deciding the question content, develop the question wording, ordering questions, checking the length of the questionnaire, pre-testing the questionnaire, good questionnaire 'dos' and 'donts', coding data and creating templates in Epi-Info, SPSS, CSPro and SAS, Non-parametric Statistical methods of Analysis i;e Kruskal Wallis, Wilkoxon-Rank-sum Test, Spearman Correlation, Mann-Whitney-U test, Cross-tabulations and odds ratios; Triangulation: Data triangulation, methodological triangulation, investigator triangulation, environmental triangulation, variants of the triangulation design; Data envelopment analysis: Productivity analysis using ratios, Estimation and interpretation of basic DEA model, Estimation of cost-efficiency estimation, Some application of SFA and regression analysis.

SORS2102 Computer Packages **10 Credits**

This module shall be a practical module, dealing with the use of computers in a variety of fields through the use of software tools. It is designed to complement the understanding of some of the Operations Research, Statistics and Mathematical concepts through practical use; Statistical packages, including data handling, descriptive statistics, distribution fitting, graphs; Operations Research packages, including linear programming, goal programming, integer programming, waiting line models, network analysis, etc; Mathematical packages, including solution of equations, limits, differentiation and integration, solution of systems of linear equations.

SORS 2103 Probability Theory **10 Credits**

The module explores probability: random/statistical experiments, sample spaces, events, set theory; Axioms of probability; Laws of probability; Finite sample spaces; Conditional probability, independent events; Random variables and probability distributions; Discrete probability distributions; Continuous probability distributions; Discrete bivariate distributions; Continuous bivariate distributions; Marginal probability distributions; Independent random variables; Conditional probability distributions; Distributions of functions of a single random variable; Conditional probability distributions of mathematical expectations; Expectations of discrete and continuous random variables; Expectation of a function of a single random variable; Expectation of a function of several random variables; Properties of expectations; Variance and covariance; Markov and Chebyshev inequalities; Moment generating functions; Properties of moment generating functions; Special Distributions: Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson, Normal, Gamma, Weibull, Exponential, and Beta.

SORS 2104 Operations Research Techniques **10 Credits**

The module examines project management: Critical path analysis; Deterministic activity times; Probabilistic activity times; Gantt charts; Resource scheduling; Cost crashing; Inventory Models: Deterministic demand models: Economic order quantity, Economic production lot size, Economic order quantity with backorders, Quantity discounts; Probabilistic demand models: Single period models, safety stock, Multiple period models; Inventory control: Material requirements planning, materials resource planning, product structure, gross requirements, net requirements; Network Analysis: Terms and definitions; Minimum Spanning Tree problem (Kruskal's Algorithm); Shortest Route problem (Dijkstra's Algorithm); Network Flow problems: Maximum network flow problem (Ford-Fulkerson Labelling Algorithm), Max-flow Min-cut Theorem, Integral flows; Heuristic Problem Solving: Ill structured problems, Heuristics- the human approach to problem solving, Satisfying, heuristic procedures and programs and a case study (e;g; solving a facility location problem).

SORS 2105 Linear Programming **10 Credits**

The module looks at model formulation; Solution methods: graphical, simplex, two phase, computer solutions; Duality and sensitivity analysis; Transportation: initial feasible solution methods—north-west corner, least cost, Vogel's methods; Balanced and unbalanced problems, unacceptable routes, degeneracy, Transhipment problems, Assignment problems; Integer Programming: model formulation; Solution methods: graphical, branch and bound method, cutting plane algorithm, implicit enumeration method; Goal programming: model formulation; Goal programming algorithms—the weighting and pre-emptive methods.

SORS 2202 Design And Analysis Of Experiments **10 Credits**

This module explores theory and applications of statistics, which include: Experimental design and analysis: 2^k factorial experiments; Confounding, complete and partial confounding; Orthogonal contrasts; Fractional factorial experiments, aliasing; Multiple linear Regression: Variable selection and model building; Multiple coefficient of determination, r^2; Mullow's, C_p and S_p statistics; Covariance analysis; Stepwise regression methods; Forward selection, backward elimination and stepwise regression.

SORS 2203 Optimisation **10 Credits**

The module explores deterministic and stochastic dynamic programming; Markov programming: value and policy iteration procedure; Advanced Linear Programming: The revised simplex algorithm, validity proofs of the simplex method, use of column generation to solve large-scale linear programming problems, bounded variables algorithm, parametric linear programming, Dantzig-Wolfe decomposition algorithm and Karmarkar interior point algorithm.

SORS 2204 Queuing Models **10 Credits**

The module examines single Server Models: Queuing processes, Kendall-Lee notation, definitions and notation, the role of the exponential distribution, pure birth processes, pure death processes, birth and death processes, parameters of a queuing model; Multiple Server Models: Queuing models with m parallel servers, models with non-Markovian input and output, the Pollaczek-Khintchine formulae and a case study of an $M/M/S$ queuing model.

SORS 2205 Simulation **10 Credits**

The module examines simulation by hand, pseudo random numbers, data collection, distribution fitting, activity cycle diagrams, model development, verification, validation, experimentation, analysis of results, method of common random numbers, use of a simulation package; Discrete simulation; Systems dynamics; Simulation software sampling methods; Model testing and validation.

SORS 2206 Survey Methods **10 Credits**

The module explores simple random sampling, sample size estimation; Systematic sampling; Sample survey and questionnaire design, postal and telephone questionnaires, interviewer-administered questionnaires; Errors in sample surveys; Ratio and regression estimators, separate and combined ratio estimators; Stratified populations and stratified simple random sampling, optimum allocation and Neyman allocation; Cluster multi-stage sampling and Survey method project.

SMA2206 Numerical Analysis **10 Credits**

The module looks at errors in numerical analysis; Taylor Series; Solutions of equations in one variable: Bisection and Newton-Raphson methods; Fixed point iteration; Order to convergence; Direct and iterative methods of solving linear systems; Gaussian elimination with scaled partial pivoting; Jacobi and Gauss-Seidel iterations; Convergence criteria; Interpolation and extrapolation; Lagrange interpolating polynomial; Newton interpolating polynomial; Richardson extrapolation; Integration; Trapezoidal rule, Simpson's rule; Gaussian quadrature and numerical Solutions of Ordinary Differential Equations.

YEAR III

YEAR IV

SORS 4101 Decision Analysis **10 Credits**

The module looks at decision environments; Decision making under certainty: Analytical Hierarchy Approach; Decision making under uncertainty: optimistic, conservative and minimax regret approaches; Decision making under conflict: game theory; Decision making under risk; expected value criterion, value of perfect information, value of survey information, variants of the expected value criterion, Bayes posterior probabilities, decision trees, loss and risk functions, admissible estimator, minimax estimator, Bayes risk, Bayes estimator; Hypothesis testing in decision analysis: loss function, risk function, minimax test, Bayes test; Utility Functions: Expected utilities, attitudes of risk and procedures for obtaining utility function from a decision.

SORS4102 Statistical Inference **10 Credits**

The module looks at indicator function, exponential family of densities; Parametric Point Estimation: parameter space and point estimators; Methods of finding estimators, method of moments, maximum likelihood method, least squares method; Properties of point estimators; unbiased estimators, minimum variance unbiased estimators (most efficient estimators), consistent estimators, sufficient estimators, asymptotic normality of estimators; Confidence Intervals: One-sided confidence intervals; Methods for finding confidence intervals, pivotal quantity, statistical and Bayesian; Hypothesis Testing: definitions; Simple and composite hypotheses, test statistic, critical regions, type I and II errors, level of significance, power of a test; Neyman-Pearson lemma; Uniformly most powerful tests and likelihood-ratio tests.

SORS 4103 Stochastic Processes **10 Credits**

The module is a review of probability, conditional expectation; Theory and applications of random processes; Poisson process, Brownian motion process, stationary processes and Gaussian processes; Markov chains; Gambler's ruin, Birth and death processes Branching processes and random walks.

SORS 4104 Econometrics **10 Credits**

The module is an introduction to econometrics; General linear model; Autocorrelation; Heteroscedasticity; Multicollinearity; Testing linear restrictions; Stochastic regressors; Lagged variables and distributed-lag models; Dummy variables and tests for structural change and simultaneous system of equations in econometrics.

SORS 4105 Case Studies In Operations Research **10 Credits**

The module covers consulting Skills: Skills required in practical consulting, covering elements such as: What is Operations Research from the point of view of the clients? Problem structuring- immediate feedback to client-importance of eliciting values; who is the client? The consultant's role in context-sponsor, client, partner, significant actors, politics of OR; Interviewing skills; Proposal preparation, covering costing and making proposals; Case Studies: Introduction to quantitative modelling in Operations Research, case studies, presentation skills and report writing skills.

SORS 4207 Multivariate Analysis **10 Credits**

The module examines the methodology and applications of multivariate analysis; Hotelling's T2, multivariate regression and analysis of variance; Classification and discrimination; Principal components, clustering, multidimensional scaling; use of computer packages, MANOVA.

SORS 4010 Project **30 Credits**

Projects may be carried out on an individual basis. Where possible the project shall be done in an industrial setting. The projects test students' ability to organise, complete and report on a significant piece of either Operations Research or Statistics or Applied Mathematics.

ELECTIVE MODULES

SMA 4213 Graph Theory **10 Credits**

The module is an introduction to the abstract known as a graph; Definitions and characterisation of classes of special graphs; Distance and connectedness measures; Various algorithms applied to graphs and some of their proofs, classical and contemporary.

SMA 4241 Financial Mathematics **10 Credits**

The module is an introduction to financial derivatives, the Cox-Ross-Rubinstein model, finite security markets, the Black-Scholes model, foreign market derivatives, American options and exotic options.

SORS 4201 Dynamic Programming And Stochastic Control **10 Credits**

The module is an introduction to Dynamic Programming, examples and formulation; The Dynamic Programming Algorithm; Deterministic systems and the shortest path problem; Shortest path algorithms; Linear quadratic problems; Inventory control; Shopping and scheduling problems; Deterministic continuous time optimal control; The Pontryagin Maximum Principle; Imperfect state information problems; Linear quadratic problems with imperfect state information; Imperfect state information problems for finite-state systems;

Sub optimal control; Rollout Algorithms; Infinite Horizon problems; Stochastic shortest path and discounted problems; Average cost problems; Markov processes value and policy iteration procedure and some case studies in stochastic control.

SORS 4202 Global Optimisation 10 Credits
The module explores local search methods: descent and ascent methods; Neighbourhood search techniques; Metaheuristics. Students shall be introduced to simulated annealing and the metaheuristic simulated annealing shall then be used to solve at least one practical problem in Operations Research;

SORS 4204 Advanced Probability Theory 10 Credits
This module is a review of Univariate Probability Distributions: random variables, univariate probability distributions, functions of a random variable, expectations; Bivariate Probability Distributions: bivariate probability distributions, functions of two random variables, expectations; Multivariate Probability Distributions: multivariate probability distributions, marginal probability distributions, independent random variables, conditional probability distributions, functions of random variables and expectations.

SORS 4205 Non-Linear Programming 10 Credits
The module explores classical Optimization Theory: unconstrained and constrained problems, necessary and sufficient conditions, equality and inequality constraints; Karush-Kuhn-Tucker conditions; Nonsimplex Based Nonlinear Programming: gradient search methods for unconstrained and constrained problems; Introduction to penalty and barrier methods; Simplex Based Nonlinear Programming Techniques: separable programming, quadratic programming, convex simplex method criteria and geometric programming.

SORS 4206 Nonparametric Statistics 10 Credits
The module is an introduction to nonparametric statistics; Order statistics and their applications; Nonparametric tests concerning a single sample; Nonparametric tests that utilise data from two independent samples; Variable location tests that utilise data from two related samples; Tests involving variable location for three or more independent samples; Tests involving variable location for three or more related samples; Goodness of fit tests; Tests of association and an introduction to robust techniques.

SORS 4208 Statistical Quality Control 10 Credits

The module examines statistical process control, Statistical control charts ($\bar{\bar{x}}$ chart, R chart, S chart, C chart, Cp chart); Control chart patterns; Action on control charts; Process capability; Reliability of systems; Reliability function, Failure rate function and expected life.

SORS 4209 Risk Theory 10 Credits
The module explores the utility theory: Jensen's inequality, utility and insurance; Optimal insurance; Individual risk models: individual claim random variables, sum of independent random variables, approximation of distribution of the sum; Application to insurance; Collective risk models for a single period: Distribution of aggregate claims; Compound Poisson and Negative Binomial distributions; Properties of the compound Poisson

distribution; Convolutions, recursive method; Collective risk models over an extended period: Surplus processes, claim processes, Poisson processes, Compound Poisson processes; Adjustment coefficient; Ruin function; Discrete time model, continuous time model; Maximal aggregate loss and application of risk theory

SORS 4210 Official Statistics 10 Credits

The module looks at the functions of statistical services; National and International statistical agencies; Methods of data collection; The module shall put more emphases on; Environmental statistics, Health statistics, Agricultural statistics, Industrial statistics, Economic statistics, Postal censuses and fieldworker surveys.

SERVICE MODULES

SORS 2110 Introduction To Applied Statistics 10 Credits

The module covers the definition of statistics: Scope, sampling, questionnaire, measurement scales, types of data; Data descriptions: Graphical Methods: Bar graphs, Pie Charts, Histograms, Stem and Leaf Plots, Scatter Plots; Numerical Methods: Measures of Central Tendency and Dispersion; Quartiles and the Interquartile Range; Estimating the Mean and the Variance from Grouped Data; Probabilities: Definitions of Probability; Calculation of Probabilities of Events; Random Sampling; Conditional Probability and Independence; Random Variables: The Binomial and Poisson Distributions; The Normal Distribution; Point Interval Estimation: Estimation of the Population Mean, Proportion, Difference Between Populations, Difference Between Proportions; Hypotheses Testing: Tests about the Population Mean, Proportion, Difference Between Population Means, Difference between Population Proportions; Regression Analysis: Simple Linear Regression and One way Analysis of Variance (ANOVA).

SORS 2210 Applied Statistics For Biological Sciences 10 Credits

The module is an introduction to statistics, descriptive statistics, measures of central tendency, measures of dispersion; Presentation of data; Probability distributions, discrete probability distributions, Binomial, Poisson and Hyper-geometric distribution; Continuous probability distributions, Uniform, Normal and Exponential distributions; Hypothesis testing; Tests concerning means and difference between means; z and t distributions; One sided z and t tests, two sample z and t tests, paired comparisons; Confidence intervals based on z and t statistics for a single mean and the difference between means; Chi-Square test; Chi distribution, contingency tables, observed and expected frequencies; Chi-Square goodness of fit test, Chi-Square test of independence; Simple linear Regression and One way Analysis of Variance (ANOVA). All these should be done with applications in the biological sciences;

SORS 4106 Experimental Design And Multiple Regression 10 Credits

The module looks at the theory and applications of Statistics which include: Experimental Design and Analysis, 2^k Factorial Experiments; Confounding, complete and partial confounding; Orthogonal contrasts; Fractional Factorial Experiments, Aliasing; Multiple Linear Regression: Variable selection and model building; Multiple coefficient of determination, r^2; Mullow's C_p and S_p statistics; Covariance analysis; Stepwise regression methods; Forward selection, backward elimination and stepwise regression;

SORS 4107 Queuing Theory And Stochastic Process 10 Credits

The module looks at the queuing Theory; Elements of queuing models, Queues as birth and death process, Poisson queuing models, non-Poisson queues, P;K; formula, Some simple generalizations such as series queues and applications of queuing theory; Stochastic processes; Theory and applications of random processes, including Markov chains, Poisson processes as well as Birth-and-death processes.

SORS4108 Time Series Analysis And Simulation 10 Credits

The module explores the time series: Smoothing techniques; Moving averages, simple exponential smoothing, decomposition, identification of trend, seasonal, cyclic and irregular components; Additive and multiplicative models, autocorrelation functions; Autoregressive moving average models; Statistical Process Control: x charts, range charts, statistical control, capable processes; Simulation: Simulation by hand, pseudo random numbers, data collection, distribution fitting, activity cycle diagrams, model development; Verification, validation, experimentation; Analysis of results; Method of common random numbers and the use of simulation package.

BACHELOR OF SCIENCE HONOURS DEGREE IN BUSINESS ANALYTICS

PROGRAMME SUMMARY

YEAR I

SEMESTER I

Module Code	**Module Description**	**Credits**
SORS1101	Introduction to Operations Research	10
SORS1102	Operations Management	10
SMA1101	Calculus	10
SMA1102	Linear Algebra	10
SCS1101	Introduction to Computer Science and programming	12
SORS1103	Introduction to Applied Statistic	10

SEMESTER II

SBA1201	Introduction to Linear Programming	10
SBA1202	Network Models	10
SMA1204	Ordinary Differential Equations	10
SBA1203	Introduction to Business Management	12
SCS1203	Business Information Systems	10
CTL1101	Conflict Transformation and Leadership	10

YEAR II

SEMESTER I

SBA2101	Integer Linear Programming	10
SBA2102	Inventory Control and Management	10
SBA2103	Transportation and Logistics	10
SBA2104	Financial Analytics	10
SORS2106	Monitoring and Evaluation	10
SORS2103	Probability Theory	10

SEMESTER II

SBAS2203	Simulation and Queuing Models	10
SBA2204	Decision and Risk Analysis	10
SBA2205	Scheduling	10
SBA2202	Stochastic Optimization	10
SBA2201	Advanced Linear Programming	10
SORS2202	Design and Analysis of Experiments	10

YEAR III

SBA3010	Industrial Attachment	10

YEAR IV
SEMESTER I

SBA4101	Non Linear Optimisation and Dynamic Programming	10
SBA4102	Supply Chain Management	10
SBA4103	Algorithms and Heuristics	10
SBA4104	Case Studies in Business Analytics	10

ELECTIVE

SBA4010	Research Project	10

SEMESTER II

SMA4241	Financial Mathematics	10
SBA4202	Big Data and Data Mining	10
SBA4203	Business Intelligence	10

ELECTIVE

SBA4010	Research Project	10

ELECTIVE I

SORS4103	Stochastic Processes	10
SORS4102	Statistical Inference	10

ELECTIVE II

SBA4201	Location Modelling	10
SORS4208	Statistical Quality Control	10
SBA4204	Time Series and Forecasting	10
SBA4205	Advanced Optimisation	10
SBA4206	Advanced Dynamic Programming	10
SBA4207	Global Combinatorial Optimisation	10
SMA4213	Graph Theory	10

MODULE SYNOPSES

YEAR I

SMA1101 Calculus **10 Credits**

The module explores the limits of functions; One-sided and infinite limits; Continuity; Differentiation: definition, basic properties, Rolle's theorem, mean value theorem, Cauchy's mean value theorem, Leibniz's rule, applications, Taylor series; Integration: definite integrals, antiderivatives, fundamental theorem of calculus, improper integrals, Gamma and Beta functions, definition of natural logarithm as integral of 1/x and exponential as inverse; Area, volume of revolution, arc length, surface area; Parametric equations: arc length, surface area; Polar coordinates; Graph sketching; Area in polar coordinates; Complex numbers; Algebra of complex numbers; DeMoivre's theorem and exponential form.

SMA1102 Linear Algebra **10 Credits**

The module looks at vector Algebra: scalar and vector product; Collinear, coplanar vectors; Applications; Equations of lines and planes; Matrices: products, sums, echelon form, rank, inverse; Determinants: definition, properties, evaluation; Systems of Linear equations, Gauss's method, Cramer's rule, homogeneous systems; Vector Spaces: definition, linear independence, bases and subspaces.

SCS1101 Introduction To Computer Science And Programming **12 Credits**

The module explores information and Knowledge Societies, Evolution of Computers, Computer Organisation and Architecture: CPU; Memory; I/O, Number Systems and Conversions (Bin; Dec; Hex; Oct), Concepts of Computer Languages: high\low level languages; compiler; interpreter, Programming Techniques: grammar; recursion; Variables; Data types; Initialization; Comments; Keywords; Constants; Assignment, Programming constructs: branching; looping; recursion; Programming using data structures: arrays; lists; trees; hash tables; queues; stacks; files, Programming Algorithms for Problem Solving: Sorting; compression; numerical and encryption, Fundamentals Operating System, Fundamentals Data Bases and fundamentals of Networks.

SORS1101 Introduction To Operations Research **10 Credits**

The module gives a historical overview; Definition of Operations Research; Operations Research to problem solving; The process of quantitative modelling; Some quantitative techniques used in Operations Research; Methodology of Operations Research: The phases of an Operations research project, formulation of the problem, the components of a decision problem, state of nature or environment, the systems orientation of Operations Research, the team concept; An abbreviated Case study: Construction of a mathematical model, models as approximations, deriving a solution to the problem, sensitivity analysis, testing the solution for performance, problems of implementation, planning for implementation, controlling and maintaining the solution.

SORS1102 Operations Management 10 Credits

This is an introduction to Operations Management; Operations Strategy; Design; Facility locations and capacity planning; Production planning, types of production processes and criteria for measuring performance; Materials management, scheduling and control.

SORS1103 Introduction To Statistics 10 Credits

The module looks at basic Concepts of Statistics: Definition and scope of Statistics, Variables, Types of data, Measurement scales, Use of calculators and statistical computer software; Data Collection Methods: Data sources, Population and sample, Probability and non-probability sampling, Survey data collection; Data Presentations: Contingency and frequency tables, Pie charts, Bar charts and Histograms, Line graphs, Cumulative frequency curves, Stem and leaf plots, Box and whisker plot; Index Numbers: Types of indices, Simple indices, Un-weighted aggregate index; Introduction to Probability Theory: Counting rules in probability, Sets and events, Outcome sets for random experiments, Experimental probability, Classical Probability, Theoretical Probability, General laws of probability; Introduction to Hypothesis Testing: Definition of a hypothesis, Procedure for testing a hypothesis, Z-test, t-test; Introduction to Nonparametric Statistics: Order Statistics, Tests concerning a single sample, Chi-square test; One way Analysis of Variance (ANOVA) and Simple Linear Regression.

CTL1101 Conflict Transformation And Leadership 10 Credits

The thrust of the module is understanding peace and conflict; theories of conflict; conflict analysis and tools; economic roots of conflict; gender and conflict; leadership; leadership and conflict handling mechanisms; leadership and conflict handling mechanisms; women in leadership; leadership ethics; interplay: leadership, conflict and development.

SCS1203 Business Information Systems 12 Credits

The module examines Business Environments; Changing lives and businesses in the Information Era, Redesigning the organization with information systems Types of Information system: TPS; MIS; DSS; and Expert Systems; The Systems life cycle, the phases within it and the activities and documentation appropriate to each phase; Other development strategies, including 4GLs, Prototyping, and Evolutionary development; Building and managing information systems; IS project organization and management Information System Security and Control the Internet and electronic business.

SMA1204 Ordinary Differential Equations 10 Credits

The module explores first order differential equations; Separable, linear, exact; Integrating factors; Existence, uniqueness and applications; Second Order Equations; Linear equations and linear differential operators; Linear equations and linear differential operators; Linear independence, 103 ; Ordinary Linear Differential Equation with constant coefficients; Undetermined coefficients; Variation of parameters; Applications; Systems of equations; Phase plane portraits for Linear systems; Introduction to Non-linear systems; Predator-prey and Lotka - Volterra equations; Series solution of ordinary differential equations; Method of Frobenius; Legendre polynomials and Bessel functions.

SBA1201 Introduction To Linear Programming 10 Credits

The module gives a definition of Linear programming; Linear programming notation and formulation; Graphical solution, special cases, extreme points and optimal solution; Computer solution; Simplex algorithm; Algebra and the simplex tableau; Two phase method; The big M method; Degeneracy, cycling and stalling; Duality and the dual simplex method; Primal-dual method; Economic interpretation of the dual problem; Computer solution and sensitivity analysis; Applications of Linear Programming in manufacturing, marketing, agriculture, dietary problems, product mix, finance and other; Linear Programming software and sensitivity analysis.

SBA1202 Network Models 10Credits

The module explores basic definitions; Shortest route algorithms (Dijkstra's Algorithm and others); Minimum spanning tree algorithms (Kruskal's Algorithm and others); Network Flow problems: Maximum network flow problem (Ford-Fulkerson Labelling Algorithm), Max-flow Min-cut Theorem, Integral flows; Minimum cost network flow; Chinese postman problem/ Route inspection problem; Travelling salesman problem; Network simplex method; Max-flow Min-cut Theorem, Integral flows Project scheduling using networks; Critical path analysis; Deterministic activity times; Probabilistic activity times; Gantt charts; Resource scheduling; Cost crashing analysis and use of Network software.

SBA1203 Introduction To Business Management 10 Credits

The module has an understanding the Business World: forms of businesses and establishment of a business organisation; Introduction to management: levels of management, managerial roles and management skills; Environmental scanning, social responsibility and ethics; Planning and organising in management; Leadership and control in management and a brief overview of the functional management of the organisation.

YEAR II

SBA2101 Integer Linear Programming 10 Credits

The module highlights the basic definitions and formulations; LP relaxation; Graphical and computer solutions for an all integer linear program; Using the LP relaxation to create bounds; Branch and bound for solving a pure integer programming problem; Branch and bound for solving a mixed integer programming problem; Gomory's cutting plane algorithm; Solving 0-1 integer linear programming problems; Inequalities for 0-1 Knapsack constraints, *k* out of *n* alternatives constraints; Sensitivity analysis; Branch and Cut algorithm.

SBA2102 Inventory Control And Management 10 Credits

The module covers inventory Models: Deterministic demand models: Economic order quantity, Economic production lot size, Economic order quantity with backorders, Quantity discounts; Probabilistic demand models: Single period models, safety stock, Multiple period models; Inventory models with planned shortages; Periodic review with Probabilistic demand; Inventory control: Material requirements planning, materials resource planning, product structure, gross requirements, net requirements; Inventory management systems; Warehouse management and the use of Inventory management software.

SBA2103 Transportation And Logistics **10 Credits**

The module gives a definition, representation and formulation of the transportation problem; Transportation Simplex method; Finding the basic feasible solution (Phase I) using north-west corner, least cost, Vogel's methods; Iterating to the optimal solution (Phase II); Balanced and unbalanced problems, unacceptable routes; Degeneracy; Transshipment problems; Computer solution and sensitivity analysis; Assignment Problem; Representation and formulation of the assignment problem; Hungarian method; Alternating basis algorithm for assignment problem; Transportation and Logistics management; Logistics including Packaging, Containerization, Documentation, Insurance, Storage, Importing and Exporting Regulations, Freight Damage Claims, Working & collaborating with other executives within the supply chain, Managing vendors and partners, Responsible for mitigating risk and mitigation expenditures; Reverse logistics, Maritime Logistics, Air Freight Logistics, Land Logistics, Express Delivery, City logistics and the use of Transportation and logistics software.

SORS 2106 Monitoring And Evaluation **10 Credits**

The module offers an introduction to monitoring and evaluation (M&E): Terms and concepts applied in M&E processes, difference between M & E, M & E in projects implementation; Introduction to Monitoring and Evaluation Plan; Gathering Performance Data; Coding data and creating templates in Epi-Info, SPSS, CSPro and SAS, Non-parametric Statistical methods of analysis i;e Kruskal Wallis, Wilkoxon-Rank-sum Test, Spearman Correlation, Mann-Whitney-U test, Cross-tabulations and odds ratios; Data envelopment analysis (DEA): Productivity analysis using ratios, Estimation and interpretation of basic DEA model, Estimation of cost-efficiency estimation, Some application of SFA and regression analysis.

SORS2103 Probability Theory **10 Credits**

The module explores probability: random/statistical experiments, sample spaces, events, set theory; Axioms of probability; Laws of probability; Finite sample spaces; Conditional probability, independent events; Random variables and probability distributions; Discrete probability distributions; Continuous probability distributions; Discrete bivariate distributions; Continuous bivariate distributions; Marginal probability distributions; Independent random variables; Conditional probability distributions; Distributions of functions of a single random variable; Conditional probability distributions of mathematical expectations; Expectations of discrete and continuous random variables; Expectation of a function of a single random variable; Expectation of a function of several random variables; Properties of expectations; Variance and covariance; Markov and Chebyshev inequalities; Moment generating functions; Properties of moment generating functions; Special Distributions: Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson, Normal, Gamma, Weibull, Exponential, and Beta.

SBA2104 Financial Analytics **10 Credits**

The module examines cash flow streams, present value and fixed income instruments; Linear programming models in finance:- cash flow matching, dedication and immunization; Fandumental theorem of asset pricing; Risk- neutral probabilities and arbitrage detection; Mean variance Markowitz portfolio model using quadratic programming; Constructing an index fund using Integer programming; Structuring CMO's using Dynamic programming;

Dynamic portfolio optimization; Stochastic programming and optimal control models in Finance.

SBA2201 Advanced Linear Programming 10 Credits

The module covers a revised Simplex method; Complexity of the simplex algorithm;; Convergence, complexity and basic optimal solutions; Using column generation to solve large scale LP problems; Bounded variables algorithm, parametric linear programming; Karmarkar's interior point algorithm; Dantzig-Wolfe Decomposition algorithm; LP and Zero-Sum Game theory; Lagrangian duality; Multicriterial programming; Goal programming model formulation; Goal programming algorithms—the weighting and pre-emptive methods; Complex problems in goal programming; Analytic Hierarchy Process (AHP), Establishing Priorities using AHP; Using AHP to develop an overall priority ranking; Use of Linear Programming software and sensitivity analysis.

SBA2202 Stochastic Optimisation 10 Credits

The module gives definitions and notations; Contrast of Stochastic and Deterministic Optimization; Some principles of Stochastic Optimization; Properties of Convex sets; Continuity and differentiability of convex functions; Sub-gradients and optimality conditions; Properties of sub-gradients; General properties of direct random search; Stochastic approximation; Stochastic optimization algorithms; Pure random search; Accelerated random search; Simulated Annealing; Evaluating stochastic algorithms and Stochastic Algorithm in R.

SORS2202 Design And Analysis Of Experiments 10 Credits

The module gives a definition of basic terms; Completely randomized design (CRD); Randomized Block Design (RBD); Latin Square Design (LSD); Factorial Designs; factorial experiments; Confounding, complete and partial confounding; Orthogonal contrasts; Fractional factorial experiments, aliasing; Multiple linear Regression: Variable selection and model building; Multiple coefficient of determination, ; Mullow's, and statistics; Covariance analysis; Stepwise regression methods; Forward selection, backward elimination, stepwise regression and the use of Statistical packages in solving problems.

SBA2203 Simulation And Queuing Models 10 Credits

The module look at simulation by hand, pseudo random numbers, data collection, distribution fitting, activity cycle diagrams, model development, verification, validation, experimentation, analysis of results, method of common random numbers, use of a simulation package; Discrete simulation; Systems dynamics; Simulation software sampling methods; Model testing and validation; Use of Simulation package; Single Server Models: Queuing processes, Kendall-Lee notation, definitions and notation, the role of the exponential distribution, pure birth processes, pure death processes, birth and death processes, parameters of a queuing model; Multiple Server Models: Queuing models with parallel servers, models with non-Markovian input and output, the Pollaczek-Khintchine formulae and a case study of anqueuing model.

SBA2204 Decision And Risk Analysis **10 Credits**

The module outlines problem formulation, payoff tables, decision trees; Decision making without probabilities: Optimistic Approach, Pessimistic approach, Minimax Regret Approach; Decision making with probabilities: The expected value approach; Decision making with perfect information; Computation of branch probabilities using Bayes theorem; Bayes posterior probabilities, decision trees; Value of Sample information; Efficiency of sample information; Utility Theory: Utility and Decision Analysis, Utility functions, Exponential utility function; Risk profile; Loss and risk functions, admissible estimator, minimax estimator, Bayes risk, Bayes estimator; The Difference between Risk Analysis and Risk Assessment; Performing a Risk Analysis; Risk Assessment and Risk Analysis Elements.

SBA2205 Scheduling **10 Credits**

The module is an introduction to scheduling in manufacturing and other environments; Optimisation overview as needed for scheduling; Single machine project, parallel machines projects, flow shops, job shops; Advanced issues such as uncertainty as it applies to service industries; Machine scheduling to other areas like sports, transportation and military operations.

YEAR III

YEAR IV

SBA4101 Non Linear Optimisation And Dynamic Programming **10 Credits**

The module gives introductory concepts in Non-Linear Programming (NLP); Graphical illustration of non-linear programming; Convex and Concave functions; Solving NLP with one variable; Unconstrained optimization with several variables; Steepest Ascent Method; Lagrange Multipliers; The Karush-Kuhn-Tucker (KKT) conditions; Quadratic programming; Separable programming; Convex and Non-Convex programming; Pareto Optimality and trade off analysis; Dynamic Programming notation; Shortest route problem; The Knapsack Problem; Dynamic Programming examples: A network problem, Production and Inventory control, Resource allocation problems, Equipment replacement problems; Formulating Dynamic Programming Problems; and using EXCEL to Solve Dynamic Programming Problems.

SBA4102 Supply Chain Management **10 Credits**

The module gives supply chain operations, Supply Chain Planning; Procurement, Purchasing, Supply; Make versus Buy Decisions; Management and Strategic Sourcing; Strategic process improvement; Planning and Control; Management Strategy; Supply Chain Optimization; Logistic and the external environment; Technology Applications and a supply Chain Optimization Case Study.

SBA4103 Algorithms And Heuristics **10 Credits**

The module gives definitions of algorithm and heuristics; Graph Algorithms and Problems; Algorithmic Techniques; Types of Algorithms; Classification of problems: P, NP, NP-Complete, NP-Hard; Randomized Algorithms, Greedy Algorithms, Graph Algorithms, String Algorithms; Introduction to Heuristic procedures; Heuristic Problem Solving: Ill structured problems, Heuristics- the human approach to problem solving, Satisfying, heuristic procedures and programs; Simulated Annealing; Genetic Search; Tabu Search and Comparison of Heuristics.

SBA4104 CASE STUDIES IN BUSINESS ANALYTICS 10 CREDITS

The module explores consulting Skills: Skills required in practical consulting, covering elements such as: What is Business Analytics from the point of view of the clients? Problem structuring- immediate feedback to client-importance of eliciting values; who is the client? The consultant's role in context-sponsor, client, partner, significant actors, politics of OR; Interviewing skills; Proposal preparation, covering costing and making proposals; Case Studies: Introduction to quantitative modelling in Business Analytics, case studies, presentation skills and report writing skills.

ELECTIVE 1

SORS4103 STOCHASTIC PROCESSES 10 CREDITS

The module is a review of probability, conditional expectation; Theory and applications of random processes; Poisson process, Brownian motion process, stationary processes and Gaussian processes; Markov chains; Gambler's ruin, Birth and death processes Branching processes and random walks.

SORS4102 Statistical Inference 10 Credits

The module examines the indicator function, exponential family of densities;Parametric Point Estimation: parameter space and point estimators; Methods of finding estimators, method of moments, maximum likelihood method, least squares method; Properties of point estimators; unbiased estimators, minimum variance unbiased estimators (most efficient estimators), consistent estimators, sufficient estimators, asymptotic normality of estimators; Confidence Intervals: One-sided confidence intervals; Methods for finding confidence intervals, pivotal quantity, statistical and Bayesian; Hypothesis Testing: definitions; Simple and composite hypotheses, test statistic, critical regions, type I and II errors, level of significance, power of a test; Neyman-Pearson lemma; Uniformly most powerful tests and Likelihood-ratio tests.

SMA4241 Financial Mathematics 10 Credits

This is an introduction to financial derivatives, the Cox-Ross-Rubinstein model, finite security markets, the Black-Scholes model, foreign market derivatives, American options, and exotic options.

SBA4202 Big Data And Data Mining 10 Credits

The module looks at fundamental concepts of Decision Making, Big Data and Data Mining; Data Mining processes, Passive Data mining and Active Data Mining; Big Data and Data Mining Computing Environment-hardware, distributed systems and analytical tools; Turning data into insights that deliver value- through methodologies, algorithms and approaches for big data analytics-Modelling, visualisation, interpretation, assessment, evaluation and iteration; Big Data and Data Mining in Practice- case studies of the world's most successful companies; Design and implement a prototype.

SBA 4203 Business Intelligence **10 Credits**

The module gives a Business Intelligence (BI) overview; Adding value through BI; Essentials of BI; BI Architecture; Data integration; Databases & Data warehousing; Online Data Processing (OLAP); Online Transaction Processing (OLTP); Data Marts; BI front-end; Data Mining & Data mining algorithms; BI Application; Extract, Transform and Load concepts and tools.

SORS4208 Statistical Quality Control **10 Credits**

The module covers statistical process control, Statistical control charts (chart, R chart, S chart, C chart, C_p chart); Control chart patterns; Action on control charts; Process capability; Reliability of systems; Reliability function, Failure rate function and expected life.

ELECTIVE 2

SBA4201 Location And Modelling **10 Credits**

The module explores optimal location procedures, Location problems, Methods for solving location problems: Exact Enumerative, Exact Analytical, Approximate Heuristic Algorithms, Approximate Statistical Algorithms, Exact Mathematical Programming, Approximate Simulation Methods, Location in continuous space, Location on a route structure, Multi-facility location on a network: Minimizing average distance, Minimizing the maximum distance to closest supply centres and minimizing the number of centres required for every demand point.

SBA4203 Time Series And Forecasting **10 Credits**

The module looks at smoothing techniques; Moving averages, Simple exponential smoothing, decomposition, identification of trend, seasonal, cyclic and irregular components; Additive and multiplicative models; ARIMA and ARMA models: Model building strategy, models for stationary time series, models for non-stationary time series, parameter estimation, model diagnostics, model specification; Judgmental Forecasting; Seasonality in forecasting; Forecasting errors; Casual Forecasting with Linear Regression; Box-Jenkins method; Modeling volatility using ARCH/GARCH model; Short term and long term forecasting and the use of R in Forecasting.

SBA 4010 Project **10 Credits**

Projects may be carried out on an individual basis. Where possible the project shall be done in an industrial setting. The projects test students' ability to organize, complete and report on a significant piece of either Operations Research or Statistics or Applied Mathematics.

SBA4205 Advanced Optimisation **10 Credits**

The module covers the Game Theory: Two-Person zero-sum games; Games with mixed strategies; Graphical solution; Linear Programming and zero-sum games; Introduction to n-Person Game Theory; The Shapley Value; Advanced Markov Chains: Chapman-Kolmogorov equations; Classifications of state of nature of a Markov chain; Continuous time Markov Chains; Markov Decision Processes; Model for Markov Decision Processes; Linear Programming and Optimal Policies and Discounted Cost Criterion.

SBA4206 Advanced Dynamic Programming **10 Credits**
The module analyses a prototype example of Dynamic Programming; Characteristics of Dynamic Programming Problems; Deterministic Dynamic Programming; Probabilistic Dynamic programming; and the use of computers to solve Dynamic programming Problems.

SBA4207 Global Combinatorial Optimisation **10 Credits**
The module examines local search methods: descent and ascent methods; Neighbourhood search techniques; Metaheuristics; Cluster Analysis; Discriminant Analysis; Imperfect state information problems for finite-state systems; Sub optimal control; Rollout Algorithms; Infinite Horizon problems; Stochastic shortest path and discounted problems; Average cost problems; Markov processes value and policy iteration procedure and case studies in stochastic control.

SMA4213 Graph Theory **10 Credits**
This is an introduction to the abstract known as a graph; Definitions and characterisation of classes of special graphs; Distance and connectedness measures; Various algorithms applied to graphs and some of their proofs, classical and contemporary.

MASTER of Science Honours In Operations Research and Statistics

1.0 Degree Profile : Master of Science Honours In Operations Research and Statistics

Institution:	National University of Science and Technology
Type Of Degree:	MASTERS
Credit Load:	360 Credits
Level:	SADC-QF - Level 8
Accreditation Organisation(S):	Zimbabwe Council For Higher Education
Period Of Reference:	2018

PURPOSE OF THE PROGRAMME :

To develop knowledge skills and competences in the field of Operations Research and Statistics which are relevant to various career paths. To provide a foundation for further studies and research in Operations Research and Statistics.

PROGRAMME CHARACTERISTICS

Areas of Study: Operations Management, Industrial Statistics, Stochastic Modelling, Simulation Modelling, Information Systems for Management, Operations Research Techniques for Management, Financial Modelling and Forecasting, Quantitative Analysis

Specialist Focus: Application of necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from a large pool of data (data mining) and the use robust statistical analysis and mathematical modeling to solve an array of business and organizational problems, as well as improve decision-making.

Orientation: Real problems solving, research and survey activities, teaching and learning oriented programme.

Distinctive Features: Provide basic techniques in theory of Operations Research and Statistics and their applications to real-world problems by enhancing analytical skills to attack complex, large-scale optimization problems of both a deterministic and stochastic nature to make better decisions that impact society and the world positively.

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability: Academia, Transport and logistics, Financial services, Biometricians, Data, Mining, research and Development, Treasury, Monitoring and evaluation, Mining and manufacturing, Health Information management, Bio-informatics, hydrology and Climatology

Further Studies: PhD

TEACHING AND LEARNING

Teaching and Learning Methods:	Lectures, tutorials and seminars, computer practical classes, group enquiry and/or problem based study, individual learning, research and research projects, oral tests
Assessment Methods:	Written and oral examinations, tests, seminar presentations, mini-research report, final year dissertation report, continuous assessments

2.0 REGULATIONS

These regulations shall be read in conjunction with the Academic General Regulations.

3.0 ENTRY REQUIREMENTS

3.1 Candidates with an Honours Degree in Applied Mathematics/Mathematics, Applied Statistics/Statistics, Operations Research, Computer Science with at least a 2.2 degree class.

3.2 Candidates with at least a 2.1 Honours Degree class in a programme with significant* Mathematics content.

3.3 Candidates with at least a 2.2 Honours Degree class in a programme with significant* Mathematics content and should also have at least one year's relevant work experience will be accepted.

4.0 DURATION

4.1 Fulltime

The programme will be offered on a full time basis for 18 months or Block Release basis for 24 months (4 semesters) or on part-time basis for at least 24 months.

4.2 Block Release Programme

The programme is offered on block release basis for 2 years (4 blocks). It consists of two parts. Part I consists of 6 taught Modules for 2 semesters (2 blocks). Part II consists of 4 taught Modules (3 Modules in block 3) and 1 Module in Block 4 and a dissertation is also done in block 4.

4.3 Part-Time Programme

Students on Part-time shall normally take a maximum of 3 taught Modules per semester over a period of 2 years (4 blocks).

The student will do one Module and a dissertation in the second semester of Part II. The dissertation may commence after the end of second semester (Part I). The dissertation report will normally be submitted to the department one month before the end of the Part II of the degree program.

5.0 AWARD OF THE POSTGRADUATE DIPLOMA

Students who pass, or are credited with, all ten taught Modules, but do not successfully complete the dissertation; will be awarded a Postgraduate Diploma in Operations Research and Statistics.

Students who fail the MSc. degree but who pass, or are credited with, at least eight taught Modules and the dissertation, will be eligible to be awarded a Postgraduate Diploma in Operations Research and Statistics.

6.0 DETERMINATION OF THE DIPLOMA

6.1 The weighting of the components of the diploma for those students who pass all ten Modules but not the project, will be:

Average of all 10 taught Modules 100%

6.2 The weighting of the components of the diploma for those students who pass the project and at least eight taught Modules:

Average of Eight Taught Modules	70%
Dissertation	30%

7.0 ASSESSMENT

Each Module will be assessed at the end of the semester. The final grade in the Module will be based on the marks obtained in the final examination mark and on Module-work. The proportion of the final assessment from Module-work will range from 25% to 100% depending upon the Module. The final grade will be awarded by a panel drawn from members of staff and the external examiner appointed by the department. The grade allocation will be according to the usual university grades, that is; distinction, merit, pass and fail.

PROGRAMME SUMMARY

PART I

SEMESTER I

SORS 5101	Operations Management
SORS 5102	Stochastic Modelling
SORS 5103	Industrial Statistics

SEMESTER II

SORS 5201	Operations Research Techniques for Management
SORS 5202	Simulation Modelling
SORS	*Elective*

PART II

SEMESTER I

SORS 6101	Applications of Quantitative Analysis
SORS 6102	Forecasting
SORS	*Elective*

SEMESTER II

SORS 6010	Dissertation
SORS	*Elective*

ELECTIVES

SORS 5203	Information Systems for Management and Business
SORS 5204	Spread-sheet Modelling and Visual Basic
SORS 6104	Advanced Optimisation theory and Applications for Management
SORS 6103	Financial Modelling
SORS 6201	Business Management and Consulting Skills
SORS 6202	Network Optimisation
SORS 6203	Supply Chain Management
SORS 6204	Scheduling

NB: Students will be required to choose a minimum of two Modules from the list of elective Modules whose availability shall be subject to expertise and equipment in the Department.

MODULE SYNOPSES

PART I

SORS 5101 Operations Management

The module looks at the operations strategic objectives; Operations strategy; Design; Planning and control; Improvement; Deterministic and stochastic inventory models Inventory control; Supply chain management; Facility location; Project management; Total quality management and Just-In-Time (JIT.

SORS 5102 Stochastic Modelling

The module covers elements of stochastic processes; Discrete and Continuous time Markov Chains; Markov processes; Birth and Death processes; Stationary processes; Brownian motion and renewal processes.

SORS 5103 Industrial Statistics

The module explores principles of experimental design; Completely randomised designs; Randomised block designs; Balanced incomplete block designs; Latin square and crossover designs; Factorial designs; Fractional factorial designs; Response surface methodology; Nested designs; Split-plot designs; Repeated measures designs; Analysis of covariance; Quality control and Reliability.

SORS 5201 Operations Research Techniques For Management

The module highlights advanced linear programming; Non-linear programming algorithms; Classical optimisation theory: unconstrained and constrained problems; Dynamic programming; Global optimisation techniques and tabu search. Emphasis will be on solving practical problems using tabu search.

SORS 5202 Simulation Modelling

The module examines discrete event simulation; Systems dynamics; Simulation software Sampling methods; Model testing and validation.

SORS 5203 Information Systems For Management And Business

The module outlines management information and information systems; Information and techniques for providing information: database; Fast cycle systems; Fast cycle data entry; Networks and electronic data interchange; Communication networks-standards, applications and techniques; Expert systems; Determination and implementation of an information strategy: determining strategy, information technology tactics; Internal control and security;
Information for business management; Processing by computers; Design of a database; Administration of a database; Data preparation, coding and validation; Design implementation, testing conversion and evaluation; Office automation; Executive and decision support systems.

SORS 5204 Spreadsheet Modelling And Visual Basic Programming

The module looks at spreadsheet Modelling: Spreadsheet as a tool to support the development of quantitative models; Development of spreadsheet models to support: linear and integer programming, allocation of scarce problems, queuing theory and simulation; Programming simple macros within Excel; Use of management science packages: TORA and MSCI; Visual Basic Programming: Appreciation of the principles behind the structuring and execution of computer programs; Write simple Visual Basic programs; Creating a windows user interface; Planning the design of an application and processing user input.

PART II

SORS 6101 Applications Of Quantitative Analysis

The module looks at Case studies; Presentation skills; Report writing skills; Problem structuring methods: Soft Systems Methodology (SSM), Strategic Options Development and Analysis (SODA) and Strategic Choice (SC).

SORS 6102 Forecasting

The module emphasizes multiple regression modelling; Binary choice models, multiple discrete choice models and limited dependent models; Time series analysis: ARIMA, ARMA and VARMA models.

SORS 6103 Financial Modelling

The module examines arbitrages and equivalent Martingale measures; The one period model; Multi period models; The continous model; Hedging and completeness; Self financing portfolios; Attainability of a claim; Complete markets; Ito representation theorem; Girsanov's first theorem; Option pricing; European options; American options; The Black Scholes option pricing formula; Optimal portfolio and stochastic control; Stochastic control theory; The Hamilton-Jacobi-Bellman equation; Girsanov's second theorem and the Levy characterization.

SORS 6104 Advanced Optimisation Theory And Applications For Management

The module covers Classical Optimisation Theory: unconstrained and constrained optimization, necessary and sufficient conditions, equality and inequality constraints, Hessian, Lagrange and Jacobian methods; Algorithmic methods to include: steepest descent and ascent, Newton's method, conditional gradient and subgradient optimization, interior-point methods, penalty and barrier methods; Global optimization: neighbourhood search techniques, metaheuristics, simulated annealing and tabu search and applications to business management.

SORS 6201 Business Management And Consulting Skills

The module explores Business Management: The Business world and the community, Needs and need satisfaction, Business practice and social responsibility, Establishment of a business organization, Drawing up of a business plan, Importance of a business plan, Importance of the environment, General management: importance of management, levels of management; Functional management of organizations; Consulting Skills: Skills required in practical consulting, covering elements such as: What is Operations Research from the point of view of the clients? Problem structuring- immediate feedback to client-importance of eliciting values; who is the client? The consultant's role in context-sponsor, client, partner, significant actors, politics of OR; Interviewing skills; Proposal preparation, covering costing and making proposals.

SORS 6202 Network Optimisation

The module is an introduction to network models, computational complexity and data structures, Graph search algorithms, Transformations and flow decomposition, Shortest paths: label setting algorithm, the radix heap algorithm, label connecting algorithm; Basic algorithms for the maximum flow problem, Combinatorial applications for maximum flows, Preflow push algorithms, the global min cut algorithm; Minimum cost flows: Basic algorithms, the successive shortest path algorithm, the network simplex algorithm, minimum cost spanning trees, generalized flows and multi-commodity flows.

SORS 6203 Supply Chain Management

The module covers supply chains, Enterprise resource planning, Inventory management, Picking, dispatching, assignment, delivery; Capacity management; Data analysis and business Statistics; Information and data management.

SORS 6204 Scheduling

The module looks at the sequence of scheduling activities; Aggregate planning; Master scheduling; Scheduling services; Maintenance; Material requirements planning and applications to business management.

SORS 6010 Dissertation

Research Projects may be carried out on an individual basis. The research project normally involves work with some outside organization. The research projects test students' ability to organise, complete and report on a significant piece of Operations Research and Statistics.

DEPARTMENT OF SPORT SCIENCE AND COACHING

Lecturer and Chairperson
S. H. Rutsate, MSc (Belgium); MSc (Zim/NSA, Bulgaria), BA (Rhodes, SA)

Senior Lecturers
M. P. D. Gundani, MSc (Zim/NSA, Bulgaria); B Tech (SA)

B. Njekeya, MSc (ZIM/NSA, Bulgaria); BSc (Cuba)

Lecturers
Dr. B. Khumalo, PhD (SA); MSc (Belgium); BSc (Zim)

D. Makaza, MPhil (Zim); BED (Zim); BSc (Zim)

E. M. Tapera, MPhil (Zim); BED (Zim)

M. Ndlovu, MSc (UK); BSc (UK)

J. S. Sibindi, MPhil (Zim); BSc (Zim)

Demonstrator
K. Dlamini, BSc (Zim); Dip (Zim)

Technician
M. Banda, MSc. (SA); BSc (Zim)

Secretary

UNDERGRADUATE PROGRAMMES

BACHELOR OF SCIENCE HONOURS DEGREE IN SPORT SCIENCE AND COACHING

1.0 Degree Profile of: Bachelor of Science Honours Degree in Sport Science and Coaching

Institution:	National University of Science and Technology
Type Of Degree:	Honours
Credit Load:	500 Credits
Level:	SADC-QF - Level 8
Accreditation Organisation(S):	Zimbabwe Council For Higher Education
PERIOD OF REFERENCE:	2018

PURPOSE OF THE PROGRAMME

To produce graduates capable of developing solutions in Sport Science and its related Industry.

PROGRAMME CHARACTERISTICS

Areas of Study: Sport Science and Coaching

Specialist Focus: Sport Science, Recreation Science and Management, Leisure Studies

Orientation: Research and innovation oriented. Teaching and learning are professionally oriented and focused on practical aspects

Distinctive Features:

CAREER OPPORTUNITIES AND FURTHER EDUCATION

Employability: Exercise Physiologist, University Researcher, University Academics, Sport Scientist, Kinesiology, Biomechanist, Sport Nutritionist, Sport Coach, Sport Analyst, Sport Psychologist, Human Performance Analyser, Strength and Conditioning Coach, Personal Trainers, Sports Development Officers, Sports Teacher, Sports Managers, Physiotherapist

Further Studies: Masters in Sport Science and Coaching, MPhil, PhD

TEACHING AND LEARNING

Teaching and Learning Methods: Lectures, tutorials, laboratory classes, seminars, group work, practical based activities, industrial visits, industrial attachment, research project, individual independent study

Assessment Methods: Written and oral examinations, tests, laboratory reports, seminar presentations, industrial attachment report, mini-research project report, final year research project report.

2.0 REGULATIONS

These regulations should be read in conjunction with the Department of Sport Science and Coaching Regulations and the General Academic Regulations for Undergraduate Degrees hereinafter referred to as General Regulations.

3.0 ENTRY REQUIREMENTS

3.1 The candidate must have obtained a PASS at 'A' level in at least two of the following subjects or their recognized equivalents: -

Physical Education, Sport Science, Biology, Chemistry, Physics, Mathematics and/or any other relevant "A" level qualifications.

3.2 Special entry: candidates who have successfully completed a Diploma in Sport Science or Physical Education or its recognized equivalent may apply.

4.0 DURATION OF THE PROGRAMME

The Programme shall run for a period of four years.

5.0 MODE OF STUDY

The Programme is offered on full time and Block Release.

6.0 STRUCTURE OF THE PROGRAMME

The program shall consist of thirty-six taught modules plus Industrial Attachment/Work Based Experience Report and a final year project.

7.0 ASSESSMENT OF CANDIDATES

Assessment of modules with a practical component, unless specified otherwise, shall be weighted as follows: continuous assessment 20%, practical 20% and examination 60%.

PROGRAMME SUMMARY

		Module Code	Module Description	Credits
Year I	Semester I	SSC 1106	The Fundamentals of Sport History and Olympism	10
		SSC 1104	Fundamentals of Athletics	10
		SSC 1105	Fundamental of Gymnastics	10
		SSC 1107	Principles of Human Anatomy	10
		SSC 1108	Principles of Human Physiology	10
		SCS 1100	Introduction to Computer Science (Service Module)	10
	Semester II			
		SSC 1220	Functional Anatomy	10
		SSC 1221	Theory and Methodology of Physical Education	10
		SSC 1222	Introduction to Psychology	10
		SCS 1200	Data Concepts and Data Processing	10
		CTL1101	Conflict, Transformation And Leadership	1010
		SSC	Elective Sports Speciality Modules 1 Level I	10
		SSC	Elective Sports Speciality Modules 1 Level I	
			Elective Modules –a student must choose two(2) modules from the list below:	**130 Credits**
		SSC 1210	Martial Arts I	10
		SSC 1211	Gymnastics I	10
		SSC 1212	Field and Track Athletics I	10
		SSC 1213	Swimming, Life Saving and First Aid	10
		SSC 1214	Tennis I	10
		SSC 1215	Soccer I	10
		SSC 1217	Volleyball I	10
		SSC 1218	Basketball I	10
		SSC 1223	Cricket I	10
Year 2	Semester I			
		SSC 2103	Principles of Biochemistry	10
		SSC 2104	Biomechanics	10
		SSC 2105	Sport Management	10
		SORS 2110	Introduction to Applied Statistics for Biological	10
			Sciences	10
		SSC	Elective Sports Speciality Modules 2 Level 2	10
		SSC	Elective Sports Speciality Modules 2 Level 2	

Elective Modules –a student must choose two(2) modules

from the list below:

	SSC 2111	Gymnastics II	10
	SSC 2110	Martial Arts II	10
	SSC 2112	Field and Track Athletics II	10
	SSC 2113	Swimming II	10
	SSC 2114	Tennis II	10
	SSC 2115	Soccer II	10
	SSC 2117	Volleyball II	10
	SSC 2118	Basketball II	10
	SSC 2123	Cricket II	10
Semester II			
	SSC 2206	Exercise Physiology and Biochemistry	10
	SSC 2209	Theory and Methodology of Coaching	10
	SSC 2216	Testing, Measurement and Exercise Prescription	10
	SSC 2220	Research Methodology in the Sports Sciences	10
	SSC	Elective Sports Speciality Modules 2 Level 3	10
	SSC	Elective Sports Speciality Modules 2 Level 3	10
			120 Credits

Elective Modules –a student must choose two(2) modules from the list below:

	SSC 2211	Gymnastics III	10
	SSC 2210	Martial Arts III	10
	SSC 2212	Field and Track Athletics III	10
	SSC 2213	Swimming III	10
	SSC 2214	Tennis III	10
	SSC 2215	Soccer III	10
	SSC 2217	Volleyball	10
	SSC 2218	Basketball III	10
	SSC 1223	Cricket III	**10**
Year 3	SSC3000	Industrial Attachment	**120 Credits**

Year 4	Semester I	SSC 4101	Theory of Sports Training	10
		SSC 4102	Sports Biokinetics	10
		SSC 4103	Sports Psychology	10
		SSC 4104	Nutrition and Sports Nutrition	10
		SSC 4010	Project (weighting of 2 modules assessed in Semester II)	10
		SSC	Elective Sports Speciality Module 3Level 4	10
		SSC	Elective Sports Speciality Module 3 Level 4	10

Elective Modules –a student must choose two (2)modules from the list below:

SSC 4111 Gymnastics IV	10
SSC 4110 Martial Arts IV	10
SSC 4112 Track and Field Athletics IV	10
SSC 4113 Swimming IV	10
SSC 4114 Tennis IV	10
SSC 4115 Soccer IV	10
SSC 4117 Volleyball IV	10
SSC 4118 Basketball IV	10
SSC 1223 Cricket IV	10

Semester II	SSC 4207 Health, Exercise and Sports Recreation	
	SSC 4208 Basic Law, Sports Law and Diplomacy	10
	SSC 4209 Advanced Sports Studies	10
	SSC 4010 Research Project (Weighted as 2 modules)	10
	SSC Elective Sports Speciality Module 1 Level Professional	10
		10
	SSC Elective Sports Speciality Module 2 Level Professional	10
		130 Credits

Elective Modules –a student must choose two(2) modules from the list below:

	10
SSC 4211 Gymnastics V	10
SSC 4210 Martial Arts V	10
SSC 4212 Field and Track Athletics V	10
SSC 4213 Swimming V	10
SSC 4214 Tennis V	10
SSC 4215 Soccer	10
SSC 4217 Volleyball	10
SSC 4218 Basketball	**10**
SSC 1223 Cricket IV	

TOTAL CREDITS **500**

MODULE SYNOPSES

YEAR I

SEMESTER I

SSC 1103 The Fundamentals Of Sport History And Olympism 10 Credits
This module shall cover sporting activities of men since early time of their existence. It shall include Ancient Nations to today Modern times including Zimbabwe; The International Olympic Commission (IOC), principles of Olympism, Olympic Solidarity; Code of Ethics and the Anti-Doping Code.; Physical culture, including the significance of sport in society and the trends in elite sports.

SSC 1104 Sports Module (Fundamentals Of Athletics) 10 Credits
Students shall be introduced to the basic foundations of theory and practice of athletics exercise. This module shall also develop awareness in students of athletics as a discipline whose natural movements form a basis for improvement of fitness for other sporting activities and lifelong fitness. Students' shall acquire knowledge and skills in athletic movement in the following athletics events; walking, sprints, relays, hurdles, jumps and throws middle and long distance. Rules of each of the events shall be discussed. The module also covers planning and organization of athletics competitions.

SSC 1104 Sports Module (Fundamentals Of Gymnastics) 10 Credits
This module is aimed at providing students with theoretical knowledge and practical skills in general gymnastics for use of all athletes in sports preparation. Students will be expected to participate in training drills of basic and complex gymnastic exercises and to present a composition.

SSC 1107 Principles Of Human Anatomy 10 Credits
The module is designed as the basis in understanding the movements frequently encountered in the teaching and coaching of sports. This module is also designed for students preparing for future careers in health related professions. The module shall include topics like the organization of the human body, (skeletal, muscular, nervous system and internal organs), principles of support and movement, control system and maintenance of the human body as well as homeostatic mechanisms of the major functional systems.

SSC 1108 - Principles Of Human Physiology 10 Credits
The module looks at the physiology of muscle tissue; The cardiovascular system; Function of the respiratory system; Function of the digestive system; Physiology of the urinary system; Physiology of the endocrine system and Physiology of the nervous system (somatic, central and autonomic nervous systems).

Semester II

SSC 1220 Functional Anatomy 10 Credits

The module explores the discipline of Functional Anatomy forms part of the foundation for studies in Exercise Science. A detailed understanding of the musculoskeletal?, cardio-respiratory and neuromotor systems help scientists and therapists to understand how human variation affects our ability to move, exercise and perform within both the competitive sports and industrial settings. Numerous research projects have emanated from the applied anatomy discipline, including studies on the advantageous body size, shape, composition and proportionality in a host of elite sports, as well as identifying factors that predispose individuals to develop joint disease or injury. The module shall enable students to improve their knowledge of the human structure and understand how certain morphological characteristics can provide an advantage for human physical performance. This should enable them to apply theoretical understanding of body modification principles and practical skills in physical capacity measurement to sporting and occupational settings.

SSC 1221 Theory And Methodology Of Physical Education 10 Credits

The module is designed as the basis for understanding the theory and practical issues in the teaching of Physical Education. The module also provides a didactic paradigm for students with no teaching experience hence prepare students to design and conduct practicals in teaching/coaching. The module shall include topics like Foundations of Physical Education. Curriculum issues in Physical Education. Pedagogical issues in Physical Education and Sport.

SSC 1222 Introduction To Psychology 10 Credits

The module covers the scientific study of human behaviour. The module shall include developmental Psychology, which studies the mental development at different stages of ontogenesis. Different personality theories and traits shall be studied so as to enable The Sports Scientist apply himself more effectively in his field of work, in training athletes, coaches, academics and in the Sport Industry. An evaluation of these Psychological theories shall be done so as to come up with a holistic approach to the study of human behaviour.

SSC 1210 Sports Specialty Module (Martial Arts) – Elective 10 Credits

The aims of the module are to provide instructions and practice in basic skills of martial arts. The primary emphasis is to gain an understanding of the history, philosophy and techniques of martial arts, the ethics for developing a powerful sense of character, courage, dedication, tolerance and shall through practical improvement of basic and special self-defense skill techniques and tactics. Students shall be expected to master the basic katas, biomechanics of martial arts and the psychological conditioning of martial arts. History, origins and development of martial arts. Structure of martial arts in the modern world. Philosophies of karate with reference to different schools (ryus). Martial art as a sport and martial art as a tradition. Basic techniques in karate (stance, kicks, punches, blocks).

SSC 1212 Sports Specialty Module (Field and Track–Sprints, Relays and Hurdles) 10 Credits

Elective

The following content shall be covered for the sprint start, sprinting, hurdling and relay;. General characteristics; Biomechanical aspects. Biomechanical requirements and consequences for training; Phase structure; Demand profile (strength, speed, endurance, mobility, coordination, technique and mental skills); Test and control methods; Annual Periodization; Training emphases (speed, endurance, strength, mobility, running technique/coordination). Students shall be engaged in practicals to develop basic skills technique and hands on knowledge of training exercises.

SSC 1213 Sports Specialty Module (Swimming) – Elective 10 Credits

Swimming shall focus on the knowledge and skill necessary to handle the body with ease in the water. The module covers basic mechanical, physiological and psychological concepts, fundamental safety skills and basic swimming strokes, the front crawl, the backstroke, the breaststroke and the butterfly stroke. The module is developmental from elementary level, intermediate and advanced swimming levels. At the end of the module one should be able to coach those aspects that shall increase endurance, as well as gain further understanding of mechanical and physiological concepts designed to introduce the skilled swimmer to training concepts in swimming. The module shall enable students taking this Module be able to also identify talent in swimming as well as design swimming training, teaching and coaching programs. The second part of the module shall aim to train students and qualify them for competence as healthcare professionals who are able to offer lifesaving emergency first aid to sick persons or to the injured during sports, occupation and traffic accidents. The students learn and practice to be responsible for managing the pre-hospital treatment, care and movement of patients to hospital without unnecessary delay. This often requires taking potentially life-saving decisions. They are required to work closely with other healthcare professionals and emergency services and are therefore required to be highly trained and skilled in all aspects of pre-hospital care. The module shall also enable the students to study for a swimming lifesaving module for rescue in water.

SSC 1211 - Sports Specialty Module (Gymnastics) – Elective

The module explores introductory movement gymnastics including educational and Olympic gymnastics; Floor movement gymnastics, apparatus movement gymnastics, stunts and transitions, tumbling stunts, static balance stunts. Basic apparatus work and Mass display movement gymnastics.

SSC 1214 Sport Specialty Module (Tennis) – Elective 10 Credits

The aims of the module are to provide students with knowledge about the theory and practice of tennis, develop basic and advanced skills techniques related to actual game strategy and the psychological aspects of competition and how to apply them in the teaching and coaching practice. Emphasis shall be put on: Rules and regulations of tennis; Detection, identification and selection of talents in tennis, modern trends in the development of tennis at grassroots national and internationally.

SSC 1215 - Sport Speciality Module (Soccer) – Elective 10 Credits

The aims of the module are to expand and improve the theoretical knowledge and practical skills of students for effective management of the coaching and teaching high level players, providing them with historical, philosophical knowledge, skill development drills and organizational strategies while working with elite amateur and professional players. Emphasis shall be on: history of soccer, law of the game, modern trends and new concepts of selecting and preparing young and adolescent soccer players.

SSC 1217 Sport Specialty Module (Volleyball) Elective 10 Credits

This module covers the fundamentals of volleyball. Emphasis is placed on the basic skills of serving, passing, setting, spiking, blocking, and the rules and etiquette of volleyball. The module shall focus on individual offensive and defensive skill and focus on the theory and methodology of coaching/teaching volleyball.

SSC 1218 Sport Specialty Module (Basketball) Elective 10credits

The main purpose of this module is to introduce the student to the sport of basketball. The student shall be introduced to the fundamentals of basketballs, and how they may be taught and coached. The module shall focus on individual offensive and defensive skill and also at team offensive skill focusing on 1v0; 1v1; 2v1; 2v2; 3v1; 3v2; 3v3. There shall also be a focus on theory and methodology of coaching/teaching basketball.

SSC 1223 - Sport Speciality Module (Cricket) – Elective 10 Credits

The aims of the module are to expand and improve the theoretical knowledge and practical skills of students for effective management of the coaching and teaching high level players, providing them with historical, philosophical knowledge, skill development drills and organizational strategies while working with elite amateur and professional players. Emphasis will be on: History of Cricket, Cricket skills, Law of the game, Modern trends and New concepts of selecting and preparing young and adolescent Cricket players and Level 1 ZCU Certification.

YEAR II

Semester I

SSC 2103 Principles Of Exercise Biochemistry 10 Credits

The module is an introduction to the structure of carbohydrates, lipids, amino acids, proteins and nucleic acids; Biology oxidation and oxidative Phosphorylation; Carbohydrate metabolism and its regulation (Glycolysis, citric acid cycle, pentose phosphate pathway, gluconeogenesis, glycogen degradation and synthesis; Lipid metabolism and its regulation (degradation and synthesis of fatty acids); Amino acid metabolism and urea cycle as well as Biochemistry of muscle contraction.

SSC 2104 – Biomechanics 10 Credits

The module explores Biomechanical characteristics of movements Static's and Dynamics Linear and Angular mechanical analysis of human motion- Linear Kinematics, Linear Kinetics, Angular Kinematics and Angular Kinetics projectile motion Biomechanics of motor qualities and criteria for qualitative assessment as well as applied software Training simulators and technical aids. The second part of the module shall cover advanced biomechanics topics and methods that shall focus on gait pattern analysis, posture control in children adults and specific populations (geriatrics). Using interfaced forces plates, digital video cameras and 3D movement analysis systems, experience is gained in the collection and analysis of external and internal forces, angular and linear kinematics, and muscle activation. Other advanced analysis techniques like integration using digital methods, inverse dynamics from ground reaction forces and anthropometric constants, centre of pressure, friction and slipping shall be covered. Impulse momentum relationships and leverage using high-impact activities such as running, jumping, swimming, ball game sport and lifting shall be studied.

SSC 2105 – Sports And Recreational Management 10 Credits

In this module students shall learn various management theories and how they relate to sports and recreation. Furthermore they shall study the various management challenges that face the recreation industry and the various sporting disciplines in Zimbabwe. They shall also learn basic accounting, financial management, human resources management, economics, and sports marketing. Sport and Recreation management as well as facility and event management, are some of the modules that shall be done to substantiate the sport management field experiences.

SORS 2110 – An Introduction To Applied Statistics 10 Credits

The module is an introduction to Applied Statistics. Statistics – its definition and scope. Descriptive Statistics/Initial Data Exploration: Summary statistics, measurements of central tendency, mean, mode, median, measures of dispersion, range, variance, standard deviation; Graphical presentation of data, stem and leaf plots, histograms, box plots. Point Estimation/Tests of Hypothesis, interval estimation, z-test, t-test; Design and analysis of experiments, completely randomized design, and randomized complete block design, Latin squares, and factorial experiment; Regression analysis, simple linear regression; Statistical Computing. Categorical Data Analysis and the Uvi-square Test for Independence and Homogeneity.

SSC 2110 Sports Specialty Module (Martial Arts) Elective 10 Credits

The module examines the methods for developing and improving the principal physical qualities in martial arts (strength, endurance, agility and flexibility); periodization in karate and tactical and technique training of both advanced and non-advanced karatekas; Biomechanics of martial arts as well as the Management and control of training process in karate.

SSC 2111 Sports Specialty Module – (Gymnastics) Elective 10 Credits

The module looks at gymnastic movements; Floor Exercises stunts and transitions, tumbling stunts, static balance stunts, pyramids and vaulting, planning of training process in gymnastics.

SSC 2112 Sports Specialty Module (Field And Track Jumps) Elective 10 Credits

The following content shall be covered; long jump, triple jump, high jump and the pole vault: General characteristics. Biomechanical Aspects. Technique and phase structure; The training of jumps demand profile (speed, strength, endurance, flexibility, coordination, technique, mental skills); Test and control method; Annual Periodisation; Training emphases (strength, speed, mobility, endurance and technique). Students shall be engaged in practicals to develop personal skills and technique. They shall also go through training exercises to develop hands on knowledge.

SSC 2113 Sports Speciality Module (Swimming) Electives 10 Credits

Students are expected to study the metabolism of energy and swimming performance. Students shall work in the laboratory as well as in the field to understand and apply the metabolism of energy principles. This module shall also equip students with the ability to apply the training principles of swimming, age group training, selection, monitoring and assessment. Students are also expected to continue the training into the intermediate level of swimming. Students shall take lessons in diving and synchronized swimming.

SSC 2114 - Sport Specialty Module (Tennis) Elective 10 Credits

The module explores the characteristics of professional tennis; Development of specific qualities skills and techniques and tactics in tennis; Tennis training and coaching strategies; Psychologies of tennis match, style, ethical norms, conduct typology and behaviour in tennis; Novel concepts and trends in preparing professional and amateur players in tennis; Management and marketing in tennis; Research and applied practice and Planning and developing drills and participation in the tennis.

SSC 2115 - Sport Speciality Module (Soccer) – Elective 10 Credits

The module covers the development of specific game related qualities and skills, initial training and improvement, technical and tactical training conditioning programs; Health related issues (fatigue recovery, nutrition); Coaching philosophy, intellectual and psychological conditioning and modern tendencies and concepts in the play activity of soccer players.

SSC 2117 Sport Specialty Module (Volleyball) Elective 10 Credits

Students shall learn advanced strategies and skills in volleyball and related Volleyball games, as well as officiating techniques. Many different basic volleyball drills shall be used leading up to game play. Techniques and fundamentals shall be stressed through developmental games and then incorporated into game play. Students shall also advance in volleyball training and coaching, by applying the various coaching theories, talent identification strategies, planning, conditioning and assessment in volleyball.

SSC 2118 Sport Specialty Module (Basketball) Elective 10 Credits

The main purpose of the module is to introduce the student to more advanced basketball training. As well as coaching philosophy, talent identification, selection and development in basketball, practice planning, structure of a practice session, fitness training and assessment in basketball.

SSC 2123 - Sport Speciality Module (Cricket) – Elective 10 Credits

Development of specific game related qualities and skills, initial training and improvement, technical and tactical training conditioning programs. Health related issues (fatigue recovery, nutrition), Coaching philosophy, intellectual and psychological conditioning, modern tendencies and concepts in the play activity of Cricket players. Level 1 ICC Certification.

Semester II

SSC 2206 – Exercise Physiology And Biochemistry 10 Credits

This module is designed to develop students' knowledge and skills in the area of Exercise Physiology and Biochemistry. The module builds upon the foundation of knowledge constructed through basic module-work in Human Anatomy, Human Physiology and Principles of Biochemistry by applying the principles learnt, to how the body performs and responds to physical activity. The following shall be covered; Energy transfer in exercise; Human energy expenditure; Cardiovascular regulation and integration during exercise; Functional capacity of the cardiovascular system; Exercise and pulmonary ventilation; Exercise at medium and high attitude; Exercise and thermal stress; Metabolic adaptations of exercise training; Exercise and endocrine system; (The endocrine system: Organization and acute and chronic responses to exercise; Neural control of human movement; Exercise and immune system and Ergogenic aids.

SSC 2209 - Theory And Methodology Of Coaching 10 Credits

Students in this module shall review Coaching Theory and Methodology within the coaching profession. They shall examine theories specific sports teams, including the development of methodologies and the development of a team, principles for coaches to follow and pass on to teams, and the end of competitive careers in organized sports. Guiding questions include: What sport has done for the player and coach? Why is theory and methodology in sport important? How does leadership and strategy play a role? Students shall develop a coaching philosophy that shall drive their coaching theories and methods. Students shall discover that teaching life lessons through sport is vital to the success of their athletes. The following content shall also be covered: Training as a physiological adaptation process. Biomotor, event, and sports specific training loads and methods. Adaptation process on sports with strength character. Adaptation progress on sports for endurance. Analysis of training loads. Analysis on adaptation process of different motor qualities e.g. Endurance and strength. This module shall provide the students with the scientific principles and the hands-on experience to develop resistance exercise and related conditioning programs for a wide range of populations, including those focusing on general fitness, therapeutic rehabilitation and sport performance.

SSC 2210 Sports Specialty Module – Martial Arts Elective 10 Credits

The module explores mental training; Basic attacking technology; Basic Defending technology; Direct and indirect attacking; Basic katas (II) and Multiple combination.

SSC 2211 Sports Specialty Module (Gymnastics) – Elective 10 Credits

The module looks at advanced gymnastic movements I and apparatus work, identification and selection of talent, conditioning in gymnastics; Teaching and coaching gymnastics.

SSC 2212 – Sports Specialty Module (Field And Track – Throws) Elective 10 Credits
The following content shall be covered for shot put, discus, javelin and the hammer: General characteristics; Both linear and rotational technique in the shot put; Biomechanical aspects and biomechanical requirements together with consequences for training practice; Training for throws (Demand profile – speed, strength, endurance, coordination, flexibility, and technique) Test and control methods; Training emphases (strength, speed, mobility, endurance, technique); Annual periodization; Training plan. Students shall be engaged in practicals to develop personal skills and technique. They shall also go through training exercises to develop hands on applicable knowledge and skills.

SSC 2213 Sports Speciality Module (Swimming) Elective 10 Credits
This is a swimming module development, where students shall scientifically plan for practice sessions; Stroke analysis of the front, back, breast and butterfly strokes; Talent identification and development anddeveloping swimming programs for different age groups.

SSC 2214 - Sport Specialty Module (Tennis) Elective 10 Credits
The focus of this module shall be on the rotation of the ball and the general principles of spin; Analysis of static and dynamic progressions; Analysis of drills and teaching formations at different levels.

SSC 2215 - Sport Speciality Module (Soccer) Elective 10 Credits
Focus of this module shall be on psychological and pedagogical orientation, junior soccer training principles, periodization, Conditioning in football, talent identification talent detection, talent development models talent Selection, talent selection models, nutrition for soccer performance.

SSC 2216 Testing, Measurement And Exercise Prescription 10 Credits
The module examines testing and Measurement concepts; Importance of Testing and Measurement; Measurement scale;. Discrete and continuous variables; Test validity; content-related evidence of validity, construct related factors affecting the testing programme; Planning test administration; Converting interpreting and evaluating results; Administration of motor skill tests, fitness tests, body composition test and anthropometric tests.

SSC 2217 Sport Specialty Module (Volleyball) Elective 10 Credits
In this module emphasis is placed on the refinement of the advanced skills required in the volleyball game as well as the more advanced aspects of setting, hitting, and serving. The 6-2 and 5-1 offensive and defensive systems of play are emphasized. Students shall continue with developing the mastery of the game by coaching, training and designing developmental programs. Students should also develop officiating skills of volleyball. The students shall analyze the psychological skills necessary in volleyball.

SSC 2218 Sport Specialty Module (Basketball) Elective 10 Credits
The student shall be introduced to advanced basketball tactical play both offensively and defensively. Offensive and defensive transition, man-to-man defense and offence; zone defense and offence. The students shall analyze the psychological skills necessary for basketball.

Students shall be introduced to the legal aspects of basketball teaching and coaching and liability.

SSC 2220- Research Methodology In The Sport Sciences 10 Credits

This module focuses on the approaches to research design, data collection and statistical analysis and further discusses quantitative and qualitative research methods and introduces advanced statistical techniques. The module provides an essential introduction to research ethics and the ethical approval procedures when using human participants for research.

SSC 2223 - Sport Speciality Module (Cricket) Elective 10 Credits

The focus of this module will be on psychological and pedagogical orientation, junior soccer training principles, periodisation, conditioning in Cricket, talent identification talent detection, talent development models talent Selection, talent selection models, nutrition for performance and Level 2International Certification.

YEAR III

SSC 3001 – Industrial Attachment 120 Credits

This module offers students the opportunity to apply all the theoretical and practical knowledge learned and experienced during the first two years in a working environment. Students have the opportunity to learn to apply principles on the job and get supervised and assessed.

YEAR IV

Semester I

SSC 4101 – Theory Of Sports Training 10 Credits

The module is an analysis of stress and adaptation reaction in sports; Types of fatigue and the motor expression of fatigue; Steady state adaptation and the morphological and functional changes in muscles. The module shall allow students gain theoretical and practical knowledge of practitioner skills which they shall apply in a real world sport setting. Students shall apply their knowledge on different types of motor skill e.g. strength training and conditioning. Students shall be able to gain experience by opportunities created during the performance testing of professional teams of any sport. The module is meant to equip the graduate alongside other modules related to training, coaching and performance, relevant, practical and contemporary learning. Students from this module are also able to develop consultancy skills in this field of popular study.

SSC 4102 -Sport Bio kinetics 10 Credits

The module will enable students to be able to assess and prescribe preventative or rehabilitative exercise therapy. The module areas shall include the following topics: morphological status, musculoskeletal status, cardiorespiratory status, and metabolic status. Knowledge shall then be applicable to specific applications or chronic conditions, like attenuation & rehabilitation of hypokinetic/Metabolic Disorders, Stress-Related Disorders, Hypertension, Coronary Artery

Disease, Stroke, Parkinsosn's Disease, Osteoporosis, Low Back Pain, Arthritis, Hyperlipidemia, Obesity and Diabetes.

SSC 4103 – Sports Psychology **10 Credits**

The module is designed to help students understand human behaviour in sport and exercise settings with the view of enabling them to use that knowledge to enhance performance of athletes. The module shall therefore cover; Motor Development and Skill Acquisition during childhood and adolescence; Personality and sport motivation; Arousal, stress and anxiety; Group and team dynamics. Leadership; Communication. Imagery; Concentration, Self-confidence and Psychological skills training.

SSC 4104 – Nutrition And Sports Nutrition **10 Credits**

This module will equip the Sport Scientist with the ability to apply the science of nutrition, nutritional issues in general and to sport specific issues. Athletes the worlds over are in search of ergogenic aids to enhance their their performance hence the study should enable anyone to apply nutrition concepts in sports practice.

SSC 4110 Sports Specialty Module – Martial Arts Elective **10 Credits**

The module explores umpiring techniquesk Katas (Applications;. Kumite; Management and control of training; Biomechanics of karate; Bone alignment, breath, force production and balance.

SSS 4111 Sports Specialty Module (Gymnastics) Elective **10 Credits**

The module is on advanced gymnastic movement II; Apparatus work and routines, teaching and coaching gymnastics and judging in gymnastics.

SSC 4112 – Sports Specialty Module (Field And Track – Middle And Long Distance And Race Walking) Elective **10 Credits**

The module looks at the technique of middle and long distance running; Technique of Steeplechase – Clearing the Barriers, Clearing the water jump, Technique of Race Walking; Biomechanical aspects of the events; Strategy and tactics in the events; Demand profile (Biomotor abilities – speed, strength, endurance, mobility and technique); Test and control methods for the events; Annual periodization; Main training emphases (endurance, speed, strength, mobility, technique) and weekly training plans.

SSC 4113 Sports Speciality Module (Swimming) Elective **10 Credits**

In this module students are expected to do advanced swimming that is: ensure the correct technique while they swim very fast. They are expected to apply further training principles that shall study: anaerobic thresholds in swimming, endurance swimming, sprint training, specialised forms of training swimmers, and swimming speed development, while continuing to perfect the techniques of the swimming strokes. Age group swim training and development. Students are expected to do a study on developing synchronized swimming in their final year as well.

SSC 4114 Sport Specialty Module (Tennis) – Elective 10 Credits

The focus of this module shall be on the diagnosis and correction of both the techniques and tactics in tennis, attention shall be on all strokes; Psychological and physical; Analysis and understanding different tournaments of tennis. Fitness for tennis; Chronological age versus developmental age and Equipment, anatomy of the racket.

SSC 4115 Sport Speciality Module (Soccer) – Elective 10 Credits

The module emphasizes game concepts, ;game model, tactical strategies, nature and development methods of recording and analyzing individual and team activities analysis of the performance of leading clubs and national teams; Periodization of sports training in preparing young players and professional soccer players, structures of macrocycles and microcycles; Evaluation and follow up assessment of conditioning; Management and marketing in soccer structure and management of a professional club; Contracts and transfer system as well as research and applied practice.

SSC 4117 Sport Specialty Module (Volleyball) Elective 10 Credits

This module shall apply the scientific aspects of Sport Science to volleyball. The Module shall examine the study of human movement and its relationship to sports activities. Methods for analyzing and improving performance shall be presented and analysed. The module shall also cover volleyball advanced training techniques, nutritional requirements and volleyball biomechanical analysis.

SSC 4118 Sports Specialty Module Basketball. 10 Credits

The aims of this module are to apply the scientific aspects of Sport Science to basketball. Content shall include training in basketball, nutrition in basketball, biomechanical aspects of basketball, pedagogy in basketball, skill acquisition and motor learning in basketball. Students are expected to contextualize the theory of sports science in basketball.

SSC 4123 - Sport Speciality Module (Cricket) – Elective 10 Credits

The module looks at game concepts, game model, tactical strategies, nature and development methods of recording and analyzing individual and team activities analysis of the performance of leading clubs and national teams; Periodisation of sports training in preparing young players and professional Cricket players, structures of macrocycles and microcycles; Evaluation and follow up assessment of conditioning; Management and marketing in Cricket structure and management of a professional club. Contracts and transfer system; research and applied practice and level 3 International Certification.

Semester II

SSC 4206 - Health, Sport And Sports Recreation 10 Credits

This module shall lead to the full understanding of the effects of exercise on the physiological as well as the psychological wellbeing using a behavioural epidemiological framework.

Physical activity and inactivity within a lifespan shall be studied, together with motivational theories to support and promote a healthy active lifestyle. Other topics to be covered in this module shall include, psychological wellbeing through sport, anxiety and stress, depression, affect and mood, self-esteem, biological rhythms, sleep, cognitive function, dependence and the promotion of sport and health. the epidemiology of exercise and coronary heart disease (CHD) and the influence of exercise on the risk factors for CHD shall be studied. The module should also enable students to plan community sport programs that shall enhance activity, exercise and maintain good health.

SSC 4207 Health, Exercise And Sport Recreation 10 Credits

This module will lead to the full understanding of the effects of exercise on the physiological as well as the psychological wellbeing using a behavioural epidemiological framework. Physical activity and inactivity within a lifespan shall be studied, together with motivational theories to support and promote a healthy active lifestyle. Other topics to be covered in this module shall include, psychological wellbeing through sport, anxiety and stress, depression, affect and mood, self-esteem, biological rhythms, sleep, cognitive function, dependence and the promotion of sport and health. the epidemiology of exercise and coronary heart disease (CHD) and the influence of exercise on the risk factors for CHD shall be studied. The module should also enable students to plan community sport programs that will enhance activity, exercise and maintain good health.

SSC4208 Basic Law, Sports Law And Diplomacy 10 Credits

Sports law has emerged as one of the most important and controversial fields of law in the last fifty years. Sports law overlaps with contract law, employment law, competition law, intellectual property law, criminal law, tort law and many others. There are a number of legal issues which are specific to sport such as policy responses to doping and drug use, athlete behaviour and discipline, corruption, and selection processes. The module will examine these several legal issues pertaining to the different Sport areas and analyse the way in which sport and the law interact. The module will provide an overview of some of the unique legal issues which arise in modern elite and professional sports at a national and international level. Subjects covered may include: commercialisation of sport, national and international governance of sport and sporting organisations; employment and contract law issues relating to elite athletes; labour market controls and issues such as salary caps; disciplinary tribunals and the regulation of athlete behaviour; anti-doping policy and cases; restrictive trade practices; and civil/criminal liability for sporting injuries.

SSC 4209 Advanced Sport Studies 10 Credits

This module is designed to give students further enrichment in the content covered in the areas of mostly Testing and Measurement and Exercise Physiology and Biochemistry, through further practical work both field and laboratory, especially in the area of Kinanthropometry and how it relates to sports performance, Physcial Activity and other Sport related fields.

SSC 4210 Sport Specialty Module (Martial Arts) Elective 10 Credits

The focus of this module shall be conditioning exercises, the five categories of conditioning exercises; Advanced katas demonstrations and their applications. Sparring, prearranged and free sparring; Self defense, principles of self defense and psychology of self defense; Theory of power. Motivation; The progression of physical practice and mental practice; Discipline and respect and Advanced kumite.

SSC 4211 Sports Specialty Module (Gymnastics) Elective 10 Credits
The module focuses on advanced gymnastic movement III; Apparatus work and floor routines, biomechanics of gymnastics and movement analysis; Rhythmic gymnastics is another of the beguiling sports combining athletics with artistry and music.

SSC 4212 Sports Specialty Module (Field And Track – The Combined Events) 10 Credits
The training for the individual events within the combined events follows the same patterns as for those separate events. However, the sequence of the events in a combined meet affects the performance that follow. As such training for combined events has to follow a special system. Hence the content for the module shall cover, Training Theory for Decathlon; Training Theory for Heptathlon; Annual Training for the Decathlo; The training schedules, (special fundamentals of the combined events).

SSC 4213 Sports Speciality Module (Swimming) Elective 15 Credits
Students are expected to continue the development of advanced specialization of individual swimming events. Students shall design and develop training programs for different age group swimmers as well as for special populations. Students shall apply their knowledge in the analysis of the correct swimming techniques in swimming, officiating and judging events. Talent identification and development in swimming shall be done within the clubs that work with the department. Students shall work on a mini project for the application of specific training principles that develop anaerobic and aerobic thresholds in swimming performance. Diving and Synchronized swimming development shall be continued as part of their final year.

SSC 4214 Sport Specialty Module (Tennis) Elective 10 Credits
In this module focus shall be on drills and teaching formations, types of drills and formations. Coaching beginners and intermediate players to play tennis , coaching adult beginners. Coaching beginners and intermediate players with disability : players with amputation, players with cerebral palsy, players with an intellectual disability , players with vision impairment and players with psychiatric disability. Playing the game : tactics and techniques, singles and doubles tactics.

SSC 4215 Sports Specialty Module (Soccer) Elective 10 Credits
In this module, focus shall be on functional tactical, technical, physical and psychological training of all age group soccer players. FIFA, CAF, ZIFA statutes, Managing Football Competitions, Formulation of football Competition rules, FIFA World Cup, AFCON, Euro Technical rules, Fixture formulation, Managing Football conflicts, Ethics and Fair Play in Football.

SSC 4217- Sport Specialty Module (Volleyball) Elective 10 Credits
This module is designed for advanced skills, principles and techniques necessary and fundamental to understanding and playing at an advanced level. Emphasis shall be placed on the 6-2 and 5-1 team offensive/defensive systems and strategies. This module shall also require that students participate in organized round-robin competition. Students shall also learn how to

apply managerial skills in volleyball. The content shall cover planning, implementation and evaluation of volleyball programs and sessions. Students should be able to design long term strategic plans/lesson plans, and to device checklists for monitoring and critique existing volleyball programs.

SSC 4218- Sport Specialty Module (Basketball) Elective 10 Credits

This is a sports specialty module on basketball. The aims of this module are to provide students with knowledge on the managerial aspects of basketball. The content shall cover planning, implementation and evaluation of basketball programs and sessions. Students should be able to design long term strategic plans/lesson plans, to device checklists for monitoring basketball programs, to critique existing basketball programs. Content also includes talent identification in basketball and talent development.

SSC4010 Research Project (Weighted As 2 Modules) 20 Credits

SSC 4223 Sport Specialty Module (Cricket) Elective 10 Credits

This module will focus on functional tactical, technical, physical and psychological training of all age group Cricket players. WR, ARU, ZRU statutes, Managing Cricket Competitions, Formulation of Cricket Competition rules, World Cricket Cup, World Cricket development programs. Contemporary issues in World Cricket, Ethics and Fair Play in Cricket as well as Additional International Certification.

MASTER OF SCIENCE DEGREE IN SPORT SCIENCE AND COACHING

1.0 Degree Profile: Master of Science Degree in Sport Science and Coaching

Institution:	National University of Science and Technology
Type of Degree:	MSc
Credit Load:	300 credits
Level:	SADC-QF - Level 9
Accreditation Organisation(s):	Zimbabwe Council for Higher Education
Period of reference:	Accredited by ZIMCHE 2018

PURPOSE OF THE PROGRAMME

Our innovative, engaging and broad-ranging module will help students to strengthen the practical skills required to work with both elite athletes and the general population. The Master of Science in Sport Science and Coaching degree programme is meant to advance holders of an Honours degrees to Masters Level. It is designed to provide graduates with knowledge of scientific intervention that enhances training and performance, while exercise science has a central role in physical activity programmes aimed at improving the general health. The programme is also meant to cover a wide range of theoretical knowledge, applied practical knowledge and necessary skills to improve the physical health of the nation, to introduce teaching of lifelong fitness strategy, to enhance the performance and physical fitness in sportsmen and sportswomen and to prepare athletes for podium performance. The programme will equip students with practical skills in advanced methods of those areas related to physical activity promotion and implementation, sports training and coaching as well as adequate relevant research methods in sport and exercise science. It will also enable students to become competent in independent work of enhancing sporting endeavours at local, regional and international levels. The program will produce a constant stream of quality graduates who will contribute to the future development of sport and health related exercises thus contributing towards economic development and fulfilling the ZIMASSET aspirations.

2.0 REGULATIONS

The Regulations for the Master of Science Degree in Sport Science and Coaching should be read in conjunction with the Faculty of Applied Science Regulations and the General Academic Regulations.

3.0 ENTRY REQUIREMENTS

The entry qualification shall normally be an Honours Degree with at least a 2.2 classification in any of the following fields: Sports Science and Coaching, Biokinetics, Kinesiology, Exercise Science, Sport Psychology, Exercise Physiology, Physical Education or any other relevant first degree qualification.

4.0 DURATION

This is a fulltime programme which runs over a period of twenty four months. When offered on block release it shall run over two blocks per year for two years. Each Block comprises of 4 weeks Contact Time. A student shall be required to start working on their research project at the beginning of the second year. He/she will give an oral presentation of his/her project work at least two weeks before the end of the last semester. The research project carries 60 Credits.

5.0 ASSESSMENT

Each module shall be assessed by both continuous assessment (35%) and a written examination (65%) at the end of each semester. The eight taught modules shall contribute 60% while the internship and the Research Project report shall contribute 40% of the overall aggregate mark. The Project and Internship modules shall each contribute 20% towards the 40% of the overall aggregate mark.

6.0 ELECTIVE MODULES

A student may select only one elective module per Semester in Year I. Elective modules shall be offered subject to availability of staff as well as demand.

7.0 AWARD OF DEGREE

A student shall be required to earn full Credits in all ten (10) modules which shall include two elective modules (sports modules), the internship and research project/dissertation modules. The classification of the Degree shall be based on the Faculty of Applied Science and the University General Academic Regulations.

PROGRAMME SUMMARY

YEAR

Semester I

Module Code	Module Description	Credits
SSC 5101	Functional Anatomy with Age Morphology	20
SSC 5104	Sports Psychology and Motor Learning	20
SSC 5111	Advanced Biomechanics	30
SSC	Elective Module	20
Total		**90**

Semester II

SSC 5221	Theory of Sports Coaching and Training	20
SSC 5222	Advanced Research Methods in Sports Science	20
SSC 5228	Exercise Physiology and Biochemistry	30
SSC	Elective Module	20
Total		**90**

List of Elective Modules for Year I

YEAR 1

Semester I

SSC 5103	Exercise Biochemistry	20
SSC 5105	Nutrition and Health Related Aspects of Exercise	20
SSC 5106	Psychology and Behavioural Sciences	20
SSC 5107	Kinesiotherapy and Physical Activity Therapy	20
SSC 5108	Adapted Physical Activity	20
SSC 5109	Recreation and Leisure Studies	20
SEMESTER II		
SSC 5212	Track and Field Athletics (Short, Middle and Long Distances/ Jumps/Throws)	20
SSC 5215	Field Sports (Soccer/ Rugby /Field Hockey/Cricket/Handball/Baseball)	20
SSC 5218	Court Sport Games (Basketball/Netball/Volleyball/Tennis/Teniquate/Badminton/ Squash	20
SSC 5213	Water Sports (Swimming/Diving/Canoeing/Water Rafting)	20
SSC 5211	Gymnastics/Mass Display/Dance Sport (Aerobics, Traditional	20

		and Modern Dance)	
SSC	5219	Combat Sports (Boxing/ Weightlifting /Wrestling/Martial Arts (Judo/ Karate)	20
SSC	5220	Tourism, Trekking and Rafting	20

YEAR II
SEMESTER I

SSC	6129	Internship	60
SSC	6010	Research Project	
		Total	**60**

SEMESTER II

SSC	6010	Research Project	**60**
		Total Year II	**60**
		Grand Total of Credits	**300**

MODULE SYNOPSES

YEAR I

SSC 5101 Functional Anatomy With Age Morphology 20 Credits

The module explores human anatomy and age morphology as the basis to understand the nature and function of human movement and specific movement patterns in sport, dance, physical recreation, and rehabilitation; Body axes and planes - positions and directions; Systemic and structural arrangement of living matter; The locomotive apparatus as a whole; Age morphology - origin, growth and aging; The study of bones; Kinematic units; Study of Joints; The vertebral column; The thorax; Skull bones; Bones of the upper extremity - the shoulder girdle and the upper arm, elbow and lower arm; Bones of the lower extremity - the pelvis and upper leg, lower leg, ankle and foot; Connections of bones by articulation; Continuous (immovable) articulation - types; Discontinuous (movable) articulation; Elements of the joints; Mechanics of the joints - freedom and range of movement; Kinematic chains; Articulations between the bones of the upper extremity and of the lower extremity; Connections between vertebrae; The vertebral column as a whole - arches, mechanics, age specificity; Connections between the bones of the chest; Age and kinesiological characteristics of the human bone-joint apparatus; The study of muscles; Systems of internal organs; Circulatory system, Humoral regulation of vital functions; Nervous system and the organs of the senses.

SSC5103 Exercise Biochemistry 20 Credits

The module focuses on Bioenergetics and oxidative Phosphorylation, Metabolic pathways of carbohydrates, lipids, amino acids, nucleic acid metabolism and protein biosynthesis, metabolism of the muscle tissue; Regulation and the integration of metabolism, metabolic and hormonal adaption; Amino acids and proteins, function of proteins, enzymes, structure of carbohydrates; Bioenergetics, Biologic Oxidation; Oxidative Phosphorylation; Role of ATP/ADP cycle; Basic concepts of Metabolism; Glycolysis; Citric acid cycle; Gluconeogenesis; Cori cycle; Glycogen degradation and synthesis, co-ordinated control by enzymatic cascade; Lipids and lipid metabolism; Degradation and synthesis of fatty acids; Ketone body formation; Lipoprotein and cholesterol metabolism; Steroid metabolism; Amino acid metabolism; Urea cycle; Conversion of amino acids to specialised products; Nucleic acid metabolism; Biosynthesis of DNA; Gene rearrangements, transportation and cloning; Biosynthesis of RNA's; Protein biosynthesis; Metabolism of nervous tissue; Na+ K+ ATPase; Biochemistry of neurotransmission; Metabolism of muscle tissue; Biochemistry of muscle contraction; Muscle fiber types; Biochemistry of hormones; Mechanism of action; Transduction by cell-surface receptors; Intracellular messenger systems and transduction by intracellular receptors;

SSC5104 Sports Psychology And Motor Learning 20 Credits

The module examines fundamentals of the theory of motor learning, Analysis and prediction of motor learning strategies; Sports Psychology; Sports education and contemporary culture; Motor learning cognition - diagnostics and prognostics in the motor learning activity; The process of motor learning and training; Nature, specificity, structure and characteristics; Motor learning strategies in the sport Sports Psychology activity; The learning process; Self-education; Development and education; Factors of personality development; Behavioural strategies in the sport pedagogical activity; Pedagogical communication and training in the sport pedagogical activity; Professional and personality model; Age and Sports Psychology; Age psychology and sports psychology, Mental development and psychological sports conditioning from preschool age to advanced and elderly age; Competitive and recreational sports psychology, Regulation and self-regulation of start and pre-start anticipation, Personality enhancement and motivation management, communication and interaction in team sports, conflict resolution and conflict management and overall psychological conditioning of sports activities.

SSC5106 Psychology And Behavioural Sciences 20 Credits
The module covers the psychological and mental factors that influence and are influenced by participation and performance in sport, exercise, and physical activity, Human behaviour: observation in natural settings; survey research: questionnaire and interviewing, experiment; data analyzing, ethical considerations; Personal development through the lifespan: infancy, childhood, adolescence, maturity, old age; gender-related psychology; Perception: perception for self and others; social roles, social influence, attitudes, group processes, cross-cultural perspectives, groups in society, etc memory and learning, thinking and language, emotions, individual differences in intelligence; Personality: Theories of personality: psychoanalytical and Psychodynamic theories, social learning theory and humanist approaches.

SSC5105 Nutrition And Health Related Aspects Of Exercise 20 Credits
The module outlines digestion, absorption and bioenergetics of the food macro and micronutrients, their role in metabolism and energy yield during exercise training and recovery; Use of different nutrients for enhancing physical performance during training, competitions and for effective recovery; Use of different nutrients for enhancing physical performance during training, competitions and for effective recovery; Optimal nutrition for different kinds of sports events and in extreme environmental conditions - heat, high humidity, cold, high altitude; Thermoregulation, fluid balance and dehydration during exercise; The role and place of the food supplementation in exercise and training; Quantity, quality and timing of administration of food supplements determining desirable effect on the performance and recovery or on the body composition ;Ergogenic aids - definition and classification; Pharmacological, chemical and nutritional ergogenic aids evaluated ;Permitted ergogenic aids and their proper administration for enhancing the sports performance and body composition for specific sport events; Body composition assessment - definition and comparative description of the methods of measurement; Reference man and reference woman, essential and storage fat-their optimal content in the body of athletes with different sport specialisation and in the general population; Obesity and weight control; Determining goal body weight/composition and desired energy balance; Designing scientifically controlled weight loss/gain programs; Eating disorders in sportsmen and sportswomen (anorexia nervosa, bulimia nervosa, female athlete triad) and their impact on the health and performance; Athletes at risk and means for minimising the hazards; Physical activity in the population; Ageing, physical activity, health and longevity; Coronary heart diseases and pre-exercise evaluation osteoporosis and exercise; Physical activity, fitness and

hypertension; Physical exercise programmes and their use for the treatment of diabetes and cancer, cardiovascular and pulmonary rehabilitation.

SSC5107 Kinesiotherapy And Physical Activity Therapy 20 Credits

The module focuses on neurologic Care, Orthopedic Care, Cardiac Rehabilitation, Pediatric Care, Psychiatric Care, Geriatric Care, Wellness/Fitness Programs, Post-Rehabilitation Programs, therapeutic exercise, aquatic therapy, learning to walk, using prosthetics/orthotics and developing a lifelong exercise regimen.

SSC5108 Adapted Physical Activity 20 Credits

The module looks at society and persons with disability, Universal Programming and Facilitation, Policy Analysis and Development, Communication and Relationship Management, Wellbeing Health and Disability, Inclusive Sports, Dance ability, Inclusive Fitness, Research Studies in Adapted Physical Activity; Adventure Therapy and Adapted Outdoor Education.

SSC5109 Recreation And Leisure Studies 20 Credits

The module highlights community recreation studies, leisure services in diverse and changing communities, including management, community development and the needs of participants; Outdoor recreation focuses on leadership in the natural environment; Therapeutic Recreation focuses on the goal of ensuring that all individuals, regardless of ability, have access to meaningful leisure in their lives; Students shall gain hands-on experience in providing services to marginalized individuals (people with disabilities and illnesses, recent immigrants, people who experience poverty and older adults) using leisure to improve functional abilities and quality of life; Activities include lectures, outdoor and experiential activities and small group work.

SSC5111 Biomechanics 30 Credits

The module explores mathematical bases; Relationships and their presentation; Applied software; Biomechanical characteristics of movements; Statics; Dynamics; Kinematics and kinetics; Spatial, temporal, and spatial-temporal characteristics; Types of motion and movements; Biochemical classification; Force characteristics -forces, force impulse, quantity of motion, work, energy, power, etc; Inertia characteristics; Body stability variables, torque and momentum of force; Management and control of equilibrium stability; Biomechanics of the human locomotive apparatus; Distribution of mass in the human body; General and specific centers of gravity; Mass and inertia characteristics; Biomechanical properties and characteristics of the motor apparatus; Applied software; Principles for management and control of the motor apparatus; Force structure; Interaction between external and internal force fields (forces of elastic deformation, resistance, friction, drag, specific environmental variables, etc);Biomechanics of the motor qualities and criteria for their quantitative assessment; Training simulators and technical aids; Biomechanical methods of analysis; Kinematographic methods of registration, analysis and modelling using applied software; The main reverse problem and task of biomechanics; Motor control; Management of specific movements; Biomechanical feasibility and expediency; Criteria for assessment of specific motor activities; Complex (functional-anatomical, video-computer, bio-dynamic) analysis and modelling of movement patterns and motor activities.

SSC 5210 Martial Arts (Judo, Karate) 20 Credits

The emphasis of the module is on applied Research Methods, Contemporary Approaches and Modern trends to player Selection and Development in Martial Arts, History, origins, development and distribution of judo in the world, Expertise and Skill Acquisition in Martial Arts (Defense and Attack), Martial Arts Coaching Cultures, Independent Projects, Performance and Match Analysis in Martial Arts , Biomechanics of Martial Arts Players, Professional Development in Martial Arts Coaching , Periodization of sports training in professional Martial Arts, Management and marketing in Tennis and Field Hockey; Refereeing Martial Arts and Advanced Tactics in Martial Arts.

SSC 5211 Gymnastics And Mass Display 20 Credits

The following 7 kinds of specific gymnastics recognized as disciplines by FIG (International Gymnastics Federation) will be studied in the module: artistic gymnastics men, artistic gymnastics women, rhythmic gymnastics, trampoline and tumbling (trampolining), sports acrobatics, sports aerobics, general gymnastics; sports dances , choreography and rhythmics; Complex gymnastic exercises. The module will also look at Analysis and feedback to practice Physical Conditioning, Developing a specific physical conditioning programme for the different age groups, Analysis and evaluation, Research and Practical Activities; Applied Research Methods, Contemporary Approaches and Modern trends in Gymnast Selection and Development, Expertise and Skill Acquisition in Gymnastics, Gymnastics Coaching Cultures, Independent Projects, Performance and Analysis in Gymnastics, Biomechanics of Gymnastics, Professional Development in Gymnastics Coaching , Periodization of sports training in professional in Gymnastics Management and marketing in Gymnastics and Judging Gymnastics.

SSC5212 Track And Field Athletics (Short, Middle And Long Distances/ Jumps/Throws) 20 Credits

The module looks at the historical origins, humanistic bases, conceptual contents and terminology of track and field athletics, Social, biomechanical and physiological bases of walking and running, Sports, technique training, biomechanical and physiological bases of track and hurdle runs, jumps, throws, sprint (dash), (speed, strength and endurance), Specifics of the athletic exercises and drills for girls and women, Medical supervision and prevention of injuries; Principles and rules of using track and field athletics in the educational system as a tool to improve physical development, enhance fitness, and promote health and vitality, Track and field athletics exercises at the first level of physical education, Track and field athletics exercises at the second level of physical education, Track and field athletics exercise at the third level of physical education, Track and field athletics exercise in the system of colleges and universities; Evaluation and assessment, Athletics conditioning; Development of the different forms of speed, strength, power, endurance; Training models for (aerobic) endurance, aerobic-anaerobic endurance, speed (alactic and glycolytic) endurance, jumping power, maximal strength and power, Complex training models and control tests for developing athletic conditioning and fitness at home; Models for recreational track and field athletics in different settings.

SSC 5213 Water Sports (Swimming/Diving/Canoeing) 20 Credits
The module focuses on the theory and fundamentals of swimming as a competitive sport, Different techniques and styles of swimming based on the principles and laws of hydrodynamics, Fundamental principles and laws of buoyancy and interaction with the water environment; Characteristics of the specific techniques of swimming movements and aquatic activities, Technique of Swimming and Cycling styles: (Front Crawl, Back Stroke, Breast Stroke, Butterfly); Applied Research Methods, Contemporary Approaches and Modern trends to player Selection and Development in Swimming and Cycling, Expertise and Skill Acquisition in Swimming and Cycling, Swimming and Cycling Coaching Cultures, Independent Projects, Performance and Analysis in Swimming and Cycling, Biomechanics of Swimmers and Cyclists, Professional Development in Swimming and Cycling Coaching , Periodization of sports training in professional Swimming and Cycling, Management and marketing in Swimming and Cycling; Refereeing Swimming and Cycling as well as the art of Competition Swimming.

SSC 5214 Tennis /Badminton/Squash 20 Credits
The module explores applied Research Methods, Contemporary Approaches and Modern trends to player Selection and Development in Tennis and Field Hockey, Expertise and Skill Acquisition in Tennis and Field Hockey (Defense and Attack), Tennis and Field Hockey Coaching Cultures, Independent Projects, Performance and Match Analysis in Tennis and Field Hockey, Biomechanics of Tennis and Field Hockey Players, Professional Development in Tennis and Field Hockey Coaching , Periodisation of sports training in professional Tennis and Field Hockey, Management and marketing in Tennis and Field Hockey; Refereeing Tennis and Field Hockey; Advanced Tactics in Tennis and Field Hockey.

SSC 5215 Soccer (Football)/ Rugby/Field Hockey 20 Credits
The module examines applied Research Methods, Contemporary Approaches and Modern trends to player Selection and Development in Rugby and Soccer and Field Hockey, Expertise and Skill Acquisition in Football (Defense and Attack), Rugby and Soccer and Field Hockey Coaching Cultures, Independent Projects, Performance and Match Analysis in Football, Biomechanics of Rugby and Soccer and Field Hockey Players, Professional Development in Football Coaching, Periodization of sports training in professional Soccer, and Rugby, Management and marketing in soccer and rugby; Refereeing Rugby and Soccer and Field Hockey; Advanced Tactics in Rugby and Soccer and Field Hockey.

SSC 5218 Basketball And Volleyball 20 Credits
The module explores applied Research Methods, Contemporary Approaches and Modern trends to player Selection and Development in Basketball and Volleyball, Expertise and Skill Acquisition in Basketball and Volleyball (Defense and Attack), Basketball and Volleyball Coaching Cultures, Independent Projects, Performance and Match Analysis in Basketball and Volleyball, Biomechanics of Basketball and Volleyball Players, Professional Development in Basketball and Volleyball Coaching , Periodization of sports training in professional Basketball and Volleyball, Management and marketing in Basketball and Volleyball; Refereeing Basketball and Volleyball as well as Advanced Tactics in Basketball and Volleyball.

SSC 5219 Boxing/Weight-Lifting/Wrestling 20 Credits

The module examines applied Research Methods, Contemporary Approaches and Modern trends in Weight-lifting and Wrestling Development, Expertise and Skill Acquisition in Weight-lifting and Wrestling, Weight-lifting and Wrestling, Coaching Cultures, Independent Projects, Performance and Analysis in Weight-lifting and Wrestling, Biomechanics of Weight-lifting and Wrestling, Professional Development in Weight-lifting and Wrestling Coaching , Periodization of sports training in professional in Weight-lifting and Wrestling, Management and marketing in in Weight-lifting and Wrestling; Judging Weight-lifting and Wrestling; History of Weight-lifting and Wrestling from Antiquity to present day, Development and improvement of the rules and regulations of competitive Weight-lifting and Wrestling, Tactical preparation of the Weight-lifting and Wrestling Physical conditioning of the wrestler - development and improvement of strength, speed, endurance, agility and flexibility; Biomechanical characteristics of Weight-lifting and Wrestling as a competitive sport; Psychological conditioning of the Weight-lifting and Wrestling Management and control of training and coaching in Weight-lifting and Wrestling.

SSC 5220 Tourism, Trekking And Rafting 20 Credits

The module emphasizes health and functional fitness improvement, Emotional and aesthetic appreciation, Educational and intellectual advancement, Introduction to the study of high altitude and its significance, Physical factors of high altitude, High altitude flora and fauna; Wildlife conservation; Lungs ventilation and heart function at high altitude; High altitude pulmonary edeme; Myocardial metabolism, Adaptation and acclimatization, Descent to sea level, Climbing, Mountain travel and wilderness adventure, Trekking in different mountains - grading of altitude; Three-grade classification, Exercise, fatigue and recovery in mountain trekking, Management and control of sports training and conditioning in mountain trekking, Modern trends in mountaineering, sports climbing, high altitude tourism (alphinism), Modern approaches in developing general fitness and specific physical qualities needed for mountaineering.

SSC 5221 Theory Of Sports Coaching And Training 20 Credits

The module focuses on the theory and Methodology of Sport Training, Training as an adaptation process; Training and Development in different ages and gender groups, Training for Sedentary and Active persons, Stress and adaptation reactions in sport, Specific nature of training loads, Specifics of the immediate adaptation, fatigue and recovery, Specific features of the steady-state adaptation; Training state and top form, Specifics of the adaptation process in strength (power) sports, Specifics of adaptation in endurance sports, Specifics of adaptation in speed sports, Specific features of the adaptation process in non-specific conditions; Planning, management, periodization and control of the training (conditioning) process of highly qualified athletes in different sports and sport disciplines, identifying relevant trends and forecasting top sport performance.

SSC 5222 Advanced Research Methods In Sports Science 20 Credits

The module looks at the research Methods of Sports Training and Coaching, Applied statistics in sports, Physical Education, Kinesiotherapy, and Sports Management; efficacy and evaluating the efficiency of various methods used for recovery after the application of kinesitherapeutic procedures and problems related to the rehabilitation of specific injuries; Descriptive Statistics (Frequency Tables and Graphs, Statistics by Computer), Probability Distributions (Binomial, Continuous, Normal, etc;), Sampling and methods of sampling, Point Estimation (mean, Mode, Median), Regression - relating two or more variables (single, multiple regression and extensions, correlation, multicollinearity); Analysis of variance by regression – ANOVA and MANOVA, ;Confidence Intervals, Hypothesis Testing (Two-Sided Test), Nonparametric Statistics (confidence test for the median and confidence interval for the median), Tests of Variance (one-way and two-way ANOVA), Methods for evaluation and estimation of different variables and sets of variables.

SSC 5223 Cricket And Baseball 20 Credits

The module covers the foundations of Cricket and baseball Development; Principles and Practice of Cricket and Baseball Coaching; Scientific Analysis of Cricket and Baseball Coaching; Sport Event Operations; Motor Skill Progression; Contemporary Issues in Sports Coaches; Applied Performance Analysis in Cricket and Baseball; The Sports Entrepreneur; Cricket and Baseball Dynamics; Developing cricket and Baseball from childhood strategies; Sport Event Marketing; Strategic Planning for Sport Events and Facilities; Personal Growth and Team Building Through Outdoor Adventurous Activity in Cricket and Baseball; Cricket and Baseball as a Sport Touristic Industry; Sponsorship and Fundraising.

SSC 5224 Netball And Handball 20 Credits

The module focuses on the foundations of Netball and Handball Development; Principles and Practice of Netball and Handball Coaching Scientific Analysis of Netball and Handball Coaching; Sport Event Operations; Motor Skill Progression; Contemporary Issues in Sports Coaches; Applied Performance Analysis in Netball and Handball; The Sports Entrepreneur; Netball and Handball Dynamics; Developing Netball and Handball from childhood strategies; Sport Event Marketing; Strategic Planning for Sport Events and Facilities; Personal Growth and Team Building Through Outdoor Adventurous Activity in Netball and Handball; Netball and Handball as a Sport Touristic Industry; Sponsorship and Fundraising.

SSC 5225 Aerobic Dance Sport 20 Credits

The module examines the aerobic Activities benefits and values in different communities; Aerobic Dance Sport Background and Origins; Medical Restrictions; Heart Rate Formula; Physical Tests; Aerobic Workout Cardio, Leg Work, Upper Body Strength Work and Abdominal Work; Circuit Training Exercises Used for Aerobic Workout; Dance choreography, Dance displays, dance biomechanics, dance modifications, Modern dances, contemporary dances, current dance trends in different societies; Dances and Research.

SSC5226 Traditional And Modern Dance 20 Credits

The module explores historical/cultural heritage; Cultural, Historical, and Artistic Diversity of dances; Dance phrases, moods, Space Usage and Awareness; Dance choreography, Dance displays, dance biomechanics, dance modifications, Modern dances, contemporary dances, current dance trends in different societies; Dances and Research.

SSC5228 Exercise Physiology And Biochemistry 30 Credits

The module examines exercise metabolism, hormonal adaptation and stress during physical exercise and training, Physiological and biochemical determinants of sports performance; Banned substances and the health hazards of their use, Energy transfer in exercise; Human energy expenditure during rest and physical, exercise; Regulation of pulmonary ventilation during exercise; Acid-base regulation exercise; Cardiovascular regulation and integration during exercise; Functional capacity of the cardiovascular system; Training for anaerobic and aerobic power; Neuronal control of human movement; Muscular strength and strength training; Metabolic adaptation to exercise; Biochemical and physiological principles of sports training; Biochemical and physiological basis of exercise fatigue and post exercise recovery; Exercise and endocrine system; Hormonal response to exercise and sports training; Adaptation and stress; Exercise and immune system; Exercise and thermal stress; Exercise at medium and high altitude; Assessment of physiological and biochemical determinants of sports performance; Banned substances doping);Biochemistry of doping; Mechanism of action; Physiological and pathophysiological impact on the performance and health of sportsmen and anti-doping control.

YEAR II

SSC 6129 Internship 60 Credits

This is a practical module designed to enable the student to refine Sport Science related professional practice, in the chosen field of specialization. The module is designed to enhance theoretical, practical, and soft skills in an applied setting during the Graduate Internship Program.

SSC6010 Research Project 60 Credits

The research Project shall be undertaken by all students during the final year of year II of the program. This module is designed to develop and provide a critical overview of the main methods and approaches used for research into topics areas related to sport nutrition, exercise physiology, biomechanics, physiology, psychology, physical activity, exercise and health, training and coaching, and to equip the student to apply this knowledge in the planning a research proposal. Students will also have an opportunity to appraise the strengths and weaknesses of published work in their specialisation area. The research project must enable students explore philosophical, ethical and methodological differences which underpin various approaches to knowledge generation that can inform Sport Development applications and health care work. The module will ensure students undertake inter-professional workshops which will develop the research proposal, its adequacy and limitations, as the researcher is enabled to read and justify the approaches taken to investigate the study.

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

Yearbook

2018/19

THE MISSION STATEMENT

To lead in human capital development for industrial and socio-economic transformation, with a bias towards science, technology, engineering and mathematics (STEM) based solutions.

THE VISION

To be a world class University in science, technology, innovation, entrepreneurship and business development, spearheading industrialisation locally and beyond.

CORE VALUES

- In the delivery of value to our clients, we pursue academic excellence with integrity, honesty and ethical behaviour.
- We are committed to responsible research and innovation that drives commercialisation and industrialisation.
- We thrive on mutual respect, teamwork and effective partnerships.
- We are driven by a passion to fulfil your dream.

Interpretation of Logo

Colours

- **White** – Facts and Figures
- **Red** – Intuition/ Gut Feeling
- **Green** – Creative Thinking
- **Yellow** – Positive Assessment
- **Blue** – Control of the thought Processes
- **Black** – Negative Assessment

Symbols

- **Star**– Rising
- **Bird**– Zimbabwe
- **Scroll**– Programmes/ Qualifications
- **Cap**– Knowledge
- **Telescope**– Looking
- **Wall** – Industry
- **Shield** – Protection

ADDRESSES

Main Campus:
Cnr Gwanda Road and Cecil Avenue, Bulawayo
Postal Address:
P. O. Box AC 939, Ascot
Bulawayo
+ 263 292 282842| www.nust.ac.zw

OTHER LOCATIONS

School of Medicine
Mpilo Central Hospital
Bulawayo

Institute of Development Studies (IDS)
Surburbs
Bulawayo

Centre for Continuing Education
55 Jason Moyo
Bulawayo
+263 292 88 75 48
+263 292 88 74 88

NUST Guest House
12 Kerr Road
Kumalo
Bulawayo

Harare Office
Zimdef House 18572
Off Mother Patrick Avenue
Rotten Row
Harare
+263 242 251534/ Fax +263 242 794848

FACULTIES AND TEACHING DEPARTMENTS

Faculty of Applied Science

Department of Applied Biology and Biochemistry

Department of Applied Chemistry

Department of Applied Mathematics

Department of Applied Physics

Department of Computer Science

Department of Environmental Science and Health

Department of Forest Resources and Wildlife Management

Department of Radiography

Department of Statistics and Operations Research

Department of Sports Science and Coaching

Faculty of Commerce

Department of Accounting

Department of Banking

Department of Finance

Department of Business Management

Department of Marketing

Department of Insurance and Actuarial Science

Graduate School of Business

Institute of Development Studies

Faculty of Communication and Information Science

Department of Journalism and Media Studies

Department of Library and Information Science

Department of Records and Archives Management

Department of Publishing Studies

Faculty of Engineering

Department of Chemical Engineering

Department of Civil and Water Engineering

Department of Electronic Engineering

Department of Industrial and Manufacturing Engineering

Department of Fibre and Polymer Materials Engineering

Faculty of Medicine

Department of Anatomy & Physiology

Department of Pharmacology and Biochemistry

Department of Pathology

Department of Psychiatry and Social Behavioural Sciences

Department of Nursing and Midwifery Sciences

Department of Surgery and Anaesthestics

Department of Obstetrics and Gynaecology

Department of Paediatrics

Department of Medicine

Faculty of The Built Environment

Department of Architecture

Department of Quantity Surveying

Department of Landscape Architecture and Urban Design (LAUD)

Faculty of Science and Technology Education

Department of Art, Design and Technology Education

PRINCIPAL OFFICERS OF THE UNIVERSITY

Chancellor

The President of the Republic of Zimbabwe,
His Excellency Cde Emmerson DambudzoMnangagwa
LLB, London; Hon. LLD, MSU; Hon. LLD, UZ; Hon. DPIR, GZU; LLB, LPI, UNZA

Vice-Chancellor

Professor Mqhele E. Dlodlo; PhD (Delft University of Technology, The Netherlands); MSEE (Kansas State University, USA); BSEE, BS- Mathematics and Engineering Management (Geneva College, USA)

Pro Vice-Chancellor (Acting): Academic, Research and Consultancy

Dr Nduduzo Phuthi; PhD (Ass & Quality Ass in HE & Training); Pretoria, (2012),MScEd (Science Education); Curtin, Australia (1998), PGradDip (Educational Technology) UZ; 1992,BEd (Biol); University of Zimbabwe(1988)

Pro Vice-Chancellor: Innovation and Business Development

Dr Gatsha Mazithulela; PhD (Genetic Engineering); University of East Anglia, John Innes Centre Norwich, UK (1998); MBA, Middlesex University Business School, London, UK (2002); B.ApSc Hons Biology and Biochemistry (1994)

Registrar

Mr Fidelis Mhlanga; TI Science, Z'bwe; Bed, Msc, UZ; MBA NUST, Z'bwe

Librarian

Ms Katherine Matsika; BA (Hons) Rhodesia, Dip.AdEd.Z'bwe, HDip. LibSci (UNISA)

Bursar

Dr F S Nkomo; B.B.S Z'bwe, MBA Finance, Stirling, C.I.S, Ex DBA (PSB)

Senior Proctor

Professor S. Dube; BSc, MSc Benin, (Nigeria); Grad CE (UZ)

UNIVERSITY COUNCIL

(As constituted in terms of Section 10 of the National University of Science and Technology ActChapter 25..13 (Formerly Act, 1990)

*a) **Ex officio***:

Vice-Chancellor
Professor Mqhele E. Dlodlo; PhD (Delft University of Technology, The Netherlands); MSEE (Kansas State University, USA); BSEE, BS- Mathematics and Engineering Management (Geneva College, USA)

Pro-Vice-Chancellor: Innovation and Business Development
*Dr Gatsha Mazithulela;*PhD (Genetic Engineering); University of East Anglia, John Innes Centre Norwich, UK (1998); MBA, Middlesex University Business School, London, UK (2002); B.ApSc Hons Biology and Biochemistry NUST (1994)

Pro-Vice-Chancellor (Acting): Academic, Research and Consultancy
*Dr Nduduzo Phuthi;*PhD (Ass & Quality Ass in HE & Training); Pretoria, (2012),MSc Ed (Science Education); Curtin, Australia, (1998), PGradDip (Educational Technology) UZ; 1992,BEd (Biol); University of Zimbabwe (1988)

*b) **Appointed by the Minister of Higher and Tertiary Education, Science and Technology Development:***

Ambassador Zenzo Nsimbi; Msc Industrial Metallurgy and Management, Aston University , Higher National Diploma in Metallurgy, Certificate in Metallurgy, Professional Manager's Program, Professional Manager's Workshop, Mineral Project Management in Developing Countries, Finance for Non-Financial

Mrs Nomathemba Ndlovu; MSc Marketing NUST, BCom

Mr Job Sibanda; Bachelor of Laws Honours Degree

Mr Japhet Gwante Ndabeni–Ncube; M.A Economics, Post graduate Diploma, Financial Economics, B. A Economics

Mr Israel Ndlovu; Chartered Management Accountant (CIMA); B.Acc (UZ)

Mrs Sithembinkosi Nyathi; Bachelor of Philosophy Honours in Marketing;Masters in Business Administration, Post Graduate Diploma in Management, Diploma in General Management, Diploma in Marketing Management

Ms Elizabeth Chikwanda; Master of Business Administration (MBA)

Mr Obert Sibanda; Masters of Business Administration, Executive Development Programme, HND Marketing Management, ND Marketing Management, NID in Business Studies, Diploma in Salesmanship, Diploma in SMEs Management & Development

Mr Stephen Nyambuya; Bachelor of Architecture

Engineer Simela Dube; Bachelor of Science Honours (Civic)

Mr Casper Ronney; Master of Business Administration Degree, Bachelor of Science Honours Degree In Accounting, Post graduate diploma in Management, Grad ICSA, Advanced diploma in Accounting and Business, Diploma in Secondary Education

Rev. Dr Rudo Lois Moyo; PhD in Theology, Master of Theology, Honours Bachelor of Theology in Biblical Studies, Certificate in Education

Engineer Todd G Nkiwane; Master of Science in Electrical Engineering, Programmable logic Controller and Mechano-electronics, Wiring Regulations, Portable Appliance Testing
Engineer Gratitude Charis; M Eng. Manufacturing Systems and Operations Management, Bachelor of Engineering Honours Degree in Chemical engineering

Mrs Kezinet Ndhlovu; Master of Business Administration Degree in Banking, Bachelor of Commerce Honours
Degree in banking, Diploma in Credit Management & Advanced Bank Credit Management, Business Systems & Training, Relationship Management, Selling Skills

Mr Chrispen Mugova; Bachelor of Commerce in Accounting

Pastor (Dr) Jefrety Sibanda; Doctor of Ministry in Leadership, Master of Arts in Theology, Bachelor of Education in Educational Administration and Policy Studies, Certificate in Education

Engineer Josephine Makuvara; BSc in Electrical Engineering

Dr Mbongeni Ndlovu; MB ChB, Mmed,

Mr Alois Muzvuwe; Master of Science in Finance and Actuaries, Bachelor of Commerce Honours Degree in Actuarial Science

Ms Bridget Chipungu; Master of Science in Telecommunication Engineering, Bachelor of science in Electrical Engineering, Certificate in Project Management

Engineer E Gwaze; Master of Business Administration, Bachelor of Science Honours Degree in Metallurgy

Ms Fiona Gandiwa Magaya; Certificate in Public Policy, Governance and Leadership, Post Graduate Diploma in law Conciliation and Arbitration, Certificate in Globalisation and Labour Rights, Certificate – Educators development Training, Certificate in Paralegal Training, Diploma in Business Studies accounting

Mr Godwin Zarura Manyonganise; Certificate in Management of Development Programme, Certificate in Post Harvesting and Processing of Certificate in Monitoring and Evaluation, Horticultural Crops, LCCI Diploma In Marketing, Diploma in Project Planning and Management; National Diploma in Agriculture

Mrs Mildred Mkandla; MSc Health Education, (University of London), BA Hons Applied Social Studies; Certificate in Health Visiting, Certificate in Neonatal Intensive Care, State Certified Neonatal Intensive Care, State certified Midwife's Certificate, State Registered Nurse, Primary Teacher's Certificate

c) ***Appointed by the Senate:***

Engineer Dr A Chinyama
Dr D J Hlatywayo
Ms V Madiro
Mr H Tshuma
Dr P Nkala
Professor P J Mundy
Mr T Nyamande
Mrs A Chivore
Professor L Nkiwane
Professor E O Enwerem
Dr N Phuthi
Dr C Mabhena
Ambassador M Ngulani
Mr M Mukawa

d) ***President of the Student' Union (Ex officio):***
Mr D Mwashita

e) ***A distinguished Academic Appointed by the Council on the recommendation of Senate:***
Professor P J Mundy

f) ***A woman appointed by the Minister to represent women's interests:***
(Vacant)

g) ***Elected by the Non-Senate Members of the Academic Staff and approved by the Vice-Chancellor:***
Mr Alois Muzvuwe

h) ***Elected by the Administrative Staff and approved by the Vice-Chancellor:***
Mr Lawrence Ncube

i) ***Appointed by the Workers Committee and approved by the Vice-Chancellor:***
Mr R Dube

j) ***Appointed by the Minister from the Zimbabwe Congress of Trade Union (ZCTU):***
(Vacant)

k) ***Appointed by the Minister from a list of Associations or Organisations representing Lecturers/Teachers Associations:***
(Vacant)

l) ***Appointed by the Minister from a list of the Zimbabwe National Chamber of Commerce (ZNCC):***
(Vacant)

m) ***Appointed by the Minister from a list of the Confederation of Zimbabwe Industries (CZI):***
(Vacant)

n) ***Appointed by the Minister from a list of the Council of Zimbabwe Institution of Engineers:***
(Vacant)

o) ***Appointed by the Minister from a list of names of the Chamber of Mines of Zimbabwe:***
(Vacant)

p) ***Appointed by the Minister from a list of names of Farmers' Union:***
(Vacant)

q) ***Appointed by the Minister from a list of Church Organisations:***
(Vacant)

r) ***Appointed by the Minister from a list of Organisations representing the Youth Secretary:***
The Registrar

ADMINISTRATIVE STAFF

Vice-Chancellor
Professor Mqhele E. Dlodlo; PhD (Delft University of Technology, The Netherlands); MSEE (Kansas State University, USA); BSEE, BS- Mathematics and Engineering Management (Geneva College, USA)

Communication and Marketing
Director –*Mr Felix F. Moyo*; MSc Marketing, BA Comm & Ind.Psy
Marketing-*Lindiwe Nyoni*; MSc Journalism & Media Studies, BSc Journalism & Media Studies

Pro-Vice-Chancellor (Acting): Academic, Research and Consultancy
Dr Nduduzo Phuthi; PhD (Ass & Quality Ass in HE & Training); Pretoria, (2012),MSc Ed (Science Education); Curtin, Australia, (1998), PGradDip (Educational Technology) UZ; 1992,BEd (Biol); University of Zimbabwe (1988)

Research and Innovation Office
Director- *Y S Naik;* BSc (Univ of Bombay), MSc (Univ of Bombay), PhD (Univ Zim)
Chief Research Officer- *P Makoni*; BSc (Hons) (UZ), MSc (UZ), PhD (Univ of Copenhagen)
Research Administrator- *Cinderella Dube*; Cert in Education, (UZ), Cert in Env. Edu., (Rhodes), B.A., (UNISA), M.ED. (EAPPS), (ZOU), MBA, (NUST)

Centre for Continuing Education
Professor S Mpofu; B Admin, MSc RUP (Rhodesia), PhD Michigan State

Senior Assistant Registrar/AVU Learning Centre Manager
Mr V A Mkandla; BA GRAD C.E MPhil, UZ. Diploma Personnel Mgt and Industrial Relation CTC, UK

Administrative Assistant
Buhlebenkosi Bumhira; B.Com (UNISA)

Pro-Vice-Chancellor: Innovation and Business Development
Dr Gatsha Mazithulela; PhD (Genetic Engineering); University of East Anglia, John Innes Centre Norwich, UK (1998); MBA, Middlesex University Business School, London, UK (2002); B.ApSc Hons Biology and Biochemistry NUST (1994)

Innovation and Business Development Operations Manager (Acting)
Arnold Moyo; Bachelor of Textile Technology, Master of Science in Marketing

Alumni Affairs Officer
Concillia Mpofu; Bsc Hons. Journalism and Media Studies – NUST, PGDIP - Management in Marketing – University of Cape Town

Innovation, Product and Service Development
Acting Director
Mr A Ncube; BA, Media Studies, MSc. Information Science, MIP. (Masters in Intellectual Property)

Physical Planning Works and Estate
Acting Director
Mr. M. Maphosa; BQS (Hons) in Quantity Surveying, NUST

Administrative Officer
Mr R. Moyo; BA (Gen), PGDE, UZ; MBA, MSc Mktng, NUST

Information and Communications Technology Services
Director
CC L Sibanda; BSc (Hons) Comp Science NUST Z'bwe; MSc Elect Eng (Telecoms), UCT

Managers
Mr Z E Ndlovu; BSC Computer Science, MSc Information Systems
Ms Novuyo N T Bobo; BBA Computer and Management Information Systems, MSc Computer Science, Diploma in ICT and Pedagogical Development.
H Tsokodayi, BSc (Hons) Comp. Science NUST Z'bwe

Engineers
Mr Alan Ntini; BSc (Hons) Computer Science, MBA
Ndlovu Thulani; BEng (Hons) Electronic Engineering (NUST) Reading MSc in Communication Engineering (UZ)

Webmaster
Ngqabutho B Nhlabano; BSc Computer Science, MSc Information Systems

Chief Technician
Tiese D Maseko; BSc (Hons) Computer Science (NUST)

Registrar
Mr Fidelis Mhlanga; TI Science, Z'bwe; Bed, Msc, UZ; MBA NUST, Z'bwe

Deputy Registrar, Academic
Mr E Phiri; BSc (Hons) Pol Admin, UZ, MBA NUST Z'bwe

Senior Assistant Registrar: Admissions and Student Records
Mr L J Hadebe; Med (ZOU), BEd (UZ), Cert in Edn (Gwanda Zintec)

Administrative Assistant : Admissions and Student Records
Mrs Shorayi Manjeru; MBA (Executive) (NUST), B Mgt Human Resources, ND Secretarial Studies

Administrative Assistant:Admissions and Student Records
Mrs D Dengu; BEd, Bristol, Dip Ed, MED, UZ, IPMZ fellow

Senior Assistant Registrar: Examinations
Mrs J Nyathi; JEB TIP Diploma in Typing, Pitman UK, BA English and Communication ZOU, MBA NUST Z'bwe

Administrative Assistant - Examinations
Ms Ndlelenhle Mpala; MSc RAM, BSc(Hons) RAM NUST

Deputy Registrar, Administration
Ms V R Dube; Cert Tng & Dev. (IPMZ), Dip. Pers. Mgt (IPMZ) BSc Home Economics Messiah USA, MBA NUST

Senior Assistant Registrar: Human Resources – Academic Section
Mr T Moyo; BA, Grad CE (UZ); MBA NUST; Dip Training Mgt; Higher Dip HR

Senior Assistant Registrar: Human Resources– Non -Academic Section
(Vacant)

Senior Assistant Registrar: Human Resources – Training and Staff Development Section
Mrs Nonsikelelo Ndlovu; BBA, Solusi; MBA, NUST

Administrative Assistant: Human Resources
Mrs Faith Ndlovu; B Com (Hons) HR, HND in Secretarial

Central Services: **Acting Assistant Registrar**
Mrs Monicah Matema; B. Management Human Resources (ZOU), MSc Marketing (NUST)

Security
Chief Security Officer
Mr C C Banda; MSc Aeronautical Eng, Hellenic Academy-Greece, City and Guilds, QA Psc. SqnLdr (rtd)

Administrative Assistant
Mr L Mazhanyuro; EMBA (NUST), B Ad Edu (UZ), Dip in Ad Edu (UZ), Dip in Dev and Disaster Management (NUST), Soccer Referees' Certificate (ZiFA), InterAction Leadership

Programme (British Council), Police Driving School Instructor's Certificate (Z R Police Driving School), Certificate of Achievement, Manager's Toolkit (Aura Factor), Certificate of Attendance (Human Rights and the Law) (Legal R/Foundation), Human Rights and the Law (ZiPAM), Basic Counselling and Communication (ZOU), Certificate in Internal Controls and Fraud detection (NUST), Certificate of Attendance, Communication (Rowa), Certificate in Basic Counselling Skills (ZOU), Certificate in Security, Human Rights and the Law (NUST CCE)

Security Officer
Abednico Dube; MSc Disaster Management, BSc (Hons) degree in Police and Security Studies (BUSE), Diploma in General Management (CACC), Certificate in Training Methods (UZ), Certificate in Basic Police Training, Certificate in Investigations

Student Affairs Division
Dean of Students
Sibongile Kamusoko; Doctorate in Educational Leadership (Ed.D)
(Higher Education Administration)

Assistant Dean of Students
Stylish Magida; CE, (UCE); STC (Hillside); Dip Adult Edn, Bed, Med, MAdult Edn, UZ

Student Health Services- Medical Doctor
(*Vacant*)

Chief Nursing Sister
(*Vacant*)

Student Employment and Career Guidance
C. Ncube; Dip in Edn (Hillside Teachers College), Dip in French (University of Tampon, Reunion), BSc Hons Sociology (UZ), MA UNISA

Director Residences, Campus Life and Catering
Mr P Z Khumalo; Bachelor of Education (Bed) (Chem) (UZ)University Certificate in Education (CEd-Sc) UR, Master in Business Administration (MBA) (UZ)

Chaplain
Mr T Dube; BA Hons (UZ), Grad CE (UZ), Dip in Church Ministry (Calgary University, CA), MIIM (SIT, USA)

Senior Administrative Assistant
(*Vacant*)

Sports Administrator
Judith Siziba; BSc (Hons) in Sports Science and Coaching (NUST), Master of Sports Science and Coaching (University of KwaZulu Natal)

Administrative Assistant (Sports)-
Sibonile Madhodha; Dip, Edu, UZ. BSc. Sports, ZOU

Student Counselor
Sibongile Munzara; Bsc (Hons) Counseling, MBA
Racheal Ndebele; MSc in Counseling, BSc (Hons) Psychology; Dip in Edn

Librarian
Ms Katherine Matsika; BA (Hons) Rhodesia, Dip.AdEd.Z'bwe, HDip. LibSci (UNISA)

Bursar
Dr F S Nkomo; Ex DBA (PSB), B.B.S Z'bwe, MBA Finance, Stirling, C.I.S

Deputy Bursar Accountancy & Systems Management
Ms T. Ncube; B Sc Economics(UR), ACMA (CIMA)

Deputy BursarFinance and Administration
R Noko; BCom(Hons) Accounting, MCom Accounting, CPA (Zim), RPAcc (Zim)

Principal Accountant
Mr Lawrence Ncube; Msc - Banking and Financial Services (NUST-Zimbabwe), Bcom (Honors) in Banking (NUST-Zimbabwe), Cert.in basics of Business University of South Africa (UNISA), Cert.in Retirement Funds Trusteeship Insurance Intitute of Zimbabwe (IIZ)

Mr C Ncube; B Com Accounting (ZOU), MBA (Banking and Finance) (UZ)

Nomathemba Moyo;   MBA Banking and Finance (NUST), BCom Hon in Accounting (MSU), HND Higher National Diploma in Accountancy (Byo Poly)

Procurement Manager(Acting)
Mrs T Ngwenya; BCom Hons Purchasing and Supply, HND Purchasing and Supply Mgt, PGDM in Mgt

Assistant Accountants
Ms T Karikoga; HND (Bulawayo Polytechnic), B.Com Accounting (NUST) Master of Science in Finance and Investments (Nust)

Phendlinhlalo Nkomo; BBA -Accounting degree

HISTORICAL PERSPECTIVE

The idea of a Second University in Zimbabwe was first mooted in June 1982 in the Report of the University of Zimbabwe, Vice Chancellor's committee of Inquiry into the high failure rates which that University experienced in the years 1980 and 1981. The report observed that:

> "*It is estimated that the maximum number of students which the present campus can carry is about 6 000. From existing projections there will be about 5 000 students by 1985 and 6 000 in 1986 or 1987. This fact together with the already existing problem of applicants with minimum requirements failing to gain admission makes it imperative that plans should begin to be made for the establishment of a Second University Campus in Zimbabwe. The committee considered that the best and most cost effective way to do this is to set up another campus of the University of Zimbabwe which will grow towards specialisation in certain fields of study such as Education/and orScience and Technology. The campus could eventually grow into a College of the University of Zimbabwe and perhaps, into a Second University in the long run".*

Unfortunately, this recommendation was not taken seriously at the time. Government seemed to have considered the matter to be premature while the University of Zimbabwe thought it was largely a matter for the Government to decide upon.

It was not until late 1987, that the Vice Chancellor of the University of Zimbabwe, Professor W. J. Kamba, discussed with his colleagues the necessity of approaching Government about setting up a feasibility study of a second university/campus. As a result of this discussion a recommendation was made to the then Minister of Education, Dr Dzingai Mutumbuka, that a Commission be set up to look into the question of a second institution of higher education in Zimbabwe.

On the 15th of April 1988, His Excellency the President, Cde R. G. Mugabe appointed a Commission under Statutory Instrument 59A. Seven Commissioners were sworn in on April 25, 1988, by the Acting President, Cde S. V. Muzenda. The three remaining commissioners were sworn in by His Excellency the President himself on June 15, 1988.

The membership of the commission was as follows:

Mr P. R. Williams: (Chairman)
Dr S. Mahlahla
Professor R. J. Amonoo
Mr S. R. S. Dangarembwa

Mr M. F. Haddon
Professor Z. Krajina
Rev. G. Malaba
Mr S. C. Mumbengegwi
Professor E. A. Ngara
Dr G. G. Sikipa
Mr S. Q. Mphisa served as Commission Secretary

The commission was given comprehensive terms of reference, among which were:

- To investigate the need for and assess the feasibility of setting up a Second University/Campus bearing in mind the manpower requirements and development objectives of Zimbabwe.
- To make recommendations on whether the Second University/Campus should have a Science and Technology bias and or other alternative bias, taking into account the need for rapid technological and industrial development in Zimbabwe.

The Commission presented its report to His Excellency the President on the 1st of February 1989. Its major conclusion was that, on the basis of manpower requirements for economic growth as well as the increasing number of well qualified `A' level school leavers, University expansion *"is not only justified: it is also a necessity"*.

After considering the argument put to it for different possibilities in which University education could be expanded, such as: the creation of a new autonomous University; the establishment of a second major campus of the University of Zimbabwe; or starting several University Colleges or satellites in different parts of the country, the Commission opted for a new autonomous University.

It recommended that a *"Second University should be established with a Science and Technology bias"*, and that the University "*be located in Bulawayo and should admit its first students in 1993"*.

After considering the report of the Commission, the Government of Zimbabwe decided to accept all the recommendations contained therein, except the one relating to the timing of the first intake of students. Instead of 1993, the government decided that the University should open its "doors" to the first intake of students in May 1991.

However, there was a delay in taking steps for the actual implementation of the commission's report. It was not until late 1989 that a committee was formed by the Ministry of Higher Education to make a first draft of the new University's enabling legislation. The final draft Bill was presented to the Zimbabwe Parliament by the then Minister of Higher Education, Cde David Karimanzira on the 24th of October, 1990.

It was piloted through Parliament together with a Bill amending the 1982 University of Zimbabwe Act. The effect was to make the Acts of the two universities virtually identical. Some of the provisions of the two Bills were considered controversial by the University community. Students and staff demonstrations were held at the University of Zimbabwe against these provisions which were considered as significantly reducing the University's academic freedom and autonomy by shifting the power base towards the Government.

In spite of the demonstrations, protests and protracted discussions which followed the publication of the Bills, they sailed through Parliament and have now become laws of Zimbabwe. The name "National University of Science and Technology (NUST)" was adopted for the New University in Bulawayo.

Meanwhile, even before the new University Bill was presented to Parliament the Minister of Higher Education had constituted the Foundation Committee of the then proposed National University of Science and Technology.

The membership of the Foundation Committee was as follows:-

Professor P. M. Makhurane (Chairman)
Professor C. J. Chetsanga (Vice-Chairman)
Dr F. Takawira
Professor G. L. Chavunduka
Dr E. J. Chanakira
Dr M. N. Mambo
Dr S. C. Mumbengegwi
Mr M. M. Ndubiwa
Mr A. Maboyi-Ncube
Mr W. Bako
Dr J. B. Dube
Mr F. Munezvenyu
Mr V. R. M. Nyathi
Dr S. Muchena
Mr N. Kudenga
Mr P. M. Kodzwa
Mrs S. D. Nyoni
Mr A. Read
Mr A. Moyo
Mr R. Chitrin
Mr P. S. Mahlangu
Eng. M. Grant
Mr N. Mabodoko
Mr E. W. Sansole
Mr Justice G. Chinengundu

The Foundation Committee was officially launched by the Minister of Higher Education in the Large City Hall in Bulawayo on the 17th of August 1990. It became a legal entity on the 21st of December 1990 when the National University of Science and Technology Act was published in the Government Gazette.

By the time it was dissolved the Foundation Committee had met nine times. Most of its work was carried out by the Chairman who operated on a semi-full time basis having been kindly and informally seconded to NUST by the University of Zimbabwe.

In order to expedite its work, the Foundation Committee established several Sub-Committees including the following:-

the Executive Sub-Committee

the Academic Sub-Committee

the Planning/Building Sub-Committee

the Senior Non-Academic Staff Sub-Committee

the Staff Development Sub-Committee

Like the Foundation Committee, these Sub-Committees operated until the proper Council of the University had been constituted. The terms of reference of the Foundation Committee were set out in Section 30 of the Act (See Part VI).

In spite of numerous rather frustrating delays resulting from the launching of the Foundation Committee before the enabling Act had been promulgated, the long gap between the presentation of the Bill to Parliament in October 1990 and its Publication in December 1990, the lack of financial and budgetary provisions for the work of the Committee and the protracted negotiations with Treasury emanating from this, the Foundation Committee managed to meet the deadline set by the Minister of Higher Education at the launching ceremony.The Committee managed to arrange for the first intake of students into NUST to take place in April 1991.

The Committee further decided that for the 1991 academic year the University should offer first year teaching in the Faculties of Commerce, Industrial Technology and Applied Sciences. These were chosen mainly by virtue of the fact that they offered courses which were closest to those which were being offered by the University of Zimbabwe through its Bachelor of Technology (B. Tech.) programme at the Bulawayo Polytechnic. This made it possible for NUST to make use of the facilities at the Bulawayo Polytechnic for the benefit of its first year students. B. Tech. staff in Bulawayo were appointed by NUST and the transitional arrangements were satisfactory.

Meanwhile, the University of Zimbabwe decided to phase away the B. Tech. programme in the wake of the establishment of NUST. Thus there was no intake into the B. Tech. Programme in 1991.

However, the 2nd, 3rd and 4th year students on the B. Tech programme continued to be taught at both the Harare and Bulawayo Polytechnics. The academic staff were fully consulted on this and they were aware of the fact that for the next few years they would serve the interests of both Universities. A special honorarium was to be paid to them in recognition of this arrangement.

In appreciation, the Chairman of the Foundation Committee, Professor P.M. Makhurane, wrote,

> *"As former Chairman of the Foundation Committee I wish to express my great appreciation to all members of the Committee for their co-operation and assistance at all times. Although some of the meetings were called at very short notice we managed to achieve good attendance so that decisions could be taken. I also wish to extend my gratitude to all the people who were so ready to render their services either as members of the Sub-Committees or in other capacities. The then Permanent Secretary of Higher Education, Dr E. J. Chanakira, deserves special mention for his willingness to bend some of the rules in order to place facilities, equipment and personnel at the Foundation Committee's and my disposal. The principal of the Bulawayo Polytechnic, Mr A. Maboyi-Ncube, apart from being a member of the Foundation Committee also assisted the Committee tremendously in willingly allowing us to use his Board Room for all our meetings and for providing tea and some lavish meals. The then Acting Principal of the United College of Education, the late Mr G. T. Msengezi and the Principal Miss S. Chakanyuka were of invaluable service to me in that they provided the two offices and their Guest House to the National University of Science and Technology. After providing the offices and the Guest House, they continued to be very valued "neighbours" and they were untiring in offering help in all sorts of ways including some meals, teas and the collection of very heavy mail. I must express my appreciation for the services of Miss Ketiwe Dhliwayo who will go down in history as the first Secretary of the National University of Science and Technology. She was kindly seconded to me by the Secretary for Higher Education to assist with all the secretarial work. She discharged her duties with distinction and much patience. Later on she was joined briefly by Miss Thembinkosi Dube as a Temporary Clerical Assistant and more permanently by Miss Eureka Dube in the same capacity. I wish to express my personal hope that the National University of Science and Technology will grow to become a flourishing and reputable institution not only in Zimbabwe and in Southern Africa but also among the international fraternity of Universities. I hope and pray that it will achieve its Mission of, among other things, 'encouraging in all its members and in society those attitudes of fair mindedness, understanding, tolerance and respect for people and views which are essential for the attainment and maintenance of justice, peace and harmony at all times".*

On the 8th of April 1991, NUST opened for the very first time with 270 students in the three Faculties mentioned above. The number of academic staff was 28.

On the 19th of May 1991, Professor P. M. Makhurane was appointed as the inaugural Vice-Chancellor of the University and soon after that Mr Lameck Sithole and Mr Michael Kariwo were appointed as the first Bursar and first Registrar respectively. Other staff followed and by the 1st of October 1991, the total number of people involved on a full-time basis with what was going on at NUST was as follows:-

270 students

28 academic staff

41 administrators

11 support staff

On the 28th of October 1991, the University organised a large public ceremony to install its first Chancellor, His Excellency Cde R. G. Mugabe, President of Zimbabwe and its first Vice-Chancellor, Professor Phinias Makhurane, as well as to lay the institution's Foundation stone. The ceremony was held at the University site where a large and colourful camp had been constructed for the purpose. A separate report on the installation and Foundation laying ceremony wasprepared and all the speeches delivered on that day are included in the report.

For the 1992/93 academic year the University admitted an additional 300 students into the first year in the three existing faculties viz. Commerce, Applied Science and Industrial Technology. Student numbers grew to over 1200 by 1995. During the same period Academic Staff in post grew to 85.

On Saturday 27 May 1995 the University held its first Graduation Ceremony at which the Doctor of Technology honorary degree was conferred upon the President and Chancellor, Cde R.G. Mugabe. Some 163 graduates from the Faculties of Commerce and Applied Sciences were capped. This was indeed a historical event.

On the 20th of July, 1996 the University held its second graduation ceremony, where 281 graduands were capped. The first cohort of graduates from the Faculty of Industrial Technology and the Department of Computer Science were conferred with degrees on that occasion.

The generous donation by the Bulawayo City Council of a site 160 hectares in size and provision of a capital budget by Government enabled the first construction phase to begin.

The Building programme was initially delayed by the shortage of water in Bulawayo. Work started in March 1992 when the first contract valued at Z$4,6m was awarded to A. P. Glendenning for the bulk earth works and civil engineering construction for roads. Briefs for the building were completed in May 1992. In July 1993 the construction programme started with the award of our first contract to Belmont Construction for the Administration Block. A year later, in September 1994 the second contractor, International Construction Zimbabwe started work on the Faculty of Commerce block. In November and December 1994 work also started on the departments of Chemistry and Chemical Engineering respectively. Construction of the first student hostel began a year later, in September, 1995. However, progress on the construction of this building has been hampered by cash flow problems. Work on the Library began in April 1998, followed by the Ceremonial Hall and the Student Services Centre in November of the same year.

The University moved to campus on the 1st of August, 1998, to occupy the Faculty of Commerce and Administration Buildings. The first lectures on campus took place in the Faculty of Commerce Building on the 17th of August, 1998.

THE NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY ACT, 1990 ARRANGEMENT OF SECTIONS

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY ACT CHAPTER 25.13
(FORMELY ACT, 1990)

ARRANGEMENT OF SECTIONS

Section

30. Appointment and Functions of Foundation Committee.

SCHEDULE: Statutes of the University

To establish the National University of Science and Technology and also to provide for matters connected therewith or incidental thereto.

ENACTED by the President and the Parliament of Zimbabwe.

Short title and Date of Commencement	1.	(1)	This Act may be cited as National University of Science and Technology Act Chapter 25..13 (formerly Act 1990).
		(2)	Sections two to twenty-nine shall come into operation on a date to be fixed by the President by statutory instrument.
		(3)	This section and section thirty shall come into effect on the date of publication of this Act.

Interpretation 2. (a) In this Act:-

"Academic Staff" means all persons employed, whether full-time or part-time, by the University as –

(a) professors, lecturers of any class or persons engaged in research; or

(b) holders of posts declared by the Senate to be academic posts:

"Administrative Staff" means all persons employed by the University who are categorized in terms of the Statutes as members of the administrative staff;

"Bursar" means the person holding office as Bursar of the University in terms of Section Eighteen;

"Chairman of Department" means a person appointed in terms of the Statutes to be chairman of a Teaching Department or head of an Institute or Centre controlled by the University;

"Chairman of the Council" means the person elected to be chairman of the Council in terms of Section Twelve;

"Chancellor" means the President in his capacity as Chancellor of the University in terms of Section Seven;

"Council" means the University Council established in terms of Section Ten;

"Faculty" means a Faculty of the University established in terms of the Statutes;

"Institute" means an Institute established in terms of the Statutes;

"Librarian" means the person holding the office of Librarian of the University in terms of Section Nineteen;

"Minister" means the Minister of Higher and Tertiary Education, Science and Technology Development or any other Minister to whom the President; may from time to time assign the administration of this Act;

"Non-academic staff" means all persons employed by the University who are not members of the academic staff;

"Pro-Vice-Chancellor" means a person holding office as Pro-Vice-Chancellor in terms of Section Nine;

"Professor" means a professor of the University;

"Registrar" means the person holding office as Registrar of the University in terms of Section Seventeen;

"Regulations" means regulations made by the Senate under Section Twenty-eight;

"Senate" means the Senate established in terms of Section Fourteen;

"Senior," in relation to the staff of the University, means the Registrar, the Bursar and such other members of staff as the Council may determine from time to time;

"Statutes" means the Statutes of the University set out in the Schedule as amended from time to time or replaced in terms of Section Twenty-seven;

"Students' Union" means any association of students recognized by the Council as the Students Union;

"University" means the National University of Science and Technology constituted in terms of this Act;

"Vice-Chancellor" means the person holding the office of Vice-Chancellor in terms of Section Eight;

"Workers" means all persons employed by the University who are categorised in terms of the Statutes as workers.

Establishment of the University

3. (1) There is hereby constituted a university to be known as the National University of Science and Technology.

(2) The University shall be a body corporate with perpetual succession and shall be capable of suing and being sued in its corporate name and subject to this Act, of performing all acts that bodies corporate may by law perform.

Objects and Powers of the University

4. (1) The objects of the University are the advancement of knowledge with a special bias towards the diffusion and extension of science and technology through teaching, research and, so far as is consistent with these objects, the nurturing of the intellectual, aesthetic, social and moral growth of the students of the University.

(2) For the achievement of its objects, the University shall, subject to this Act, have the following powers:-

(a) to provide for research and courses of instruction, whether on a full-time or part-time basis, by correspondence or extramurally, and to take such other steps as may appear necessary and desirable for the advancement and dissemination of knowledge;

(b) to hold examinations and to confer degrees, including honorary degrees, diplomas, certificates and other awards, upon persons who have followed courses of study approved by the Senate and additionally, or alternatively, have satisfied such other requirements as may be determined by the Senate;

(c) to provide courses not leading to degrees, diplomas or certificates, including training for persons wishing to enter the University;

(d) to provide opportunities for staff and students and such other persons as the University may approve to engage in productive activity in the fields of science and technology and any other fields in which the University may from time to time be engaged;

(e) to promote research with emphasis on scientific, technological, industrial and developmental projects, with particular reference to the developmental needs of Zimbabwe;

(f) to institute professorships, lectureships, research fellowships, staff development fellowships and other posts and offices and to make appointments thereto;

(g) to institute and award fellowships, bursaries, prize medals, exhibitions and other distinctions, awards and forms of assistance consistent with its objects;
(h) to erect, equip and maintain laboratories, offices, halls of residence, lecture halls, libraries, museums and other buildings and structures required for the promotion of its objects;
(i) to regulate and provide for the residence of its students and members of staff;
(j) to provide and maintain sports fields and other recreational facilities for its students and members of staff;
(k) to demand and receive such fees as may from time to time be prescribed by or in terms of the Statutes;
(l) to enter into such contracts and to establish such trusts and to appoint such staff as the University may require;
(m) to establish pension, superannuation or provident or other credit fund schemes for the benefit of its staff or any section thereof and to enter into arrangements with the Government or any organization or person for the operation of such schemes;
(n) to acquire any property, movable or immovable, and to take, accept and hold any property which may become vested in it by way of purchase, exchange, grant, donation, lease, testamentary disposition or otherwise;
(o) to sell, mortgage, let on hire, exchange, donate or otherwise dispose of any property held by it;
(p) to invest in land or securities such funds as may be vested in it for the purpose of endowment, whether for general or specific purposes, or such other funds as may not be immediately required for current expenditure;
(q) to borrow money for any purpose which the Council thinks fit;
(r) to lend money in the form of short-term loans to its staff on terms and conditions approved by the Council;
(s) to do all such acts and things, whether or not incidental to the powers specified in this subsection and whether inside Or outside Zimbabwe, as may be requisite in order to further its objects or any of them.

Membership of the University

5. The University shall consist of:-

(a) a Chancellor, and
(b) a Vice-Chancellor, and
(c) one or more Pro-Vice-Chancellors, and
(d) members of the Council, and
(e) members of the Senate, and
(f) members of staff, and
(g) students, and
(h) the Convocation

Prohibition against discrimination in membership of University

6. (1) No test of religious or political belief, race, ethnic origin, nationality or sex shall be imposed upon or required of any person in order to entitle him to be admitted as a member of staff or student of the University or to hold any office therein or privilege thereof.

(2) Nothing in subsection (1) shall be constructed as preventing the University from giving preference to citizens or residents of Zimbabwe when making appointments or promotions or when admitting students.

Chancellor

7. (1) The President of Zimbabwe shall be Chancellor of the University.

(2) The Chancellor shall be the Head of the University.

(3) The Chancellor shall have the right:-

(a) to preside over any assembly or meeting held by or under the authority of the University, and

(b) upon the recommendation of the Council and the Senate, to confer degrees, diplomas, certificates and other awards and distinctions of the University and to withdraw or restore such awards.

Vice-Chancellor

8. (1) The Vice-Chancellor shall be appointed by the Chancellor after consultation with the Minister and Council and shall hold office for such period as is provided in his contract of employment.

(2) Subject to the general control of the Council, the Vice-Chancellor shall be the chief academic, administrative and disciplinary officer of the University, with general responsibility for maintaining and promoting the efficiency, effectiveness and good order of the University.

(3) Subject to sub-sections (4) and (5), the Vice-Chancellor may:-

(a) suspend from duty any member of staff of the University;

(b) subject to section six, prohibit the admission of a student or any person to the University;

(c) prohibit, indefinitely or for such period as he may specify, any student or groups of students from attending any class or classes;

(d) prohibit any student or group of students or person or group of persons from entering or remaining on such part or parts of the University campus as he may specify;

(e) expel or suspend, indefinitely or for such a period as he may specify, any student or group of students;

(f) dissolve or suspend, indefinitely or for such period as he may specify, the Students Union or any of its committees or organs, or prohibit or suspend, indefinitely or for such period as he may specify, any activity or function of the Students' Union or any of its committees or organs;

(g) impose any other or give any other order in respect of:-

(i) a member of staff, which is recommended by the Disciplinary Committee in terms of subsection (6) of section *twenty-four*;

(ii) a student, which is recommended by the Student Disciplinary Committee in terms of subsection (6) of section *twenty-five*.

(4) The Vice-Chancellor shall not expel a student for misconduct unless the student has been found guilty of that misconduct by the Student Disciplinary Committee in terms of section *twenty-five.*

(5) Any action taken by the Vice-Chancellor in terms of subsection (3) shall be subject to ratification by the Council.

Pro-Vice Chancellors

9. (1) One or more Pro-Vice Chancellors may be appointed by the Council with the Approval of the Minister in accordance with the Statutes.

(2) A Pro-Vice Chancellor shall assist the Vice-Chancellor in the performance of his functions and, in addition, shall have such functions as may be specified in the Statutes.

(3) The Vice-Chancellor may delegate to a Pro-Vice Chancellor, either absolutely or subject to conditions, any of his functions in

terms of this Act and may at any time amend or withdraw any such delegation;
Provided that the delegation of a function in terms of this subsection shall not prevent the Vice-Chancellor from himself exercising that function.

Council 10. (1) Subject to this Act any general directions as to policy given by the Minister, the government and executive authority of the University Shall be vested in the Council, which shall consist of:-

(a) the Chancellor, the Vice-Chancellor and the Pro-Vice Chancellors, who shall be ex-officio members; and
(b) sixteen persons appointed by the Minister; and
(c) nine persons who are members of the of the academic staff appointed by the Senate, other than the Vice-Chancellor and the Pro-Vice Chancellors; and
(d) the President of the Students' Union, who shall be an ex-officio member; and
(e) one person who is a distinguished academic appointed by the Council on the recommendations of the Senate; and
(f) one woman appointed by the Minister to represent women's interests; and
(g) one person approved by the Vice-Chancellor and elected by the non-Senate members of the academic staff from among themselves; and
(h) one person approved by the Vice-Chancellor and elected by the administrative staff from among themselves; and
(i) one person approved by the Vice-Chancellor and elected by the workers' committee of the University; and
(j) one person appointed by the Minister from a list of names submitted by the Zimbabwe Congress of Trade Unions or, if that organization ceases to exist, by such other organization as the Minister, after consultation with the Minister to whom the administration of the Labour Relations Act, 1985 (No.16 of 1985) has been assigned, recognizes as its successor for the purposes of this paragraph; and
(k) one person appointed by the Minister from a list of names submitted by such organization representing teachers and additionally, or alternatively, lecturers, as the Minister recognizes for the purposes of this paragraph; and

(l) one person appointed by the Minister from a list of names submitted by the Zimbabwe National Chamber of Commerce, if that organization ceases to exist, by such other organization as the Minister, after consultation with the Minister responsible for commerce, recognizes as its successor for the purposes of this paragraph; and

(m) one person appointed by the Minister from a list of names submitted by the Confederation of Zimbabwe Industries or, if that organization ceases to exist, by such organization after consultation with the Minister responsible for industry, recognizes as its successor for the purposes of this paragraph; and

(n) one person appointed by the Minister from a list of names submitted by the Council of the Zimbabwe Institution of Engineers (Private) Act (Chapter 226) or if that organization ceases to exist, by such other organization as the Minister, after consultation with the Minister responsible for public construction, recognizes as its successor for the purposes of this paragraph; and

(o) one person appointed by the Minister from a list of names submitted by the Chamber of Mines of Zimbabwe Incorporation (Private) Act (Chapter 162) or, if that organization ceases to exist, by such other organization as the Minister, after consultation with the Minister responsible for mines, recognizes as its successor for the purposes of this paragraph; and

(p) one person appointed by the Minister from a list of names submitted by such farmers unions as the Minister, after consultation with the Minister responsible for agriculture, recognizes for the purposes of this paragraph; and

(q) one person appointed by the Minister from a list of names submitted by such organization representing churches or organizes religion as the Minister recognizes for the purposes of this paragraph; and

(r) one person appointed by the Minister from a list of names submitted by such organization representing youths or the interests of youths as the Minister recognizes for the purposes of this paragraph.

(2) If any person, organization or authority fails or declines:-

(a) to appoint or elect any person in terms of paragraph (c), (g), (h), or (i) of subsection (1) within a reasonable time after being called upon to do so, the Council, after consultation with the Minister, may appoint any person to fill the vacancy;

(b) to submit a list of names in terms of paragraph (j), (k), (l), (m), (n), (o), (p), (q) or (r) of subsection (1) within a reasonable time after being called upon to do so, the Minister may appoint any person to fill the vacancy.

Functions of Council

11. (1) Subject to this Act and the Statutes, the Council shall:-

(a) appoint –

(i) with the approval of the Minister, the Pro-Vice-Chancellors and the Registrar;

(ii) the Bursar, the Librarian and academic staff; and

(iii) the administrative staff and other employees of the University.

Provided that the Council may delegate its duties under this paragraph to such committee as may be prescribed in the Statutes;

(b) on the recommendation of the Senate, institute professorships, associate professorships and other academic offices, and abolish or hold in abeyance any such offices;

(c) receive and, if the Council considers it proper to do so, give effect to report and recommendations from the Senate on those matters upon which the Senate is authorized or required by this Act or the Statutes to make reports and recommendations;

(d) cause to be prepared annually a statement of expenditure of the University during the previous financial year, and of the assets and liabilities of the University on the last day of that previous financial year;

(e) submit statements of income and expenditure referred to in paragraph (d) to audit by an auditor appointed by the Council, and shall publish such statements and the auditor's reports thereon;

(f) cause to be prepared annually estimates of income and expenditure for the following financial year;

(g) cause to be prepared and made available to the public a report on the activities of the University during each year.

(2) Without limitation on any other powers conferred on Council by this Act, the Council shall have the following powers:-

(a) to receive recommendations from the Senate for conferment, withdrawal or restoration of degrees, including honorary degrees, and diplomas, certificates and other awards and distinctions of the University and, if approved, to submit them to the Chancellor;

(b) to administer the property of the University and to control its affairs and functions;

(c) to exercise on behalf of the University such of the powers set out in subsection (2) of section *four* as are not exercisable in terms of this Act by any other authority;

(d) to do such other acts as it considers to be necessary for the proper administration of the University and the achievement of its objects.

Chairman and Vice-Chairman of Council

12. (1) The Council shall elect a chairman and a vice-chairman from amongst its members to hold office for such period and subject to such terms and conditions as are prescribed in the Statutes.

(2) At all meetings of Council at which the Chancellor is not present the chairman of the Council or, in his absence, the vice-chairman shall preside.

(3) If at any meeting of the Council the Chancellor and the chairman and vice-chairman of Council are all absent, the members of the Council who are present shall elect a person from amongst their number to preside at the meeting.

Executive Committee of Council

13. (1) There shall be a principal committee of the Council to be known as the Executive Committee.

(2) The Executive Committee shall consist of:-

(a) the chairman and vice-chairman of the Council and

(b) the Vice-Chancellor and every Pro-Vice-Chancellor; and

(c) ten members of the Council, of whom:-

(i) five shall be appointed by the Minister; and

(ii) three shall be appointed by the Senate; and

(iii) two shall be appointed by the Council.

(3) The Chairman and Vice-Chairman of the Council shall be the chairman and vice-chairman of the Executive Committee.

(4) the Executive Committee shall exercise such of the functions of the Council as the Council may delegate to it.

(5) Any delegation of functions by the Council in terms of subsection (4) may be made absolutely or subject to conditions and may be amended or withdrawn at any time.

(6) A delegation of any function by the Council in terms of subsection (4) shall not prevent the Council from itself exercising that function.

Senate

14. (1) Subject to this Act, the Academic Authority of the University shall be vested in the Senate, which shall consist of:-

(a) the Vice-Chancellor, the Pro-Vice-Chancellors, the Deans, the Full Professors, the Chairmen of Departments and the Librarian, who shall be *ex-officio* members; and

(b) one member of the permanent academic staff from each Faculty elected annually by such staff; and

(c) six students elected annually by the Students' Union: Provided that such students shall not be entitled to attend deliberations of the Senate on matters which are considered by the chairman of the Senate to be confidential.

(2) If the full-time academic staff or the Students' Union fails or declines to elect a person in terms of paragraph (g) or (h) of subsection (1), the council may appoint a suitably-qualified person to fill the vacancy.

Function of Senate

15. The Senate shall have the following functions:-

(a) to promote the advancement of knowledge through research;

(b) to formulate and carry out the academic policy of the University;

(c) to regulate the programmes, subjects and courses of study and the examinations held by the University;

(d) to regulate the admission of students to the University;

(e) to recommend to the Chancellor, through the Council, the conferment of degrees, including honorary degrees, diplomas, certificates and other awards and distinctions of the University and the withdrawal and restoration of such awards;

(f) to fix, subject to the consultation with any sponsors and subject to the approval of the Council, the times, modes and conditions of competitions for fellowships, scholarships and prizes;

(g) to appoint examiners for examinations conducted by the University;

(h) to cause to be prepared estimates of expenditure required to carry out the academic work of the University and to submit them to the Council;

(i) subject to the approval and direction of the Council, to formulate, modify and revise the organization of Faculties, Departments, Institutes, Centres and units of the University and to assign to them their various subjects or functions, and to advise the Council on the establishment of the Faculties, Departments, Institutes, Centres or units;

(j) to recommend to the Council the institution, abolition or holding in abeyance of professorial chairs and other academic offices;

(k) without derogation from the powers of the Council, to propose changes to the Statutes;

(l) to make any regulations it is authorized to make by or in terms of this Act;

(m) to appoint committees, which may include persons who are not members of the Senate, to exercise any of the functions of the Senate, other than the power to make regulations;

(n) to report on any matter referred to it by Council;

(o) to do such other acts as the Council may authorize or direct it to do.

Academic Board 16. (1) There shall be a principal committee of Senate to be known as the Academic Board.

(2) The Academic Board shall consist of:-

(a) the Vice-Chancellor, who shall be chairman; and

(b) every Pro-Vice-Chancellor; and

(c) *four* full professors of the University, elected annually by the Senate; and

(d) all the Deans of Faculties; and

(e) the Librarian; and

(f) two members of the Senate elected annually by the persons referred in paragraphs (a) and (b) of subsection (1) of Section *Fourteen*.

(3) The Academic Board shall exercise such of the functions of the Senate as the Senate, with the approval of the Council, may delegate to it.

		(4)	Any delegation of functions by the Senate in terms of sub-section (3) may be made absolutely or subject to conditions and may be amended or withdrawn at any time.
		(5)	A delegation of any function by the Senate in terms of sub-section (3) shall not prevent the Senate from its exercising that function.
Registrar	17.	(1)	There shall be a Registrar of the University who shall be appointed by the Council with the approval of the Minister in the manner provided in the Statutes.
		(2)	Subject to the directions of the Council, the Registrar shall be responsible for the general administration of the University, and shall perform such other functions as may be specified in the Statutes.
		(3)	The Registrar, or a member of his staff whom he may authorize to act for him, shall be secretary of the Council and the Senate.
Bursar	18.	(1)	There shall be a Bursar of the University who shall be appointed by the Council in the manner provided in the Statutes.
		(2)	Subject to the directions of the Council, the Bursar shall act as the accountant of the University and shall be responsible for the safe-guarding of its funds and, in accordance with the general directions of the Vice-Chancellor, for authorizing its investments and expenditure.
		(3)	The Bursar shall perform such additional functions as may be specified in the Statutes.
Librarian	19.	(1)	There shall be a Librarian of the University who shall be appointed by the Council in the manner provided by the Statutes.
		(2)	Subject to the directions of the Senate and the Vice-Chancellor, the Librarian shall be responsible for the administration and safe-guarding of the libraries of the University.
Convocation	20.	(1)	The Convocation of the University shall consist of all persons whose names appear on the Convocation roll maintained by the Registrar.
		(2)	The Vice-Chancellor and all Pro-Vice-Chancellors, lecturers, Chairman of Departments, the registrar, the Librarian and the Bursar shall be *ex-officio* members of the Convocation.
		(3)	All graduates of the University who signify in writing addressed to the Registrar that they desire to be members of the Convocation and who inform the Registrar of their address shall be entitled to have their names entered on the Convocations roll.
		(4)	Subject to section seven, the Vice-chancellor or such other person as he may appoint shall be chairman of meetings of the

Convocation.

(5) Meetings of the Convocation shall be held at such time and places as the Council shall direct.

(6) The convocation may deal with any matter relating to the University which may be referred to it by the Council.

Terms and Conditions of Service of Staff

21. The terms and conditions of service for each category of staff employed by the University, including the Vice-Chancellor and every Pro-Vice-Chancellor, shall be determined by the Council in terms of this Act, and such terms and conditions shall provide that:-

(a) any person so employed shall be entitled to resign from his employment on giving such notice in writing to the Registrar as may be fixed such terms and conditions;

(b) any person so employed shall, subject to any exception that may be provided, retire from his office at such time or in such circumstances as may be fixed in such terms and conditions;

(c) no summary termination of the employment of any person so employed shall take place except for good cause and, in the event of any such termination, the person concerned shall have a right of appeal to the Council, whose decisions shall be final.

Appointment and Grading of Staff

22. (1) Every appointment to the academic staff shall be made by an Academic Appointments Board consisting of :-

(a) the Vice-Chancellor or his nominee, who shall be chairman; and

(b) two members appointed by the Council from amongst those of its members who are not members of staff of the University; and

(c) the Chairman of the Department to which the appointment is made; and

(d) one other member approved by the Vice-Chancellor, of the Department to which the appointment is made; and

(e) the Dean of the Faculty to which the appointment is made; and

(f) the Chairman of a Department approved by the Council as being related to the Department referred to in paragraph (c).

(2) Subject to this Act and the Statutes, the Council shall appoint Boards of Selection for the purpose of appointing members of staff other than the Vice-Chancellor, a Pro-Vice-Chancellor, the Registrar, the Bursar, the Librarian and academic staff.

(3) The Council shall appoint a Grading Committee for the purpose of

determining all matters relating to the grades and points of entry upon salary scales by members of staff of the University.

Promotion of Staff 23. (1) Every promotion of a person to a post or grade within the academic staff shall be effected by an Academic Staff Promotions Committee consisting of:-

(a) the Vice-Chancellor or his nominee, who shall be Chairman; and

(b) every Pro-Vice-Chancellor; and

(c) four members of the Council who are not members of staff of the University, appointed by the Council; and

(d) all Deans of Faculties; and

(e) at least three full professors of the University appointed by the Senate once every three years.

(2) Every promotion of a person to a post or grade within the non-academic staff shall be effected by a Non-Academic Staff Promotions Committee appointed by the Council and consisting of:-

(a) a Pro-Vice-Chancellor, who shall be chairman; and

(b) the Registrar; and

(c) the Bursar; and

(d) the Librarian; and

(e) two members of the Council who are not members of staff of the University; and

(f) one representative of each category of the non-academic staff prescribed in the Statutes; and

(g) one representative of each Faculty.

Staff Disciplinary Committee 24. (1) There shall be a Staff Disciplinary Committee which shall consist of the following members appointed by the Vice-Chancellor:-

(a) a Pro-Vice-Chancellor, who shall be chairman; and

(b) a senior member of the academic or administrative staff; and

(c) a member of the academic or administrative staff of similar status to the person charged.

(2) Two members of the Staff Disciplinary Committee shall form a quorum.

(3) All matters to be decided at any meeting of the Staff Disciplinary Committee shall be decided by a simple majority and, in the event of an equality of votes, the chairman or person presiding shall have a casting vote in addition to his deliberative vote.

(4) The functions of the Staff Disciplinary Committee shall be to

investigate any breach of a Statute, regulation, ordinance or other misconduct on the part of any member of the academic or administrative and general staff and, subject to subsection (6), to recommend to the vice-Chancellor the punishment to be imposed on or order to be made in respect of the member if it finds him guilty of such misconduct.

(5) A person charged with misconduct referred to in subsection (4) shall have a right of audience before the Staff Disciplinary Committee.

(6) Where the Staff Disciplinary Committee has found a person guilty of misconduct referred to in subsection (4), the Committee shall recommend to the Vice-chancellor any one or more of the following:-

(a) that the person's employment be terminated;
(b) that the person pay a fine to the University not exceeding one thousand dollars;
(c) that the person be demoted;
(d) that the person be censured or reprimanded;
(e) such other penalty or order as may be provided for by or in terms of the Statutes.

Student Disciplinary Committee

25. (1) There shall be a Student Disciplinary Committee which shall consist of the following members appointed by the Vice-Chancellor:-

(a) a Pro-Vice-Chancellor, who shall be chairman; and
(b) the Senior Proctor, who shall be vice-chairman; and
(c) four members of the academic staff; and
(d) one student nominated by the Student's Union.

(2) Five members of the Student Disciplinary Committee shall form a quorum.

(3) All matters to be decided at any meeting of the Student Disciplinary Committee shall be decided by a simple majority and, in the event of an equality of votes, the chairman or person presiding shall have a casting vote in addition to his deliberative vote.

(4) The functions of the Student Disciplinary Committee shall be to investigate any breach of a Statute, regulation or ordinance or other misconduct on the part of any student and, subject to subsection (6), to recommend to the Vice-Chancellor the

punishment to be imposed on the student if it finds him guilty of such misconduct.

(5) A student charged with misconduct referred to in subsection (4) shall have right of audience before the Student Disciplinary Committee.

(6) Where the Student Disciplinary Committee has found a student guilty of misconduct referred to in subsection (4), the Committee shall recommend to the Vice-Chancellor the imposition upon the student of any one or more of the following punishments:-

(a) expulsion or suspension from the University;
(b) the withdrawal of any academic or University privilege, benefit, right or facility other than to follow courses of instruction and present himself for examination;
(c) the imposition of a fine not exceeding five hundred dollars, which fine may be deducted from any allowances payable to the student and shall be paid to the University;
(d) a censure or reprimand;
(e) such other penalty as may be provided for by or in terms of Statutes.

Finance Committee 26. (1) Subject to this Act, there shall be a Finance Committee of the Council consisting of:-

(a) the Chairman of council, who shall be Chairman; and
(b) the Vice-Chancellor; and
(c) every Pro-Vice-Chancellor; and
(d) three persons appointed by the Council from among its members who are not members of the University staff; and
(e) two persons appointed by the Senate from among its members; and
(f) the Bursar, who shall be the secretary of the Finance Committee; and
(g) the Registrar; and
(h) a representative of the Deans of Faculties appointed by the Council.

(2) The functions of the Finance Committee shall be as provided in the Statutes.

Statutes 27. (1) Subject to this Act, the University shall be administered in accordance with the Statutes.

(2) With the approval of the Minister the Council may, by statutory instrument, amend, repeal or replace the Statutes set out in the

Schedule in order to prescribe all matters which, in terms of this Act, are required or permitted to be prescribed in Statutes or which, in the opinion of the Council are necessary or convenient to be so prescribed for carrying out or giving effect to the provisions of this Act or for the proper administration of the University.

(3) Subject to this Act, Statutes made in terms of subsection (2) may provide for:-

(a) the appointment, conditions of service and functions of the Vice-Chancellor, the Pro-Vice-Chancellors, the Registrar, the Bursar, the Librarian and all members of staff and the categorization of such members of staff;

(b) the functions of the Pro-Vice-chancellors;

(c) the election or appointment of persons to the Council and the Senate to committees of the Council and the Senate;

(d) the terms of office of members of the Council and its committees, other than *ex-officio* members thereof;

(e) the terms of office and conditions of service of the chairman and vice-chairman of the Council;

(f) the convening of meetings of the Council and the Senate, the quorum at such meetings and the procedure to be adopted thereat;

(g) the terms of office of members of the Academic Appointments Board and the Academic Staff Promotions Committee, the convening of meetings of that Board and Committee, the quorum at such meetings and the procedure to be adopted thereat;

(h) the functions of the Academic Appointments Board, Boards of Selection, the Grading Committee, the Academic Staff Promotions Committee, the Non-academic Staff Promotions Committee and the Finance Committee;

(i) the persons who may enter into contracts and sign documents on behalf of the University, and the procedure to be followed in relation to transactions entered into by or on behalf of the University;

(j) the establishment and organization of Faculties, Departments, Centres and Institutes;

(k) the functions of Deans of Faculties, Chairmen of Departments and heads of Centres and Institutes;

(l) the holding of congregations of the University for the purpose of conferring degrees, diplomas, certificates and other honours and awards;
(m) the seal of the University and its use and custody;
(n) the academic year of the University;
(o) the discipline of members of staff and students and the procedures to be adopted in respect thereof;
(p) fees and charges to be paid for anything done by any person in terms of this Act;
(q) empowering any person specified in the Statutes to make ordinances or rules in respect of any matter referred to in paragraphs (a) to (p).

Regulations

28. (1) Subject to this Act and the Statutes and with the approval of the Council, the Senate may make regulations prescribing any matter which, in the opinion of the Senate, is appropriate to be prescribed for the better carrying out of the Senate's functions.

(2) Regulations may provide for:-
(a) teaching within the University, whether generally or in relation to specific subjects;
(b) progress reports to be submitted by members of the academic staff;
(c) schemes of study and research and the conditions subject to which such schemes may be embarked upon or continued;
(d) the use of libraries of the University;
(e) the conduct and supervision of examinations;
(f) the award of degrees, diplomas, certificates and other academic honours and awards, other than honorary degrees, honours or awards.

(3) The Senate may at any time amend or repeal any regulations.

(4) Regulations need to be published in the *Gazette*, but the Senate shall publish them in such manner as the Senate considers will best make them known to the persons to whom they apply.

Validity of decisions Council, Senate, Convocation and boards and Committees

29. No decision or act of the Council, the Senate, the Convocation or any of board or committee established by or in terms of this Act shall be invalid solely on the ground that:-

(a) the Council, Senate, Convocation, board or committee, as the case may be, consisted of fewer than the number of members for which provision is made by or in terms of this Act; or

(b) a disqualified person acted as a member of the Council, Senate, Convocation, board or committee, as the case may be; if the duly qualified members who took the decision or did or authorized the act constituted a quorum of the membership of the Council, Senate, Convocation, board or committee, as the case may be.

Appointments and Functions of Foundation Committee

30. (1) Subject to this section, the Minister may appoint not fewer than ten and not more than twenty-five persons to constitute a committee to bring the University into existence.

(2) Persons appointed in terms of subsection (1) shall be chosen for their ability and experience in academic matters or administration or their professional qualifications or their suitability otherwise for appointment.

(3) The Minister shall designate one of the persons appointed in terms of subsection (1) to be the chairman and another such person to be the vice-chairman of the committee.

(4) the functions of the committee appointed in terms of subsection (1) shall be:-

(a) with the approval of the Minister, to appoint a Vice-Chancellor, one or more Pro-Vice-Chancellors and other officers and members of staff of the University and to fix their terms and conditions of employment;

(b) to provide for election or appointment of the first Council of the University;

(c) to acquire movable and immovable property on behalf of the University;

(d) to make arrangements for the admission of students to the University;

(e) to make Statutes for the University;

(f) generally, to do all things necessary or expedient to bring the University into existence and make this Act effective on the date fixed in terms of subsection (2) of section one.

(5) For the purpose of subsection (4), the appropriate provisions for this Act shall apply to the committee appointed in terms of subsection (1) as if it were the Council, notwithstanding that those provisions have not yet come into operation in terms of subsection (2) of section *one*.

(6) any decision taken or act done or authorized by the committee appointed in terms of subsection (1) shall be deemed:-

(a) on or after the date fixed by the President in terms of subsection (a) of section one; or

(b) after the period specified by the Minister in terms of paragraph (a) of subsection (7); whichever is the later, to be a decision taken or act done or authorised, as the case may be, by the Council.

(7) Notwithstanding any other provision of this Act, if the Minister is satisfied that it is necessary or expedient for the committee appointed in terms of subsection (1) to continue to exercise its functions after the date fixed in terms of subsection (2) of section one, he may, by notice in writing to the chairman of the committee:-

(a) authorise the committee to continue exercising its functions for such period after that date, not exceeding twelve months, as the Minister may specify; and

(b) suspend or modify such of the provisions of this Act as the Minister may specify, for the purpose of enabling the committee to continue exercising its functions; and the provisions concerned shall be suspended or shall apply with the appropriate modifications for the period specified in terms of paragraph (a).

SCHEDULE (SECTIONS 2 AND 27)

STATUTES OF THE UNIVERSITY

ARRANGEMENT OF STATUTES

1.Appointment of Pro-Vice-Chancellors

(1) For the purpose of considering appointments to the office of Pro-Vice-Chancellor, there shall be a joint committee of the Council and the Senate consisting of –

(a) the chairman of the Council, who shall be chairman of the joint committee; and the Vice-Chairman of the Council; and

(b) the Vice-Chairman of the Council; and

(c) the Vice-Chancellor; and

(d) two persons appointed by the Council from among its members who are not members of the Senate; and

(e) three persons appointed by the Senate from among its members.

(2) The joint committee constituted by this Statute shall consider each applicant for appointment to a vacancy in the office of Pro-Vice-Chancellor and shall make recommendations thereon to the Council, and the Council, after considering the joint committee's recommendations, shall make the appointment concerned with the approval of the Minister.

(3) A Pro-Vice-Chancellor shall hold office for three years from the date of his appointment and, subject to subsection (2) and the approval of the Minister, shall be eligible for re-appointment.

2. Length of appointment of members of Council

(1) Members of the Council, other than ex-officio members, shall hold office for three years, and shall be eligible for re-appointment or re-election, as the case may be; provided that –

(i) of the first sixteen members appointed by the Minister, five shall be appointed for a period ending one year after the date of commencement of the Act and further five shall be appointed for a period ending two years after the date of commencement of the Act.

(ii) of the first nine members appointed by the Senate, three shall be appointed for a period ending one year after the date of commencement of the Act and a further three shall be appointed for a period ending two years after the date of commencement of the Act;

(2) Any member of Council, other than an ex officio member, may resign his membership at any time by notice in writing addressed to the Registrar.

3. Casual vacancies in Council

Any casual vacancy occurring among the appointed or elected members of the Council shall be filled as soon as possible by the person, persons or body which appointed or elected the member whose place has become vacant, and the person so appointed or elected shall hold office for the remainder of the period for which he fills was appointed or elected.

4. Meetings and quorum of Council

(1) The Council shall meet at least three times a year.

(2) The quorum of the Council shall be one-half of the members holding office at the time of the meeting.

5. Resolutions by circulation among members of Council

A resolution proposed by the Executive Committee of the Council, other than for the purpose of making a Statute, which is on its authority circulated by the Registrar to all members of the Council and which receives the written agreement of not less than two-thirds of such members shall, upon receipt of such agreement by the Registrar, have the same force and effect as a resolution passed at a meeting of the Council.

6. Meeting and quorum of Senate

(1) The Senate shall meet at least three times a year.

(2) The quorum of the Senate shall be one-half of the members holding office at the time of meeting.

(3) The Vice-Chancellor or, in his absence, a Pro-Vice-Chancellor, shall be the chairman of Senate.

7. Convocation

There shall be no quorum for meetings of the Convocation, the proceedings of which shall be regulated by the chairman, subject to any general or special direction of the Council.

8. Faculties

The University shall include such Faculties as may from time to time be established by the Council.

9. Deans

(1) There shall be a Dean of each Faculty, who shall be appointed by a Selection Board appointed by the Council, and chaired by the Vice-Chancellor, or in his absence, a Pro-Vice-Chancellor. The Selection Board shall consist of the Vice-Chancellor, the Pro-Vice-Chancellor(s), two persons not belonging to the Faculty appointed by the Senate, and three persons appointed by the Faculty. Normally, the Dean must be a prominent academic with a proven administrative record who commands respect among the staff in the faculty and within the University community.

(2) A Dean shall hold office for four years or such other period as may be prescribed by Ordinance, and shall be eligible for re-appointment for a further term of office.

(3) A Dean shall preside at meetings of the Faculty Board of his Faculty and at meetings called by him in terms of these statutes, and shall have such functions as are prescribed by Ordinance.

10. Composition of Faculty Boards

For each Faculty there shall be a Faculty Board which shall consist of –

(a) all the full-time academic staff of the Faculty; and
(b) such persons as may be assigned to the Faculty Board by the Senate; and
(c) two students elected annually by the students in the Faculty

11. Functions of Faculty Boards

A Faculty Board shall have the following functions –

(a) to regulate, subject to the approval of the Senate, the teaching and study of the subjects assigned to the Faculty;
(b) To report to the Senate on any matter specifically relating to the work of the Faculty;
(c) To deal with any matter referred or delegated to it by the Senate;
(d) To appoint committees, which may include a minority of persons who are not members of the Faculty Board, to carry out any of the duties or exercise any of the powers of the Board.

12. Meetings of Faculty Boards

(1) The Dean of each Faculty shall call regular meetings of the Faculty Board at which matters relating to the policy of the Faculty and appointments shall be discussed and recommendations adopted for submission to the appropriate authorities on appointments.

(2) The Vice-Chancellor and every Pro-Vice-Chancellor shall be entitled to attend any meeting of a Faculty board or any committee thereof.

13. Teaching Departments

(1) The Teaching Departments and their allocation to Faculties shall be prescribed by ordinances

(2) A Chairman of Department shall be appointed by the Vice-Chancellor, on behalf of the Council, from among the full-time members of the academic staff of the Department, and the Dean of the Faculty to which the Department is allocated.

(3) A Chairman of Department shall hold office for a period of three years, or such other period as may be determined by ordinance, and shall be eligible for re-appointment.

(4) A Department may be allocated to twoor more Faculties.

14. Institutes and Centres

The Council, after consultation with the Senate, may establish Institutes or Centres of learning within or outside the University and shall appoint at the head of any such Institute or Centre and give directions as to its studies and research and administration.

15. Appointment of Registrar, Bursar and Librarian

(1) For the purpose of considering appointments to the offices of Registrar, Bursar and Librarian, there shall be a joint committee of the Council and the Senate consisting of –

(a) the chairman of the Council, who shall be the chairman of the joint committee; and

(b) the vice-chairman of the Council; and

(c) the Vice-Chancellor; and

(d) every Pro-Vice-Chancellor; and

(e) two persons appointed by the Council from among its members who are not members of the Senate; and

(f) three persons appointed by the Senate from among its members

(2) The joint committee constituted by this Statute shall consider each applicant to a vacancy in the office of Registrar, Bursar or Librarian and shall make recommendations thereon to the Council.

16. Procedure generally

(1) Except as otherwise specifically provided by the Act or these Statutes, in the absence of the chairman or vice-chairman at a meeting of a board or committee the members present shall elect from those present a chairman to preside over that meeting.

(2) Except as otherwise specifically provided by the Act or these Statutes, the quorum at any meeting of a board or committee shall be as fixed by the person or authority that appointed the board or committee.

(3) Except as otherwise specifically provided by the Act or these Statutes, each board or committee shall determine and may make rules for the time, place and procedure of its meetings.

(4) The minutes of a meeting of a board or committee shall be laid on the table at the next following meeting of the body that appointed it.

(5) At a meeting of board or committee, in the event of an equality of votes on any matter, the person presiding shall have a casting vote in addition to his original vote.

(6) Subsection (3), (4) and (5) shall apply, *mutatis mutandis*, to the Council and the Senate, save that minutes of the Council shall be sent to the Chancellor and the Minister and a report of each meeting of the Senate shall be laid on the table at a meeting of the Council.

17. Financial Procedures

(1) The Council shall fix the financial year of the University.

(2) The Finance Committee shall submit to the Council, before the beginning of the financial year, draft estimates of income and expenditure, and such estimates, amended as the Council thinks fit, shall be approved by the Council before the beginning of the financial year.

(3) The Council may revise the estimates during the course of the financial year and give directions for the manner in which amendments of expenditure estimates may be made, which directions may make provision for delegating the powers of revision so long as such delegation does not extend to altering the total estimated expenditure.

(4) As soon as practicable after the end of financial years, a balance sheet and income and expenditure account with supporting schedules shall be submitted to the auditors.

(5) The audited accounts, with any comments thereon made by the auditors, shall be submitted to the Council.

18. Auditors

(1) Subject to subsections (2) and (3), the Council shall, before the beginning of each financial year, appoint auditors who are registered in terms of the Accountants Act (Chapter 215).

(2) No person shall be appointed as an auditor in terms of subsection (1) if he, or any of his partners or employees, holds any other office in the University.

(3) If no appointment of new auditors is made before the beginning of any financial year, the auditors in office shall continue in office.

(4) An auditor appointed in terms of subsection (1) shall be entitled at all reasonable times to require any officer, employee or agent of the University:-

(a) to produce all accounts and other records relating to the financial affairs of the University as may be in the custody of such officer, employee or agent; and

(b) to provide such information or explanation as, in the opinion of the auditor, is necessary for the purposes of the audit.

19. University seal

(1) There shall be a seal of the University, of such design as may be approved by the Council.

(2) The seal of the University shall be kept in the custody of the Registrar and, subject to the directions of the Council, shall be affixed to-

(a) certificates, degrees and diplomas conferred by the University; and

(b) any document attested by the signature of the Vice-Chancellor and the Registrar.

20. Ordinances

(1) The Council may, with the approval of the Minister, make ordinances providing for any matter referred to in paragraphs (a) to (p) of subsection (3) of section 27 of the Act.

(2) The Registrar shall publish any ordinance made in terms of subsection (1) in such manner as the Council may direct, being a manner which the Council considers will best make the ordinance known to the persons whom it applies.

21. Arrangements with other universities, affiliated bodies, etc.

(1) The Council may make arrangements with any other university whereby students of the University may be registered as students of such other university and so enabled to study for, enter the examination of and be afforded the degrees of such other university.

(2) The Council may affiliate to the University, any other institution or any branch or departments thereof and recognize selected members of the staffs thereof as teachers of the University and admit the members thereof to any of the privileges of the University and accept attendance at courses of study in such institutions or branches or departments thereof in place of such part of the courses of study in the University and upon such terms and conditions and subject to such rules as may from time to time be determined by the Council.

THE FACULTY GOVERNANCE

ORDINANCE: 2003

In terms of Statute 20(1), The Council of the National University of Science and Technology in exercise of its powers under Section 27 of the National University of Science and Technology Act Chapter 25..13 (formerly Act 1990), hereby makes the following Ordinance:-

1.0 FACULTY

A Faculty shall consist of related teaching Departments, Research Institutes, Schools and Centres as established by the Council on the recommendations of Senate.

2.0 THE FACULTY BOARD

2.1 There shall be a Faculty Board for each Faculty which shall consist of:

2.1.1 The Dean of the Faculty,

2.1.2 The Deputy Dean of the Faculty,

2.1.3 All full-time Academic Staff of the Grade of Lecturer or above of the Faculty,

2.1.4 All full-time Research Fellows of the Faculty,

2.1.5 All Teaching Assistants,

2.1.6 Where relevant, one representative of the Technical Staff of the Faculty,

2.1.7 Such persons as may be assigned to the Faculty Board by Senate, and

2.1.8 Two Student Representatives, elected annually by the students from among the Student Representatives to the Departmental Boards in the Faculty. The Chairperson shall have the authority to exclude Student Representatives from Faculty Board deliberations on matters considered by the Board to be confidential to members of staff only.

2.2 The Vice-Chancellor and Pro-Vice-chancellor(s) shall be entitled to attend Faculty Board Meetings and any Committee Meetings thereof in an *ex-officio* capacity

2.3 The Faculty Board may invite staff from the other Faculties and other persons to attend meetings of the Board.

2.4 A Faculty Board shall meet at least three times every Semester and shall maintain a proper record of Agendas and Minutes for every Meeting.

2.5 The quorum of the Faculty Board shall be 50% of the membership.

2.6 Normally, the Faculty Assistant Registrar/Senior Assistant Registrar shall serve as the Secretary of all Faculty Board Meetings.

2.7 Fifty Percent (50%) of members of the Faculty Board may petition the Dean to require him to call a Special Meeting.

3.0 DUTIES AND RESPONSIBILITIES OF THE FACULTY BOARD

Subject to the provisions of the University Statutes, the authority of the Senate and the provisions of this Ordinance, the Faculty Board:

3.1 shall regulate, subject to the approval of the Senate, the teaching and study of the subjects assigned to the Faculty.

3.2 shall make reports to the Senate on any matters specifically relating to the work the Faculty.

3.3 shall make recommendations to the Senate for the establishment of new Courses and Programmes and the Faculty Regulations thereof, and the amendment of existing General Regulations, Faculty Regulations and Syllabi relating to studies within the Faculty.

3.4 may appoint Committees, to carry out any of the duties or exercise any of the responsibilities of the Faculty Board.

3.5 shall deal with any matter referred or delegated to it by Senate

3.6 shall exercise such responsibilities as may be conferred upon it by the Senate and the Vice-Chancellor.

3.7 shall make such other recommendations and decisions as may be required of the Faculty by other University Ordinances and Regulations and make decisions on such other matters as it may deem appropriate for other proper functioning of the Faculty.

4.0 DEAN

4.1 There shall be a Dean of each Faculty who shall be appointed by a Selection Board appointed by the Council and chaired by the Vice-Chancellor, or in his absence, a Pro-Vice-Chancellor.

The Selection Board shall consist of the Vice-Chancellor, the Pro-Vice-Chancellor(s), two persons not belonging to the Faculty appointed by the Senate, and three persons appointed by the Faculty. Normally, the Dean must be a prominentj academic with a proven administrative record who commands respect among the staff in the Faculty and within the University Community.

4.2 The term of office shall be four (4) years and, on the expiry of his term of office, shall be eligible for re-appointment. Normally, a Dean may not serve for more than two consecutive terms. At the end of office, if not re-appointed, a Dean who is appointed from one of the Departments in the University shall revert to an academic position within the Faculty, if he so wishes.

4.3 The performance of a Dean shall be evaluated annually by a Committee appointed by the Vice-Chancellor and consisting of Senior Academic Staff and Administrators of which at least fifty-percent (50%) shall be drawn from the Faculty concerned.

4.4 A Dean may resign from his office by giving the Vice-Chancellor three months' written notice or such longer or shorter notice as the Dean and the Vice-Chancellor may agree on.

4.5 Subject to the approval of the Council, the Vice-Chancellor may terminate the appointment of a person as Dean:

4.5.1 on the recommendations of a Committee referred to in Section 4.3 above or

4.5.2 for any other good cause

4.6 A Dean whose appointment has been terminated in terms of Section 4.5 above may appeal to the Council within fourteen days of being notified of the termination, an on any such appeal the Council may confirm, vary or rescind the termination, as the case may be, or give such other direction in the matter as it thinks appropriate.

5.0 DUTIES AND RESPONSIBILITIES, OF THE DEAN

5.1 The Dean is the Chief Academic, administrative and Financial Officer for the Faculty and shall be responsible to the Vice-Chancellor for:-

5.1.1 The character and quality of the academic and teaching programmes of the Faculty.

5.1.2 The proper direction, control and management of the staff, students, property, equipment and finances of the Faculty

5.1.3 Contributing to the evolution and maintenance of an environment conducive to learning at the University.

5.2 Without limiting Sub-Section 5.1, a Dean's function shall include:

5.2.1 Provision of leadership in innovative curriculum design and delivery.

5.2.2 Promotion of academic achievement and learner satisfaction consistent with the nationally and internationally accepted standards in the programmes.

5.2.3 Ensuring the quality and integrity in academic functions of the Faculty.

5.2.4 Motivation and support of research activities with the Faculty and facilitation and encouragement of inter-Faculty multi-disciplinary research programmes.

5.2.5 Fostering collegiality within the Faculty at all levels and maintaining a close working relationship with Chairpersons of Departments in the Faculty.

5.2.6 Calling and Chairing regular Meetings of the Faculty Board.

5.2.7 Chairing the Faculty Planning Committee Meetings.

5.2.8 Implementing policies approved by the Faculty Planning Committee, Faculty Board, Senate, Senior University Management and Council.

5.2.9 Provision of leadership for increasing national and international visibility and reputation.

5.2.10 Attracting new resources and planning and managing the use of all resources responsibly within the Faculty.

5.2.11 Developing innovative and strategic alliances with industry, government and international partner institutions and organizations.

5.2.12 Maintaining collaborative and consultative relationships with other Deans and with the University Administration.

5.2.13 Chairing Faculty Board of Examiners Meetings.

5.2.14 Representing the Facultyinappropriate University Committees and other bodies as required.

5.2.15 Entitlement to attend Departmental Board and Panel of Examiner's meetings in an *ex-officio* capacity.

5.2.16 Making recommendations with respect to Probation, Advancement and Promotion of all staff within the Faculty.

5.2.17 Presenting to the Congregation for Conferment of Degrees, persons who have qualified for the degrees of the University at examinations held in Departments for which responsibility is allocated to that Faculty. This shall exclude honorary degrees.

5.2.18 Report to the Vice-Chancellor annually on the activities of the Faculty.

5.3 In exercising his/her duties and responsibilities, the Dean shall take full cognizance of the provisions of the Ordinance on Departmental Governance.

6.0 THE DEPUTY DEAN OF A FACULTY

6.1 In every Faculty there shall be a Deputy Dean, whose term of office shall be three (3) years. The Deputy Dean shall be appointed by the Vice-Chancellor after consultation with the Faculty Planning Committee.

6.2 In addition to teaching, research and other duties and responsibilities, the Deputy Dean of a Faculty shall:

6.2.1 serve as the Acting Dean in the absence of the Dean.

6.2.2 perform such other functions as may be delegated to him/her by the Dean.

Date of Operation

This Ordinance shall apply with effect from 1 January 2003, or any later date as approved by the Minister of Higher and Tertiary Education, Science and Technology Development, and shall remain in force until otherwise repealed or varied by a further Faculty Governance Ordinance of the National University of Science and Technology.

1.0 This Ordinance may be cited as The Departmental Governance Ordinance 1982 and shall take effect from 3 April 1992.

2.0 THE DEPARTMENTAL BOARD

2.1 There shall be a Departmental Board for each Department which shall consist of:-

2.1.1 The Chairman of the Department,

2.1.2 All full-time members of the Academic Staff of the Department, 2.1.3 Honorary and Part-time Lecturers in the Department or their representative, as determined by the Departmental Board,

2.1.4 Where relevant, at least one representative of the technical staff in the Department, or where technical staff are assigned to the Faculty and not to Departments and the Board considers it helpful to have representatives of such staff, at least one representative of the technical staff in the Faculty, elected annually by such staff, provided that the representative(s) so elected shall not be entitled to attend for deliberations on matters considered by the Chairman to be confidential,

2.1.5 Two students in the Department elected annually by the students from amongst themselves, provided that the students so elected shall not be entitled to attend for deliberations on matters considered by the Chairman to be confidential.

2.2 The Vice-Chancellor, the Pro-Vice-Chancellor(s) and the appropriate Dean and Deputy Dean shall be entitled to attend Departmental Board meetings in an *ex-officio* capacity.

2.3 From time to time, the Chairman of the Department, after consultation with members of the Departmental Board, may invite other persons to attend Departmental Board meetings.

2.4 Each Departmental Board shall meet at least twice every Semester and shall maintain a proper system of Agendas and Minutes for such meetings.

2.5 Subject to Section 3 of this Ordinance, each Departmental Board shall regulate its own procedures, including the establishment of a quorum.

3.0 DUTIES AND POWERS OF THE DEPARTMENTAL BOARD

Subject to the provisions of the University Statutes, the authority of the Senate, provision of this Ordinance and such limitations as the Faculty of which the Department forms a part may impose, the Departmental Board:-

3.1 Shall arrange for, conduct and control the teaching and instruction of students within the Department and the setting and marking of examination papers in accordance with regulations approved by the Senate, the general academic policy agreed by the Faculty Board and the approved administrative procedures of the University.

3.2 Shall make recommendations to the Faculty Board for the establishment of new courses and the amendment of existing regulations and syllabuses relating to studies within the Department.

3.3 May delegate functions and responsibilities to individuals or groups of individuals within the department.

3.4 Shall exercise such powers as may be conferred upon it by the Faculty Board, the Senate or the Vice-Chancellor.

3.5 May provide consultancy services on matters concerning the subject assigned to the department within the limitations of its capabilities and subject to the general University policy on consultancy services.

3.6 Shall monitor the implementation of the University's conditions relating to the undertaking of private remunerative work in respect of the members of the Department.

3.7 May take recommendations in respect of estimates of expenditure in the department Budget Committee.

3.8 Shall suggest preliminary short-list of candidates for appointment to academic and technical posts within the Department, taking into account the need to maintain strict confidentiality in handling applications, and shall forward such short-lists to the relevant Board of Selection for consideration.

3.9 Shall recommend candidates for Staff Development Programmes.

3.10 Shall formulate general guidelines on pure and applied research and suggest means of funding research programmes in the Department.

3.11 Shall submit recommendations to the Senate in respect of the appointment of External Examiners and any other consultations.

4.0 CHAIRMEN OF DEPARTMENTS

4.1 There shall be a Chairman of each Department appointed by the Vice-Chancellor, on behalf of the University Council, from among the full-time members of the Academic Staff of the Department.

4.2 Before appointing a Departmental chairman, the Vice-Chancellor:-

4.2.1 shall consult and take note of the views of each member of the academic staff in the Department about the appointment.

4.2.2 Shall consult and take note of the views of at least one of the Pro-Vice-Chancellors and the Dean of the Faculty concerned.

4.3 The Chairman of a Department shall hold office as such for a period of up to three years and shall be eligible for re-appointment.

4.4 After consultation with a Pro-Vice-Chancellor, the Dean of the Faculty and the Chairman concerned, the Vice-Chancellor may terminate the appointment of a Chairman of Department as such by giving him two months' notice in writing.

4.5 The Chairman of a Department may resign his appointment as such by giving the Vice-Chancellor two months' notice in writing.

4.6 Where the Chairman of a Department is unable, either by reasons of his absence from the University or for any other reason, to carry out his functions as Chairman, the Vice-Chancellor may, subject to the provisions of Section 4.2 of this Ordinance, appoint an Acting Chairman of the Department for such a period and under such conditions as he may determine, provided that the period of appointment does not exceed the balance of the period of office of the substantive Chairman.

4.7 A Chairman of Department shall be paid a responsibility allowance at a rate determined from time to time by the Finance Committee of Council for the duration of his term of office as Chairman, provided that no allowance shall be payable where the Chairman is absent or unable to perform his functions for a period of more than 10 days.

4.8 An Acting Chairman of Department who is appointed Acting Chairman for a period in excess of 10 days shall be paid a responsibility allowance at a rate determined from time to time by the Finance Committee of Council for the duration of his term of office as Acting Chairman.

5.0 DUTIES AND POWERS OF THE CHAIRMAN OF DEPARTMENT

In addition to his teaching, research and other duties and responsibilities, the Chairman of Department shall:-

5.1 Serve as Chairman of Departmental Board meetings.

5.2 Represent the Department on the appropriate University Committees and other bodies as required.

5.3 At all times use his best endeavour to ensure that proper and acceptable standards of teaching and instruction are maintained in the Department.

5.4 Make recommendations with respect to probation, advancement and promotion of academic staff within the Department, provided that:-

5.4.1 In so doing the Chairman shall consult full-time academic members of the Department.

5.4.2 If the Chairman is himself a candidate for promotion, the appropriate recommendations shall be made by the Dean of the relevant Faculty after consultation with all full-time academic members of the Department.

5.5 Serve as executive officer of the Department in the implementation of Departmental Policy, as determined by the Departmental Board and other University authorities, and be responsible for the day to day administration of the Department.

ACADEMIC STAFF GRADING, TENURE AND PROMOTIONS ORDINANCE (1997): ORDINANCE 28

1.0 This Ordinance may be cited as the Academic Staff Grading, Tenure and Promotions Ordinance 1983, and shall take effect from 1 January 1984.

2.0 The Staff (Tenure) Ordinance 1973 is hereby repealed.

3.0 Objectives

In making this Ordinance, the Council has as its objective the establishment within the University of an equitable and workable system of appointments and promotions which satisfy the legitimate career aspirations of academic staff and which ensure the achievement of the University's academic aims whilst maintaining the high quality of its academic staff.

4.0 Structure of Academic Staff Grades

4.1 the following structure of grades and notches for Academic Staff shall apply within the University;

Grade	**Number of notches**
Professor	*As approved by the University from time to time*
Associate Professor	
Senior Lecturer	
Lecturer	

4.2 The salary scales applicable to each grade and the salary step applicable to each notch within a scale shall be such as may be approved by University Council from time to time, and published as part of the University's Salary Scales.

4.3 The University Council or its authorized committees shall have sole discretion to determine the academic staff establishment in each Academic Department and Faculty in the University, and in so doing, may designate that posts be established at any of the grades listed in Section 4.1 above, but normally:

4.3.1 there shall be only one established Professorial Chair in a Department which shall be filled by appointment;

4.3.2 each of the other academic posts on a Department's or Faculty's establishment may be filled at professorial level only by the promotion of existing staff.

5.0 Grading and Notching on Initial appointment

5.1 On initial appointment of the University's Academic Staff, a successful candidate shall be graded and notched according to his or her qualifications experience and published research, and in so doing, the following criteria will apply;

5.2 Qualifications

5.2.1 The basic qualification for appointment to the University's academic staff is a good first degree or an approved equivalent in the appropriate discipline.

5.2.2 An appointee with a good first degree or any approved equivalent in the appropriate discipline, but without any relevant post-graduate experience, shall be placed at the first notch of the teaching assistant scale.

5.2.3 An Appointee with approved research or non-research post-graduate qualifications which have been the subject of an examination process, shall be granted additional notches within a grade according to the following guidelines:-

5.2.3.1 a postgraduate diploma or postgraduate Masters Degree extending over less than 2 years of study or equivalent. (1 notch).

5.2.3.2 a postgraduate Masters Degree extending over 2 years of study or equivalent. (2 notches).

5.2.3.3 a DPhil or PhD Degree or equivalent. (3 notches).

5.2.4 The qualifications which are accepted by the University as approved equivalent to the basic levels recognized are set out in the First Schedule to this Ordinance.

5.2.5 A serving member of the University's Academic Staff who obtains a further qualification, as described in Section (c) above, shall be awarded the appropriate additional notches with effect from the 1st of the month after the additional qualification is finally awarded, provided that such additional notches do not result in the member of staff being effectively promoted to a higher grade.

5.3 **Experience**

5.3.1 New appointees to the University's Academic Staff will be awarded, on initial appointment, one notch on the salary scales for each year of relevant postgraduate experience, provided that such recognition of experience does not result in the appointee being appointed at a higher grade than that of the Lecturer, unless the appointee also satisfies the criteria for promotion to such higher grade as specified in Section 7.5 of this Ordinance.

5.3.2 in granting recognition to relevant postgraduate experience the University shall:

5.3.2.1 make no distinction between professional experience

5.3.2.2 recognise in full, the time spent as a full-time member of the academic (teaching and/or research) staff of a reputable university.

5.3.2.3 no grant credit in notching on the scales for the time an appointee has spent in full time study for a postgraduate qualification.

5.3.3 in all disciplines, any postgraduate experience in the appropriate discipline will be recognized as relevant, and in particular internship year following graduation as an MBChB or B. Pharm, or equivalent will be recognized as a postgraduate experience.

5.3.4 In general, the University will not provide any credit in notching an appointee, on initial appointment, for pre-graduate experience, but from time to time the University may recognize such experience and, in so doing, shall specify the type of experience and the extent of its recognition by the University, by including such information in the Second Schedule to this Ordinance.

5.4 **Published Research**

The University recognizes published research, other than that forming part of a post-graduate qualification, for the purposes of determining the notch on initial appointment.

The University does not prescribe specific mechanisms or guidelines for such recognition, and relies on the appropriate Appointment Board to make recommendations in each appointee's case. In making such recommendations, Appointment Boards shall take cognizance of the quality of the published work and whether it had been referred by persons expert in the particular field.

6.0 PROFESSIONAL SUPPLEMENT

6.1 There shall be only one Academic (Teaching and Research) grading and salary structure, and the same salary scales shall apply to all posts in all Faculties within the University.

6.2 In certain fields a pensionable, professional supplement in addition to the basic salary may be paid to staff.

7.0 PROMOTION

7.1 **Criteria for Promotion**

In assessing the suitability of members of the academic staff for promotion to a higher grade, the University shall take into account the following broad criteria;

7.1.1 Teaching

7.1.2 Research, Scholarship and Creative Work and

7.1.3 University Service.

7.2 **Assessment of Teaching**

In making an assessment of a candidate's teaching, the University regards the following general areas as being of central importance.

7.2.1 Teaching method;

7.2.2 Course content;

7.2.3 The general performance of students in the course taught by the candidate for promotion;

7.2.4 The quality of the candidate's supervision of graduate students;

7.2.5 The development of new and effective techniques of instruction.

7.3 **Assessment of Research, Scholarship and Creative Work**

7.3.1 In making an assessment of a candidate's research, scholarship and creative work (hereinafter referred to as "research"), the University recognizes that research has a number of dimensions and, therefore, would examine a candidate's research to determine which of the following dimensions apply:-

7.3.1.1 The accumulation of data that confirms an existing theory

7.3.1.2 The application of existing theory to acts specific to given contexts;

7.3.1.3 The generation of new theory and its empirical testing;

7.3.1.4 The generation of new methodologies for dealing with problems in the discipline or in practice;

7.3.1.5 Originality and innovation in contributions to issues of culture, of creative arts, writing, architectural designs etc.

7.3.2 Normally, the University would take into account for promotion purposes only research which has been published, been accepted for publication or, in the case of longitudinal studies, is in written-up form which can be referred. Invariably, the University will seek the views of referees, which it appoints, on the quality of the candidate's research.

7.3.3 In addition to making an assessment of a candidate's research from the point of view of its quality, the University would also make an assessment in terms of the quantity of research output.

7.4 **Assessment of University Service**

In assessing a candidate's University service, the University is conscious of the fact that every member of the academic staff should be a good University citizen, performing his/her duties conscientiously and well, attending and participating on committees to which he/she is assigned. The University regards such activity as adequate University service. If a candidate has taken a leadership role in University service such as serving as Dean, Chairman of Department, Chairman of a Committee or in organizing a Faculty or organizing vacation research for students or is involved in student counseling and does the activities outstandingly well, the University would regard such service as better than adequate.

7.5 **Criteria for Promotion to Specific Grades**

7.5.1 Criteria for Promotion to the Senior Lecturer Grade

7.5.1.1 Assessments at the level of satisfactory in teaching, research and University service and

7.5.1.2 An assessment at the level of outstanding in at least one of the following, teaching, research and University service.

7.5.2 Criteria for the Promotion to the Associate Professor Grade

The criteria for promotion to the Associate Professor Grade are as follows:-

7.5.3.1.1 An international reputation for scholarship in the candidate's field as testified by external assessors, examiners or reviewers of the candidate's work;

7.5.3.1.2 In some fields, one or more books and substantial publications in scholarly journals;

7.5.3.1.3 It is possible, but unlikely, for a Lecturer to be promoted directly to the Associate Professor Grade;

7.5.5 An Associate Professor would be required to demonstrate the sustained record required for promotion to a Professor in the period he/she was promoted or appointed as an Associate Professor.

7.6 **Promotion Procedures**

7.6.1 Annually, in the early part of each calendar year, the Chairman of a department shall place in the file of each academic member of that Department a report concerning the member's teaching, research and University service in the previous year. This report shall be available to the member of staff concerned, the Faculty and the appropriate members of the University administration.

7.6.2 The Annual Reports filed in terms of Section 7.6.1 will form the basis of a chairman of Department's report to the Promotion or appropriate Academic Appointments Board for the purposes of application for promotion.

7.6.3 A member of staff wishing to apply for promotion should do so in response to the annual invitation to apply for promotion issued by the University Administration. In the first instance, such applications shall be submitted to the Chairman of the member's Department who will submit to the Promotions Committee, through the Dean of Faculty, a dossier containing the following documents:-

7.6.3.1 The candidate's complete, up-to-date curriculum vitae;

7.6.3.2 The candidate's application for promotion;

7.6.3.3 Copies of each of the Annual Reports on the member since initial appointment or since the date of promotion whichever is the most recent;

7.6.3.4 A summary of the Departmental Board's views on the candidate's application;

7.6.3.5 A report containing his recommendations on the candidate's application, which shall first have been made available to the candidate for comment, but in all other respects should be regarded as confidential to the Promotions Committee;

7.6.3.6 Any comments on the Chairman's report which the candidate may wish to submit to the Promotions Committee.

7.6.4 In circumstances where the candidate expressly wishes the Departmental Board to consider any difference of opinion between him/herself and the Departmental Chairman he/she may request the Departmental Board to do so, in which event the outcome of the Departmental Board's deliberations would be included in the dossier submitted through the Dean to the Promotions Committee.

7.6.5 The dossier shall also include a list, in order of preference, of assessors to whom the Promotions Committee may refer. This list shall be prepared by the Departmental Board and shall be as follows in applications for promotions to:-

7.6.5.1 Senior Lecturer: 3 assessors, at least one of which shall be an outsider to the University.

7.6.5.2 Associate Professor or Professor: 6 assessors, at least two of which shall be outsiders to the University.

7.6.6 The Dean of each Faculty shall forward to the Promotions Committee the dossier received from the Chairman of Department on each candidate, together with a report and recommendation by him/herself as Dean. The Dean's report shall be confidential, except that if he/she disagrees with the Chairman's report, the Dean is required to make his report available to the Chairman and the candidate, in which event the candidate's comments on the Dean's report shall be included in the final dossier submitted to the Promotions Committee.

7.6.7 The Promotions Committee shall have final authority in all promotion matters and, in particular, shall be the sole arbiter as to whether or not to seek reports from assessors in any case for promotion. If a "prima facie" case for promotion is judged to exist then the Committee shall seek the opinion of external assessors, in which event the assessors' reports shall be confidential to the Promotions Committee.

7.7 Composition of Annual Report

7.7.1 The Annual Report placed in each academic member of staff's personal file each year by the Chairman of the Department shall include an assessment of the member's teaching, research and University services as indicated in Section 1.2.1.3 and 1.4 above.

7.7.2 Report on Teaching

In compiling the section of the Annual Report on a member's teaching the Chairman of Department shall include an evaluation arrived at after implementing at least the following means assessment.

7.7.2.1 Peer Evaluation of Teaching

The Departmental Board shall establish a panel of at least two academic members of staff for each academic member of the Department, with the responsibility of attending lectures given by their colleagues on different occasions and without prior notice to the person giving the lecture. The panel's report will be considered by the Departmental Board and after constructive, open discussion with the member of staff concerned, will become a component in the assessment of each member of staff's teaching.

7.7.2.2 **Evaluation by Students**

Students will be provided with an opportunity to complete an evaluation form in respect of each course. In the first instance, evaluation forms completed by students will be submitted to the Chairman ofDepartment who will discuss the views expressed with the member of staff concerned and the Departmental Board before including any informal comment in the Annual Report.

7.7.2.3 **Assessment by External Examiners**

Any comments by External Examiners on a member's teaching shall be included in the Annual Report.

7.7.2.4 **Seminars**

All departments are required to encourage members of the staff to hold seminars on relevant subjects of their choice to which staff and students should be invited to attend. The feed-back from these seminars is seen as being helpful to the Lecturer but need not be included formally in the assessment of teaching ability for the Annual Report.

7.7.3 **Report on University Services**

The Section of the Annual Report on a member's University service shall comprise:-

7.7.3.1 a report by the Chairman of Department on the quality and quantity of the member's University service during the year in question;

7.7.3.2 any written comments by the member of the Chairman's report made in terms of Section 7.7.3.1 above.

8.0 TENURE

8.1 Only citizens and residents of Zimbabwe, in accordance with section 6(2) of the University Act, shall be appointed on permanent terms of service which enable the gaining of tenure in due course should the University so determine.

8.2 Persons who are not citizen or residents of Zimbabwe shall be appointed only on fixed term contracts, which do not entitle such staff to being considered for tenure, and therefore, the further provisions of this section of this Ordinance do not apply to such staff.

8.3 All academic staff appointed by the University shall be required to serve a probationary period before being considered for tenure.

8.4 The duration of the probationary period shall be:-

8.4.1 In the case of staff who, before appointment, had tenure at another reputable university or institution of higher education: 2 years.

8.4.2 In the case of staff who had not previously had tenure: 3 years

8.5 Appointments Boards are authorized to recommend the granting of immediate tenure, and the consequent waiver of the probationary period, in cases where the Board is recommending an appointment at the Associate Professor of Professor level and feels there are good grounds for making the appointment with immediate tenure.

8.6 The criteria for granting of tenure on completion of the requisite probationary period shall be:

8.6.1 Satisfactory teaching;

8.6.2 Satisfactory research;

8.6.3 Satisfactory University service.

8.7 The procedures for determining whether or not to grant tenure shall be as stipulated above for the consideration of applications for promotion, and therefore, the provisions of sections 7.2.3, 7.4, 7.6.2, 7.6.3, 7.6.4, 7.6.6 and 7.7 shall apply except that:-

8.7.1 the appropriate final authority shall be the appropriate Academic Appointments Board rather than the Academic Promotions Committee.

8.7.2 the initiation of the process will be made by the University Administration, at a time suitably in advance of the scheduled date of completion of a member's probationary period of service.

8.8 If a member of staff is not granted tenure after the completion of his/her probationary period the University may either:-

8.8.1 extend the probationary period by up to two further years with permission for the member of staff to apply for tenure before the expiry of that time, or terminate the member of staff's employment with the University.

8.9 If at the end of the probationary period a member of staff is granted tenure then the appointment shall be without time limit up to the age fixed by the University for retirement except that:-

8.9.1 a member may resign his appointment by giving not less than 3 months' notice in writing, provided that he/she may not give notice of resignation while he/she is on Sabbatical Leave or Contact Visit, nor may any period preceding or spent on such leave visit be counted as a period or portion of a period of notice.

8.9.2 the University Council may terminate the appointment for "good cause" by giving the member of staff not less than 3 calendar months' notice or paying the member's salary in lieu thereof.

8.10 Before terminating appointment in terms of Section 8.9.2 the Council:-

8.10.1 shall inform the member in writing of the matters alleged against him/her and give the member the opportunity of replying in writing to those charges.

8.10.2 may, and if so requested by the member of staff shall, before considering such dismissal, refer the case to the Staff Disciplinary Committee established in terms of Section 24 of the University Act.

8.11 "Good Cause" for the termination of an appointment in terms of Section 2.9.2 means:-

8.11.1 conviction of any offence which the Council considers to be such as to render the person concerned unfit for the execution of the duties of his/her office.

8.11.2 any physical or mental incapacity which Council considers to be such as to render the person concerned unfit to continue to hold his/her office.

8.11.3 conduct of an immoral, scandalous or disgraceful nature which the Council considers to be such as to render the person concerned unfit to continue to hold his office.

8.11.4 conduct which the Council considers to be such as to constitute failure or inability of the person concerned to perform the duties of his office or to comply with the conditions of tenure of his office.

9.0 TRANSITIONAL ARRANGEMENTS

9.1 On the coming into effect of this Ordinance, all existing academic staff shall be incorporated into the new grades designated in Section 4.1 of the Ordinance in accordance with the arrangements set out in the Fourth Schedule to this Ordinance.

9.2 In addition, all academic members of staff below the grade of Senior Lecturer shall have their grading and notching reviewed in the light of the criteria set out in the Section 5 of this Ordinance provided that such review:-

9.2.1 does not result in a member of staff being re-notched to a lower grade than he/she is currently on,

9.2.2 such review does not result in a member of staff being re-notched to a new higher grade,

9.2.3 the results of such review shall only come into effect from the member of staff's next incremental date.

10.0 INTERPRETATION

In this Ordinance:-

"Academic Staff" means all persons employed by the University as professors, associate professors, senior lecturers or lecturers and who are contractually required to carry out teaching, and administrative duties and to conduct research,

"A good first degree" means a first degree classified at the level of Upper Second or equivalent,

"Longitudinal" means research which is carried out over a period of at least 5 years before final results are obtainable.

FIRST SCHEDULE

QUALIFICATIONS ACCEPTED BY THE UNIVERSITY AS APPROVED EQUIVALENTS

(SECTIONS 5.2.4 OF THE ORDINANCE)

1.0 Qualifications recognized as equivalent to a postgraduate Diploma or postgraduate Masters Degree extending over less than 2 years of study.

Faculty/Department		Qualifications
1.1	Agriculture	No specific equivalent qualifications identified.
1.2	Architecture and Quantity Surveying	Bachelor of Architecture Degree
1.3	Arts	Aggregation
1.4	Commerce	Membership of the Institute of Cost and Management Accountants
1.4.1	Accountancy	Membership of the Institute of Chartered Secretaries and Administrators
1.4.2	Business Studies	Membership of the Institute of Marketing Management.
		Membership of the Institute of Chartered Secretaries and Administrators.
		Membership of the Institute of Personnel Management
1.5	Education	Graduate Certificate of Education.
1.6	Engineering	No specific equivalent qualifications identified.

1.7	Medicine	No specific equivalent qualifications identified.
1.8	Science	No specific equivalent qualifications identified.
1.9	Social Studies	No specific equivalent qualifications identified.
1.10	Veterinary Science	Specialty certificates issued after one year's full time study, or the equivalent in part-time study, and after examination by Universities and bodies such as the Royal College of Veterinary Surgeons, the American Veterinary Medical Association, and the Australian College of Veterinary Scientists.

2.0 Qualifications recognized as equivalent to a Postgraduate Masters Degree extending over 2 years of study.

Faculty/Department		**Qualifications**
2.1	Agriculture	No specific equivalent qualifications identified.
2.2	Art	B.Litt., B Phil.
2.3	Commerce	Membership of the Institute of Chartered
	Accounting	Accountants of Zimbabwe or Membership of an approved society as defined in the Accountants By-Laws promulgated in terms of the Accountants Act.
2.4	Education	No specific equivalent qualifications identified.
2.5	Engineering	Corporate Membership of an appropriate Institute of Engineering obtained by

examination at a professional interview procedure.

Faculty/Department	Qualifications
2.6 Medicine	M.Gen.Med. M. Med.(in Medicine, Surgery, Pathology, Paediatrics, Obstrics and Gynaecology or Psychiatry) MRCP (UK) FRCS (Eng.), (Glasg),(Edin)or (Irel) MRCOP, FFARCS, MRCPath any other qualification s acceptable to the Medical, dental and allied Professions Council of Zimbabwe for registration as a Practitioner on a Specialist Register
2.7 Science	No specific equivalent qualifications identified.
2.8 Social Studies	No specific equivalent qualifications identified.
2.9 Veterinary Science	Speciality Diplomas or Certificates issued after 2 years or 3 years full- time study, or the equivalent in part-time study, and after examination by Universities and bodies such as the Royal College of Veterinary Surgeons, the American Veterinary Medical Association, and the Australian College of Veterinary Scientists.

3.0 Qualifications recognized as equivalent to a DPhil or PhD Degree.

Faculty/Department **Qualifications**

3.1	Agriculture	No specific equivalent qualifications identified.
3.2	Arts	No specific equivalent qualifications identified.
3.3	Commerce	No specific equivalent qualifications identified.
3.4	Education	No specific equivalent qualifications identified.
3.5	Law	No specific equivalent qualifications identified.
3.6	Medicine	MD, Pharm. D
3.7	Science	No specific equivalent qualifications identified.
3.8	Social Studies	No specific equivalent qualifications identified.
3.9	Veterinary Science	No specific equivalent qualifications identified.

SECOND SCHEDULE

RECOGNITION OF PRE-GRADUATE EXPERIENCE

(SECTION 5.3.4 OF THE ORDINANCE)

Faculty/Department	Recognised Postgraduate	Extent of Recognition
1.0 Agriculture	Experience in the Agriculture Industry following award of a recognized Diploma in Agriculture.	One notch for each complete year of the relevant experience up to a maximum of years.
2.0 Arts	Nil	Nil
3.0 Commerce		
3.1 Accountancy	Relevant experience at an appropriate level in any of Auditing, Taxation, Financial and Management Consultancy.	One notch for each complete year of experience up to maximum of 5 years.
3.2 Business Studies	Experience at an appropriate	One notch for each complete year

	level in a relevant activity in Business or Government administration at a supervisory or more senior level.	of experience up to a maximum of 5 years.
4.0 Education complete	Depending on the job description of the post involved, teaching at Primary or Secondary level educational administrative experience following the award of a recognized certificate in education.	One notch for each complete year of experience up to a maximum of 5 years.
5.0 Engineering	Relevant experience at an appropriate level in engineering.	One notch for each complete year of experience up to a maximum of 5 years.
6.0 Law	Relevant experience at an appropriate level in law.	One notch for each complete year of experience up to a maximum of 5 years
7.0 Medicine	Relevant experience at an appropriate level in Medical Laboratory Technology following the award of a Diploma in Medical Laboratory Technology.	One notch for each complete year of experience up to a maximum of 5 years
8.0 Science	Depending on the job description of the post involved, certain technical experience may be	One notch for each complete year of experience up to a maximum of

	recognized following the award of an appropriate technical qualification.	5 years.
9.0 Social Studies		
	Professional full time experience Studies in areas such as counseling fiscal, public and social administration following the award of a recognized qualification.	One notch for each complete year of experience up to a maximum of 5 years.
10.0 Veterinary Science		
	Depending on the job description following the award of an appropriate qualification in a field related to the Veterinary profession. Examples of appropriate qualifications for this purpose are degrees in Animal Science, Microbiology or Zoology and Diplomas in Medical Laboratory or Animal Nursing.	One notch for each complete year of experience up to a maximum of 5 years

THE RULES OF STUDENT CONDUCT AND DISCIPLINE ORDINANCE NO.30 (AMENDED 2006)

These shall be the rules of Student Conduct and Discipline read together with the NUST Act Chapter 25.13 (formerly Act 1990).

1. This Ordinance may be cited as "The Rules of student Conduct and discipline Ordinance, Ordinance No. 30 (Amended 2006)".

2. The Student Disciplinary Committee hereby delegates to the officials referred to in the Rules of Student Conduct and Discipline the power of investigating and exercising disciplinary authority in respect of misconduct by any student to the extent and in the manner set out in the Rules of Student Conduct and Discipline.

3. The Student Disciplinary Committee may:-

   3.1 Order a student to pay to the University the amount of any financial loss caused to the University by such a student;

   3.2 After reference to the Vice-Chancellor, impose any penalty on a student which in the circumstances of a particular case it deems appropriate.

SCHEDULE

RULES OF STUDENT CONDUCT AND DISCIPLINE

1.0 INTERPRETATION

The University Officers charged with the administration of these rules will at all times seek to implement the letter and spirit of the University Act and will, in particular, have regard to the following principles:

1.1 The University is a Society in which high standard of communal life must be established and maintained for the benefit of both present and future members of the University;

1.2 A high level of personal integrity and a developed sense of responsibility towards others are as important to the University as outstanding scholastic achievement;

1.3 A proper concern for the reputation of the University and what it ought to stand for makes it incumbent upon its members to live decent and orderly lives;

1.4 Individual or collective action by members of the University which constitutes a breach of these rules may require to be punished, notwithstanding that the motive or goal of such action was a commendable one in the belief of such members.

2.0 UNDERTAKING AT REGISTRATION

When registering as a member of the University a student shall be given a copy of these rules and shall sign a statement in which he/she acknowledges that he/she has been furnished with the rules, and he/she undertakes to conduct himself/herself while a student of the University in accordance therewith and with any amendments duly made thereto.

3.0 STUDENT CONDUCT

3.1 No student of the University shall:-

3.1.1 Use the University premises contrary to University Regulations, residence, Faculty or Departmental rules or do any act reasonably likely to cause such mis-use;

3.1.2 Damage or deface any property of the University or do any act reasonably likely to cause damage or defacement thereto;

3.1.3 Disrupt teaching, study, research or administrative work, or prevent any member of the university or its staff from carrying on his/her study or work, or do any act reasonably likely to cause disruption or prevention;

3.1.4 Engage in any conduct whether on or off the campus which is or is reasonably likely to be harmful to the interests of the University, members of the University staff or students.

3.2 The following would be regarded by the University as instances of breaches of the rule contained in 3.1 (above):-

3.2.1 Displaying violence by word or act towards any member of the University, whether academic or administrative staff or student, or a guest of the University, or any visitor to the University or in any way intimidating or obstructing the free movement of such member, guest or visitor;

3.2.2 Disrupting or seeking to disrupt any proper function of the University whether it be an official function, Council Meeting, Senate Meeting, Faculty or Committee Meeting, Lecture, teaching session, the function of any University Society or day to day administrative activity;

3.2.3 Seeking to prevent a speaker invited by any section of the University Community from lawfully expressing his/her views.

3.3 Students are informed that:-

3.3.1 If a group of students forms a common intention to commit certain acts and assist each other in their commission, and in due course a breach of these Rules is committed by one or some of the group, then each member of the group who foresaw that the breach would occur, may be held to have committed that breach of the Rules. A member of such a group can avoid this happening to him/her by taking clear and unequivocal steps, before such a breach is committed, to show that he/she dissociates himself/herself from the acts of the group with whom he/she has so far been associating;

3.3.2 Where a number of students have committed a breach of these Rules and only one or more of these students can be identified, the University will not hesitate to take disciplinary action against those students who can be identified and against whom there is sufficient evidence to warrant such a disciplinary action;

3.3.3 Where a student commits an act which is both an offence according to the laws of the country and one which after investigation appears to be a breach of the disciplinary rules of the University, the University may punish such a student notwithstanding that he/she is prosecuted and/or punished by the courts of the country;

3.3.4 A Student Identity Card is solely for the legitimate use by the person to whom it has been issued.

3.4 A student shall obey any Rules made from time to time by the Vice-Chancellor and shall further obey all instructions given by the Vice-Chancellor and shall further obey all instructions given by the Vice-Chancellor, the Proctors, and all those persons whom the Vice-Chancellor has charged to assist him/her in the maintenance of discipline, and in this regard:-

3.4.1 Academic staff and Senior Administrative staff may order any member of a gathering of students which is committing an offence, or whose activities are likely to lead to a breach of Rule 3 (above), to disperse, and may further order any such member to furnish his/her full name or to accompany the member of staff for an interview with the Vice-Chancellor or a Proctor, or give both such orders. For the purposes of this section 'Senior Administrative Staff shall include the Registrar, Deputy Registrars, the Bursar, Deputy Bursars, Librarian, Deputy Librarian, Sub-Librarians, Directors, Dean of Students, Deputy dean of Students, Assistant/Senior Assistant Registrars, Assistant/Senior Assistant Librarians, Chief Security Officer, Accountants, Principal accountants, and Wardens of University Residence.

3.4.2 If a student misbehaves in a lecture or teaching session or interferes with the conduct of a lecture or teaching session the member of staff conducting such a lecture or teaching session may order the student to leave or to cease such interference.

3.4.3 Failing to comply with any order given as stated above constitutes a serious offence.

4.0 THE POWERS OF THE UNIVERSITY PROCTORS

The Vice-Chancellor shall from time to time appoint as many Proctors as he deems necessary from among the academic staff who are not members of the Student Disciplinary Panel or Wardens. One Proctor shall be known as the Senior Proctor with the responsibility of organising and supervising the work of the other Proctors. A second Proctor shall have legal expertise and known as the Legal Proctor with a particular responsibility for the presentation of cases before the Student Disciplinary Committee.

4.1 A Proctor shall be charged with ensuring the proper observance of these Rules by students on or off the University site and to this end shall, in addition to his power under Rule 3.4, have the following powers:

4.1.1 To receive and investigate reports of student misconduct;

4.1.2 To summon any student to appear before him/her either to answer a charge or complaint against him/her or to answer questions in regard to any matter under investigation by him/her;

4.1.3 To proceed in the absence of a student who in the opinion of the Proctor has been duly summoned but has failed to appear;

4.1.4 To recommend to the Registrar that a student be summoned to appear before the Student Disciplinary Committee to answer a charge or complaint against him/her or to answer questions in regard to any matter under investigation by the Student Disciplinary committee or Proctors;

4.1.5 To reprimand a student;

4.1.6 To impose a maximum fine on a student not exceeding 25% of the average annual tuition fees as stipulated by the Fees Ordinance for the State Universities for the first offence, and a maximum not exceeding 50% of the average annual tuition fees for the second offence. Any subsequent offences should be referred to the Registrar;

4.1.7 To order a student to pay to the University the amount of any financial loss caused to the University by such student;

4.1.8 To withdraw an existing student privilege, other than residence, for a period not exceeding 1 (one) semester.

4.2 When a report is made to a Proctor of an alleged misconduct by a resident of a Residential Unit, the Proctor shall communicate such a report to the Warden of the Residential Unit concerned before taking action against the resident.

5.0 POWER OF THE WARDENS

5.1 A Warden of a Residential Unit shall have the power to investigate any breach of these Rules by a student of his/her Residential Unit committed within any residential Unit and to make any of the following orders in respect of such student adjudged by him/her to have committed a breach of these rules.

5.1.1 To reprimand a student;

5.1.2 To withdraw an existing resident student privilege;

5.1.3 To impose a maximum fine not exceeding 5% of the average annual tuition fees as stipulated by the Fees Ordinance for State Universities;

5.1.4 To order a student to pay to the University the amount of any financial loss caused to the University. Such an order may be made on the person or persons who caused the loss or, where identity cannot be established, on members of the residence in which the loss was sustained;

5.1.5 To suspend a student from his/her University Residence;

5.1.6 To expel a student from his/her University Residence for a period not exceeding two semesters.

5.2 Where a warden wishes to impose penalties 5.1.5 or 5.1.6 above, he/she shall first furnish the Senior Proctor with a full report concerning the alleged offence and the proposed penalty. On receipt of this report the Senior Proctor may, either:-

5.2.1 Confirm the proposed penalty and order of the Warden and in the event of variation, order the Warden to execute such varied order; or

5.2.2 Institute a further investigation of the matters before making such order at the conclusion as he/she deems fit; or

5.2.3 Recommend to the Registrar that a Student Disciplinary Committee be convened to examine the case.

5.3 A Warden of a University Residence and the Warden of Non-resident Students shall have the power to report any matter of student misconduct to the Proctors or, through the registrar, to the Student Disciplinary Committee.

5.4 Where a warden has imposed any of the penalties set out in Section 5.1.1 to 5.1.4 above on a student he/she shall submit a report to the Senior Proctor, Registrar and Dean of Students.

6.0 RULES FOR UNIVERSITY STUDENT RESIDENCES

6.1 General

A resident shall obey all Rules made by the University and instructions given by the Warden, Deputy and Sub-Wardens of the residence and shall refrain from conduct which:-

6.1.1 May bring discredit upon his/her Residential Unit; or

6.1.2 Is prejudiced to the welfare of other residents of the Unit.

6.2 Powers of University Residence Committee Members

Members of Residence Committee shall have power;
To investigate and if necessary reprimand residents for any infringement of the Rules contained in this Section, and report such investigation or reprimand to the Warden.

6.3 Damage to University Residence Property

A residence shall be liable to compensate the University in full for any damage caused by him/her to University property. Damage caused to a study - bedroom shall be presumed to have been caused by the resident to whom such a room has been allocated unless the contrary is proved.

6.4 Fire

6.4.1 Normally, fire drills shall be conducted at least three times per Semester (beginning, middle and end of the Semester)

6.4.2 A resident having knowledge of the outbreak of fire in, or adjacent to Resident premises shall as soon as possible:-

6.4.2.1 Raise the alarm;
6.4.2.2 Inform the Warden, Deputy or Sub-Warden;
6.4.2.3 Summon the Municipal fire-brigade;
6.4.2.4 Inform the Director of Physical Planning, Works and Estates/Dean of Students.

6.5 Vacation Residence (Only for NUST Campus Residence)

6.5.1 A resident may not occupy a study-bedroom during University vacations, save with the prior written authority from the Office of the Dean of Students, on the recommendation of the Dean of the appropriate Faculty and the Warden. Applications for vacation residence must be submitted through the prescribed channels and on the prescribed form.

6.5.2 A student granted leave to reside in University Residence during vacation who no longer wishes to avail himself/herself of this privilege shall furnish the Office of the Dean of Students with at least 3 (three) days' written notice of such fact. Omission to do so will, normally, render such resident liable to monetary penalty equivalent to the amount that was due.

6.6 Absence from Residence

To be absent from University Residence for two or more consecutive nights, a resident student needs to inform the Dean of his/her Faculty in addition to the Warden. A resident student may be required to be in residence every night by such time as may be laid down in Residence Regulations unless he/she has given prior notice to the Warden or a Sub-warden that he/she will return to Residence at a later hour.

6.7 Visitors

6.7.1 Resident students' parents may visit them in their rooms from 1000 to 2230 hours.

6.7.2 Students in University Residence may visit each other's rooms between the following hours:

Monday to Friday	-	1000 to 2230 hrs
Saturday	-	1000 to 0000 hrs
Sunday	-	1030 to 2230 hrs

6.7.3 Students may have other Visitors between 1630 and 2030 hours.

6.7.4 Outside the prescribed visiting hours, all parts of the Residence except the Common rooms and entrance foyers are out of bounds.

6.7.5 Special arrangements for visits may be made by application to the Warden of the Residence concerned.

6.7.6 These provisions apply to all students – undergraduate and postgraduate, living in undergraduate residence.

6.7.7 No visitor or non-resident student may make unauthorised use of accommodation or dining facilities in University Residence. Students introducing visitors or non-resident students to the Residences may be held responsible by the Wardens for the conduct of such visitors, and non-resident students making unauthorized use of the residence facilities shall be guilty of misconduct.

6.8 Withdrawal from Residence

If a student should leave the University or withdrawal from Residence before the end of the session for which he/she has been admitted, fees already paid by him/her are not normally returnable, except that a student gives proper notice before the end of a session that he/she wishes to vacate Residence for the remainder of the session may be refunded the balance of Residence fees in respect of the remaining period of session.

6.9 Loss of Valuables

A resident shall report as soon as possible to the Warden, Deputy or Sub-Warden the loss of any article from Residence.

6.10 Relationship of Resident and Staff

A resident shall not require a member of the Central Services Department Staff to perform a service outside the scope of his/her normal employment duties.

6.11 **Illness**

For a resident who is confined in bed, the Sub-Warden/Warden must ensure that his/her illness is reported to the University Student Health Service.

7.0 RULES FOR THE USE OF VEHICLES

7.1 A student wishing to keep or use a motor vehicle including a motor cycle, motor scooter or motorized bicycle within the boundaries of the University site shall previously notify the Registrar in writing on the form prescribed.

7.2 Save with the prior written permission of the Registrar, a student shall not, within University grounds:-

7.2.1 Park a vehicle in a parking place marked “for staff and visitors only”;
7.2.2 Park a vehicle in any place at which parking by any persons has been prohibited;
7.2.3 Bring a vehicle within any University building;
7.2.4 Ride or drive a vehicle on any part other than roads, tracks or parking places;
7.2.5 Leave a vehicle in an unusable condition for a period longer than is reasonably required to effect necessary repairs.

7.3 Whenever a vehicle registered with the University is driven, ridden or parked in contravention of the Rules set out in Section 7.2 it shall be presumed that it was so driven, ridden or parked by the person in whose name the vehicle has been registered with the University unless the contrary is proved.

7.4 **Penalties**

7.4.1 The Wardens, Proctors and such other persons so authorized by the Vice-Chancellor shall have power to investigate breaches of the Rules contained in this Section and to impose penalties calculated as proportions of the average annual tuition fees as stipulated by the Fees Ordinance for State Universities.

7.4.1.1 First offence, 2% of annual Tuition Fees

7.4.1.2 Second offence, 4% of annual fees

7.4.2 In the case of a third subsequent offence the name of the offender, with particulars of his previous offences under this Section, shall be reported to the Proctors, who shall exercise appropriate authority in Terms of Rule 4.

RULES OF PROCEDURE IN DISCIPLINARY PROCEEDINGS BEFORE THE STUDENT DISCIPLINARY COMMITTEE

1.1 The Chairman of the Committee shall regulate proceedings in a manner as simple and informal as possible which is, notwithstanding, best fitted to do substantial justice and at all times in accord with the principles of natural justice. More particularly, a student charged with breach of the Rules of Student Conduct and Discipline shall at any investigation thereof before the Committee and with no derogation of his/her rights in terms of Section 23 (3) of the University Act:-

1.1.1 Be furnished with a full and fair opportunity to meet such allegations if he so desires;

1.1.2 Be permitted to present any relevant facts or call any witness capable of giving testimony relevant to the investigation;

1.1.3 Be permitted to put questions to witnesses save those which are irrelevant, frivolous or vexatious;

1.1.4 Be permitted to be present at all times save when the Committee is deliberating upon its decision of the matter;

1.1.5 Be advised as fully and clearly as possible of the Committee's decision or recommendation and of its reasons for arriving at that decision or recommendation.

1.2 The Proctors and Wardens shall conduct any proceedings before them in accordance with Rule 8.1 save that the provisions of Section 25 (3) of the University Act will not be applicable.

1.3 In the event of the Legal Proctor conducting an investigation before the Student Disciplinary Committee it shall further be his/her duty:-

1.3.1 To elicit all evidence brought to his/her attention which is relevant to the investigation and admissible, whether favourable to or prejudicial to the student whose conduct is the subject thereof;

1.3.2 If so required by the Committee, to advise the Committee as to the issues which they have to decide and as to any point of law or procedure so as to ensure that the conduct of the investigation is consistent with the principles of natural justice;

1.3.3 To be absent at all times from the deliberations of the Committee upon its final judgments.

1.4 A notice to a student summoning him/her to appear before the Committee for investigation of an alleged breach of the University Rules of Student Conduct and Discipline shall be contained in a letter addressed to him/her and advising him/her of:-

1.4.1 The place at which he/she is to attend;

1.4.2 The date and time at which he/she is to attend, provided that such date shall be not less than 5 days after the date upon which such notice is received;

1.4.3 The rule which he/she is to have contravened and full particulars of his/her alleged contravention;

1.4.4 His/her right to make any relevant statements he/she wishes to the Committee;

1.4.5 His/her right to call witnesses to attend and give any relevant testimony on his/her behalf before the Committee;

1.4.6 His/her right to be accompanied and represented before the Committee by a legal practitioner;

1.4.7 The right to furnish to the Proctors in advance of the investigation any information which he/she wishes to have given due consideration.

1.5 A member of the Committee who has acquired, other than in the course of his University life, knowledge of evidence in an investigation of misconduct to be held before the Committee' shall not participate in such investigation.

1.6 The member of the Committee who is a relative of a student charged with breach of the Rules of Student Conduct and Discipline shall not participate in the Committee's proceedings.

1.7 The Committee shall only find a student to have committed a breach of the rules of Student Conduct and Discipline when it is satisfied beyond reasonable doubt that the student has committed such breach.

1.8 In the event of the Committee finding a student to have committed a breach of the rules, either on the student's own admission or at the conclusion of an investigation, it shall, before determining the punishment it should impose or the terms of its recommendation to the Vice-chancellor, permit such a student a full opportunity to make a statement or produce evidence which he/she wishes to be taken into consideration in mitigation of his/her punishment.

1.9 The Chairman of the Committee or his/her nominee shall keep full notes of any proceedings before the Committee but these need not be a verbatim record.

Date of Operation

This Ordinance shall apply with effect from 1 October, 2006, or any later date as approved by the Minister of Higher and Tertiary Education, Science and Technology Development, and shall remain in force until otherwise repealed or varied by further Rules of Student Conduct and Discipline Ordinance of the National University of Science and Technology.

GENERAL ACADEMIC REGULATIONS FOR UNDERGRADUATE DEGREES

1.0 PREAMBLE

1.1 The Senate shall be the final authority for the interpretation of these regulations.

1.2 The Senate reserves the right to alter, amend, cancel, suspend, or replace any of these regulations.

1.3 The Senate has the power to exempt any student from any of the regulations.

1.4 A student who has started a programme of study following one set of regulations shall not be affected by regulations subsequently adopted unless agreed to in writing by the student.

1.5 There shall be academic regulations for each Faculty which shall be subject to approval by the Senate and which shall include provision for admission to Programmes, Subjects and Modules within the Faculty and schemes of examinations for these Programmes.

1.6 The General Academic Regulations shall take precedence over the Faculty Regulations.

1.7 Detailed syllabi for Subjects or Modules in a Subject will not form part of the General or Faculty Regulations but shall be submitted to the appropriate Faculty Boards for approval.

1.8 In these regulations the following shall be used as described:-

“Academic Year”	-	A defined portion of a Programme consisting of two semesters.
“Part”	-	A defined portion of a Programme covering one academic year.
"Continuous Assessment"	-	Prescribed assignments to be completed within a given period and forming a part of a module.
“Industrial Attachment”	-	A prescribed period of hands-on experience in a relevant work setting.
“Module”	-	Is a component within a Programme which is separately examinable.
“Programme”	-	A plan of study lasting over a period of time which leads to the award of a degree, diploma, or certificate of the University.
“Project”	-	A defined practical assignment which is separately examinable.
"Semester"	-	A prescribed period normally comprising 15 weeks, including teaching, revision and examinations.
“Subject”	-	A field of study offered by a Department.
“Credit”	-	Quantified means of expressing the volume of learning based on the workload students need in order to achieve the expected outcomes of a module.
“Credit accumulation”	-	The process of collecting credits awarded for achieving the learning outcomes of a module component of a programme.

1.9 A schedule of Programmes, Subjects and Modules and their codes for use in computerised student records shall be maintained by the Registrar. These codes shall be alphanumeric.

2.0 PROGRAMMES

2..1 The University may offer programmes for undergraduate Bachelor's Degrees at Honours Level.

2.2 **Honours Degrees**

2.2.1 The structure of Honours Degree Programmes shall be as prescribed in the Faculty Regulations. These structures may vary in accordance with the particular requirements of different Faculties and Subjects but all Honours Programmes shall normally contain the following elements:-

(a) one or more 'subjects' shall be studied over at least four years of full-time study(or equivalent), including one academic year of Industrial Attachment. These subjects shall be studied intensively and progressively (i.e. studies in the final year(s) assume prior knowledge of the Subject at first, second and third year level) and be taught and examined at a level requiring great breadth and depth of knowledge and understanding.

(b) the combination of subjects and modules within an Honours Programme shall be prescribed so as to focus on specific topics and to disallow a wide choice of disparate options. This specific focus may be influenced by the requirements for professional recognition and registration within a particular field.

(c) one or more subsidiary subjects or modules may be studied within the Honours programme but assessment in these subjects/courses either will not contribute to the final classification of the degree awarded or will be assigned a relatively lighter weighting in the overall calculation.

(d) a student for an 'Honours' degree shall normally be required to complete a project or dissertation within the programme of study. Normally, at least 60% of the courses taken in an 'Honours' Programme will be in the major subject(s)

2.2.2 The following are Degrees offered by the University:

Bachelor of Architectural Studies Honours (BArch Studies Hons)
Bachelor of Commerce Honours (BCom Hons)
Bachelor of Engineering Honours (BEng Hons)

Bachelor of Technology Honours (BTech Honours)
Bachelor of Science Honours (BSc Hons)
Bachelor Medicine and Bachelor of Surgery (MBBS)
Bachelor of Quantity Surveying Honours (BQS Hons)
Bachelor of Education Honours (BScEd Hons)
Bachelor Design Education (BDesEd)
Bachelor of Technology Education Honours (BTechEd Hons)

3.0 ENTRY REGULATIONS

3.1 Normal Entry

3.1.1 For normal entry candidates should:-

(a) have satisfied the general requirements as prescribed below; and
(b) have satisfied the special requirements for entry into the particular programme chosen; and
(c) have passed English Language and Mathematics at Ordinary Level or approved equivalents.

General Requirements

Passes in at least 5 subjects at Ordinary Level and at least 2 subjects at Advanced Level or their equivalents.

The following are acceptable to the University:-

Ordinary Level Pass or Equivalent.
Ordinary Level of the Associated Examining Board's General Certificate of Education.
Credit standard of the Cambridge Overseas Higher School Certificate;
Ordinary Level of the University of London's General Certificate of Education;
Ordinary Level of the Zimbabwe General Certificate of Education/ Zimbabwe School Examinations Council.
Subsidiary standard of the Cambridge Overseas Higher School Certificate;

Advanced Level Pass or Equivalent
Advanced Level of the Associated Examining Board's General Certificate of Education.
Principal subject standard of the Cambridge Overseas Higher School

Certificate;
Advanced Level of the University of London's General Certificate of Education.
Advanced Level of the Zimbabwe General Certificate of Education/Zimbabwe School Examinations Council.

3.1.2 **General Subject Provisions**

Subjects must have been chosen from the approved list below and restrictions against the combination of overlapping subjects must have been observed.

3.1.3 **APPROVED SUBJECTS FOR ADMISSION PURPOSES:**

Subjects approved by the Associated Examining Board; and/or the Cambridge Local Examination Syndicate and/or the London General Certificate of Education/and/or Zimbabwe General Certificate of Education/Zimbabwe School Examinations Council.

Level	
OA	Accounting
O	Accounts
OA	Accounts, Principles of
OA	Ancient History
A	Ancient History and Literature
OA	Applied Mechanics
O	Applied Statistics
OA	Art
OA	Art and Crafts (AEB)
OA	Bible Knowledge
OA	Biology
O	Bookkeeping and Accounting
OA	Botany
O	Building Studies
OA	Business Management
OA	Business Studies
OA	Chemistry
O	Commerce
OA	Computer Studies
A	Computing Science
O	Computing Studies

OA	Divinity
O	Drama and Theatre Arts (AEB)
A	Economic & Political Studies
O	Economic and Public Affairs
A	Economic and Social History
A	Economic Geography
OA	Economic History
O	Economic Principles
OA	Economics
A	Electronic Systems (AEB)
O	Electricity & Electronics
O	Elementary Physiology
O	Elements of Sociology
OA	Engineering Drawing
OA	Engineering Science
O	English Language
OA	English Literature
O	Environmental Biology (AEB)
OA	Environmental Studies
OA	Fashion and Fabrics/Dress and Textiles
OA	Food and Nutrition/Food Studies
OA	French
O	French Literature (Cambridge)
O	French Studies
O	General Mathematics
O	General Paper (Use of English)
OA	General Principles of English Law
O	General Science
OA	Geography
OA	Geology
A	Government & Political Studies/Politics
O	Government Economics and Commerce
OA	Health Science
OA	History
OA	History, Ancient
O	History & Appreciation of Music
O	Home Economics
OA	Human Biology

OA	Law
OA	Mathematics
A	Mathematics, Applied
OA	Mathematics, Pure
O	*Metalwork
O	*Metalwork Engineering
OA	Music
OA	Ndebele
OA	Physical Science
OA	Physics
O	Physics with Chemistry
OA	Political Studies
OA	Portuguese
O	Principles of Economics
OA	Psychology
OA	Religious Studies
O	Rural Biology
OA	Shona
OA	Social Science
OA	Sociology
OA	Statistics
O	*Surveying
OA	Technical Drawing
O	Technical Graphics
O	*Woodwork
OA	Zoology

* Not more than one subject indicated above by an asterisk may be recognised for the purpose of satisfying Ordinary Level requirements.

Other subjects and other Examining Boards may be accepted by the Senate on the recommendation of the Registrar.

3.1.4 Restrictions against the combination of Overlapping Subjects:

In the selection of subjects for the purpose of satisfying the general requirement, subjects listed under Column A in the Table below cannot be counted with any corresponding subjects under Column B.

COLUMN A	COLUMN B
Accounting	Accounts, Principles of Accounts, Bookkeeping.
Art	History of Art
Biology	Rural Biology, Botany, Zoology, General Science
Chemistry	Physical Science, Physics with Chemistry, General Science
Economic Geography	Geography, Environmental Studies
Economics	Economic Principles, Commerce, Economic History
Elementary Physiology	Human Biology
Elements of Sociology	Sociology
Engineering Drawing	Technical Drawing, Technical Graphics and Design
Environmental Studies	Geography
General Mathematics	Mathematics
General Science	Physics, Physical Science, Physics with Chemistry, Biology, Zoology, Botany, Rural Biology
Geography	Economic Geography
Government & Political Studies	Government & Politics
Health Science	Human Biology
Human Biology	Zoology, Biology, Health Science
Mathematics	Pure & Applied Mathematics, Pure Mathematics, Applied Mathematics, Additional Mathematics, Mechanical Mathematics, Statistics
Physical Science	Physics with Chemistry, Chemistry, General Science, Physics
Physics	Physics with Chemistry, Physical Science, General Science
Pure & Applied Mathematics	Pure Mathematics, Applied

	Mathematics
Social Science	Sociology
Zoology	Human Biology, Health Science
Building Technology and Design	
Business Enterprise	Business Studies
Design and Technology	
History	
Literature in Shona	
Literature in Ndebele	
Literature in Tonga	
Sport Management	Physical Education, Sport and Mass Displays, Sport Science and Technology
Computer Science	Software Engineering
Theatre Arts	Dance, Music
Wood Technology and Design	
Animal Science	
Communication Skills	
Food Technology and Design	
Home Management	
Literature in English	
Metal Technology and Design	
Technical Graphics and Design	
Agricultural Engineering	Crop Science
Shona	
Ndebele	
Tonga	
French	
Textiles Technology and Design	
Family and Religious Studies	

3.1.5 Faculty Requirements

For admission to a particular programme of study and/or for Subject/ Courses within the programme there may be specific restrictions on the choice of subjects in the General Requirements and/or additional requirements concerning entry. Such additional requirements shall be prescribed in the Faculty Regulations.

3.2 **Special Entry**

3.2.1 The following persons may apply for Special Entry and for permission to proceed to a first degree with exemption from the whole or part of the normal entryrequirements:

3.2.1.1 A person who has obtained a degree of this or another University or degree awarding Institution.

3.2.1.2 A person who has obtained from a University or an Institution of similar status, academic qualifications (other than degrees) acceptable to the Senate;

3.2.1.3 A person who has obtained an appropriate number of subjects at An approved examination equivalent to the standard of the Ordinary Level of the General Certificate of Education examination and has subsequently passed an intermediate or equivalent examination at a University acceptable to the Senate;

3.2.2 Students who qualify under this regulation for Special Entry may apply to the Senate to be exempted from certain courses and examinations. Permission may be given to complete the programme for a Bachelor's degree in less than the normal required period provided that no student shall be allowed direct entry to the Final Part of any Programme;

3.2.3 Students who apply for admission under this regulation may be required to attend interviews and/or special tests at the University to determine their suitability for admission to Bachelor's degree studies.

3.3 **Mature Entry**

Persons who are at least 25 years of age on the first day of the academic year in which admission is sought and who are not eligible for entry under the Normal or Special Entry Regulations may apply for Mature Entry provided that:

3.3.1 Applicants must have passed at least five approved 'O' level subjects including English Language and Mathematics (or equivalents) and must have demonstrated potential suitability for university studies by virtue of their attainments and/or relevant work experience.

3.3.2 Normally, applicants should have completed their full-time school or college education at least five years before the start of the academic year in which admission is sought.

3.3.3 **Requirements for Mature Entry**

Applicants who wish to be considered under the Mature Entry provisions may be required to attend interviews and/or special tests at the University designed to assess their command of the English Language, numeracy and reasoning ability and general suitability for admission to Bachelor's degree studies. Applicants who have previously attended Mature Entry tests and/or interviews without success will not be considered for admission under this form of entry unless in the intervening period they have acquired additional qualifications and/or experience.

3.4 **Submissions of Applications**

3.4.1 Applications must be submitted on the official Admission forms.

3.4.2 The closing dates for receipt of application forms for Normal Entry shall be as advised for each year. Another date shall also be advised for receipt of late application forms. Late applications may be considered upon payment of the prescribed late- application fee until the advised date for such applications.

3.4.3 The closing date for Special Entry and Mature Entry applications shall be as advised for each year.

3.5 **General Provisions**

3.5.1 Every student must satisfy the University that he/she has an adequate command of the English Language. New students may be required to undertake a test in English proficiency set by the University, upon registering for Bachelor's degree studies.

3.5.2 Students admitted under the Special Entry provisions may be exempted from this requirement.

3.5.3 A student may not register simultaneously for more than one programme at the University without the permission of the Senate.

3.5.4 Registration will take place in accordance with the arrangements prescribed each year through the Registrar's Office.

3.5.5 A student's registration shall not be confirmed until he/she has fulfilled the requirements for payment of fees.

3.5.6 Normally, no student shall be admitted to any programme or any course more than two weeks after its commencement. Any exception to this Regulation must have the written endorsement of the Chairperson of the Department and the Dean of Faculty concerned and will be subject to approval through the Registrar's office.

3.5.7 Students who enter or return to the University late shall not be entitled to special tuition.

3.5.8 Such students shall be liable to pay the late registration fine, unless permission for such late registration has been given by the Registrar.

3.5.9 A student registered for a Subject and/or Course is expected to attend all classes prescribed for such Subject and/or Course. Where tutorials, seminars, fieldwork, vacation work and practical sessions are prescribed a student is required to attend and to complete any assignment set.

3.5.10 If a student is unable to attend classes for health reasons for longer than 72 hours, he/she must notify the appropriate Faculty Office of the facts as soon as possible and submit certification in support thereof by a medical practitioner registered in accordance with the Medical, Dental and Allied Health Professions Act.

For absence on grounds other than health, prior permission from the Dean on the recommendation of the Chairperson of Department concerned shall be necessary.

3.5.11 After taking due consideration of the academic progress of a student, the Senate may require or allow a student originally registered for one programme or Subject to register for another Programme or Subject on the completion of either the First Part or the Second Part of the Programme for which he/she is registered.

3.5.12 Normally, no programme shall commence with fewer than five students.

4.0 STRUCTURE OF PROGRAMMES

4.1 The duration of Bachelor's Degree Programmes shall be prescribed in the Faculty Regulations.

4.1.1 **Maximum Time Allowable to Complete an Undergraduate Degree Programme.**

Except as otherwise provided for in the General Academic Regulations, a student must complete a Degree Programme within the specified duration period as ` provided for in the respective Faculty Regulations.

The maximum time allowable to complete a Degree Programme shall be calculated based on the expected course duration and shall include deferments. The maximum time allowable to complete a Degree Programme shall be calculated as follows:

For all undergraduate degrees offered by the University either Full-time or Part-time it shall be the normal duration period of the degree programme plus 2 years.

4.1.2 **Process of Requesting for an Extension of Programme Time Limit for Undergraduate Degree Programmes.**

A student who reaches the maximum time limits allowed for their programme shall submit an Application in writing for an Extension of Programme Time Limit in the prescribed Form to the Department and payment of a fee determined by the University. The Department shall recommend its decision to the Faculty which in turn will recommend to the Academic Board. The application shall be considered by the Academic Board on behalf of the Senate, which may approve or reject the application. The decision of the Academic Board shall be final.

A student whose application is rejected or does not submit an application shall be deregistered from the programme. A student who wishes to rejoin the University shall be required to re-apply.

A student who is differently abled may apply for a time limit extension for reasons directly related to their disability. Such an application shall be in the prescribed Form and must be accompanied by a supporting letter from a Medical Doctor. Such an application for an extension due to a disability shall be exempted from payment of an application fee.

Applications to extend a time limit shall be submitted before the programme Time Limit expires.

Each Programme shall be divided into Years of Study.

An academic year of study shall comprise of not less than 30 weeks excluding vacations. Before the beginning of each academic year there shall be an orientation week for Part I students. Normally, before university examinations begin, there shall be a minimum period of one week of individual study/revision.

The possible combinations of Modules within a Subject shall be in accordance with the Faculty Regulations and shall be subject to approval by the Chairperson of the Department and the Dean concerned.

5.O MARKING SCHEME DEGREE CLASSIFICATION

5.1 All Bachelor's degrees, except the MBBS degree, shall be classified in the following divisions:

5.1.1 First Division, Upper Second Division, Lower Second Division, Pass.

5.1.2 In determining the degree classification of a programme, the weightings of all parts of the degree programme shall be taken into consideration. The actual weightings shall be prescribed in the programme regulations.

5.2 The following Grading Scheme shall be adopted for all Modules and Programmes:

75%	and above	1	(First Division)
65%	- 74%	2.1	(Upper Second Division)
60%	- 64%	2.2	(Lower Second Division)
50%	- 59%	PASS	(P)

Below 50% FAIL (F)

5.3 The following Credit Accumulation regulations shall apply to all Modules and Programmes:

5.3.1. A Credit shall be equivalent to 10 notional hours of learning.

5.3.2 All programmes offered by the University shall use an academic credit allocation system approved from time to time by the Senate. The University shall adopt the following credit level framework prescribed by the Zimbabwe Council for Higher Education for all programmes offered:

SADC- QF LEVEL	**QUALIFICATION**
8	**Bachelor's Honours**
7	**Bachelor's General**

5.3.3 A student who successfully completes a module shall be awarded the credits approved for the module at the assigned level.

5.3.4 **Award of Credit**

A student shall be awarded credits on successful completion of a module.

5.3.5 **Credit Accumulation and Degree Qualification**

A student shall progressively accumulate credits for modules that they successfully complete. A student shall be required to accumulate sufficient credits to progress through the programme and would be required to gain the total credits required for the award of the degree qualification as prescribed in the Faculty Regulations.

5.3.6 **Accreditation of Prior Learning**

A student who is exempted from the first year of study shall be awarded credit determined by the Faculty recognising prior learning that matches the learning outcomes gained from an accredited institution and relevant work experience.

6.0 ASSESSMENT OF CANDIDATES FOR BACHELOR'S DEGREES

6.1 Normally, evaluation shall be based on Continuous Assessment as well as University Examinations. Unless otherwise approved by the Senate, Continuous Assessment will contribute between 25% and 50% of the overall assessment.

6.2 Each Department shall determine which items of coursework and practical work will be included in the Continuous Assessment and shall define the relative weighting assigned to each item of coursework or practical work. Each Department shall inform the students of these details at the beginning of the module and shall maintain written records of each student's Performance in these elements of Continuous Assessment. Items Incorporated in the Continuous Assessment may include assignments, tests, essays, fieldwork, laboratory work and projects.

6.3 University Examinations shall normally be taken by students at the end of each appropriate semester as prescribed in the Faculty Regulations.

6.4 External Examiners shall be appointed to moderate all University Examinations.

6.5 All matters relating to the conduct of University Examinations shall be the responsibility of the Registrar.

6.6 To be admitted to any University Examination, a candidate must:-

6.6.1 be registered as a student of the University in accordance with the General Regulations;

6.6.2 have satisfactorily completed approved modules of study at the University. 'Satisfactory completion' of modules may require submission of written work, attendance at lectures, seminars, tutorials, Industrial Attachment and other activities as stated in the Faculty Regulations;

6.6.3 have completed and submitted work on Continuous Assessment and has been awarded a mark for such work.

6.7 Exclusion from a University Examination shall require the authority of the Senate.

6.8 The Examiners may require any candidate to attend an oral examination and/ or write a special examination.

7.0 DETERMINATION OF CANDIDATES' RESULTS

Results shall be determined by the Senate on the recommendations from the Faculty Boards of Examiners.

7.1 Departmental Panels of Examiners shall comprise of all full-time lecturing staff in that Department, the External Examiner (s) and, where appropriate, as determined by the Departmental Panel, part-time lecturers and/or teaching assistants for the Course/Subject concerned.

7.2 Faculty Boards of Examiners shall comprise of the Dean and Deputy Dean of the Faculty, the Chairperson of each Department, and one other academic member of the Department nominated by the Departmental Panel from each Department involved in the subjects for that examination and normally the External Examiner(s) for the Department. The Chairperson of the Board of Examiners shall normally be the Dean of the Faculty who shall have a casting vote.

7.3 The Departmental Panel of Examiners shall:

7.3.1 agree, for each candidate, marks in terms of percentages, for Continuous Assessment, for the University Examinations and overall marks (combining the Continuous Assessment and University Examination) in courses and, where required, in terms of the Faculty Regulations, in Subjects.

7.3.2 recommend to the Faculty Board of Examiners whether a candidate should pass or fail the relevant Module (s) and Subject (s) taken.

7.3.3 where Subject/Course prizes are available for award, make recommendations for the award of these prizes.

7.4 The Faculty Board of Examiners shall:

7.4.1 consider the recommendations of the Panels of Examiners and recommend to the Senate an overall result for each candidate and any other conditions as it may deem appropriate;

7.4.2 make recommendations to the Senate with regard to the award of any prizes which may be available for candidates within the Programme.

7.5 In determining results, all Departmental Panels of Examiners and Faculty Boards of Examiners shall have regard to all special requirements as prescribed in the Faculty Regulations. Such regulations may require candidates to satisfy the examiners in Continuous Assessment and University Examinations separately and/or that candidates must satisfy the examiners in individual components of the University Examinations either separately or in aggregate.

8.0 PROVISIONS FOR PASSING A COURSE OR PART, AND PROCEEDING IN A PROGRAMME

8.1 A candidate shall be deemed to have passed a Part of a Programme if he/she has satisfied the Examiners in terms of the Scheme of Examination as prescribed in the relevant Faculty Regulations.

8.2 Each Scheme of Examination shall indicate which Courses must be passed before a candidate may be allowed to proceed to a subsequent part of the Programme (or portion thereof).

8.3 Normally, a student shall not be allowed to proceed in a Subject without having passed the previous final examination (s) in that subject and having satisfied all the prerequisites for proceeding in that Subject as may be specified in the Faculty Regulations and to timetable feasibility.

8.4 A student who passes in one part with an aggregate of 45% or above may be permitted to proceed to a subsequent part carrying a course or courses subject to the provisions in Faculty Regulations.

9.0 FAILURE TO SATISFY THE EXAMINERS

9.1 A candidate who fails to satisfy the Examiners in terms of these General Academic Regulations and Faculty Regulations may be required by the Senate to:

9.1.1 proceed to the next part of the Programme carrying not more than 25 % of the modulesfrom the preceding Parts

9.1.2 repeat

9.1.3 discontinue

9.1.4 withdraw

9.2 Where a dissertation or a project is prescribed in any programme, a candidate shall be informed in advance of the deadline for submission of such dissertation or project. Unless prior permission for an extension of this deadline has been granted by the Academic Board, any candidate who fails to meet this submission deadline shall normally fail and would be required to repeatthe dissertation or project. A candidate who fails the dissertation or project but obtains a mark of 40% - 49% may on the recommendation of the Examiners, be permitted to submit the dissertation or project at a later date, normally within three months of the publication of theresults. Unless otherwise determined by the Senate, the maximum mark allowable for such referred work shall be 50%.

9.3 CARRY OVER

9.3.1 The number of carry-over modules may be limited by Faculty Regulations.

9.3.2 For all Parts, other than the Industrial Attachment year which consists of only onemodule, the total number of carry-over modules shall not exceed 25% of the number of normally scheduled modules in a particular year of a Programme.

9.3.3 A student shall be required by Senate to undertake Continuous Assessment with their carry-over modules. This assessment will then be taken into account in the usual way in determining the overall assessment.

9.3.4 No candidate may carry over a particular module for more than two years.

9.4 REPEAT

9.4.1 A candidate who is not allowed to proceed to the subsequent Part of the Programme, but has passed at least 50% of the modules in that Part of the Programme, may be allowed to apply to repeat.

9.4.2 'Repeat' means that the student may apply for readmission into the same Programme and his/her application will be considered through the normal procedures.

9.4.3 If a student is repeating a module(s), he/she shall only be credited with the marks obtained during the 'repeat' year. A Repeat student shall only repeat failed courses.

9.5 DISCONTINUE

9.5.1 A candidate who fails more than half of the modules for any year of their programme or obtains an overall aggregate mark of less than 35% (40% in the Faculty of Medicine) shall discontinue.

9.5.2 'Discontinue' means that the student must discontinue the Programme in which he/she failed. Such a student will be free to apply for admission/transfer into a different programme and his/her application will be considered through the normal admission procedures.

9.6 WITHDRAW

9.6.1 A candidate who is not allowed to proceed to the subsequent Part of the Programme, and

9.6.1.1 has passed less than 25% of the modules in that Part of the Programme, or

9.6.1.2 has failed the same Part of the Programme twice, or

9.6.1.3 has failed two different Programmes, will be required to withdraw.

9.6.2 'Withdraw' means that the student must withdraw from the University. Once 'withdrawn' the student may not apply for admission until after a period of two years has elapsed.

10.0 INDUSTRIAL ATTACHMENT

10.1 Programmes at the University shall normally include one academic year of supervised Industrial Attachment approved by the appropriate Departmental Board, in the penultimate year of the undergraduate course. Exception will be in the MBBS programme, where the period of this attachment shall be determined by the Faculty Board.

10.2 The implementation of Industrial Attachment programme shall be as provided by Faculty Regulations.

10.3 Assessment of the Industrial Attachment programme will be carried out in accordance with the following regulations:

10.3.1 To obtain an overall pass, a student must pass both the Continuous Assessment and the Final Assessment components of the Industrial Attachment.

10.3.2 A student who fails the Continuous Assessment component will be required to repeat.

10.3.3 The Overall Assessment shall be as follows:-

50% Continuous Assessment and 50% Final Assessment.

10.3.4 The Continuous Assessment mark shall be determined by the Departmental Panel of Examiners from the marks awarded by the industrial and academic supervisors on the appropriate forms.

10.3.5 The Final Assessment mark shall be determined on the basis of the final report assessment (40%) and oral presentation assessment (10%).

10.3.6 Two copies of the final report in a form approved by the University must be submitted to the Department within two weeks of the end of the lecture period for the second semester of the academic year.

10.3.7 A student who fails to meet the required date for submission of the final report will normally be considered to have failed the Final Assessment.

10.3.8 A Student who fails the Final Assessment but has passed the Continuous Assessment component may be allowed to resubmit the industrial attachment report within two months, and be reassessed. Unless otherwise determined by Senate, the maximum mark allowable for such referred work shall be 50%.

10.3.9 The General Academic Regulations on repeat, discontinue and withdraw shall apply to industrial attachment.

10.4 A student who fails the Industrial Attachment Part shall not proceed to the Final Year of the Degree Programme.

11.0 INDUSTRIAL ATTACHMENT GENERAL GUIDELINES FOR STUDENTS

GUIDELINES FOR STUDENTS

11.1 The student is subject to university regulations and the company regulations during the industrial attachment.

11.2 The student is expected to:-

11.2.1 conform to the company's regulations, working time and discipline;

11.2.2 fulfil the supervisor's instructions concerning the training process and carrying out of the industrial research project;

11.2.3 write a log book on a daily basis and submit a report after finishing the training in a given department (or training unit);

11.2.4 take part only with educational purpose in mind according to the ultimate instructions of the supervisor;

11.2.5 put his/her best efforts to acquire extensive knowledge and skills in order to achieve the required standard of training;

11.2.6 keep good relations with all the staff of the company;

11.2.7 promote the good name of NUST.

11.3 The choice of a company for the industrial attachment will not be based on any probable monetary benefits the students may stand to gain.

11.4 The student must always bear in mind that his/her conduct during the industrial attachment period will reflect not only on him/her but also on NUST and that it may also affect considerably the future Industrial attachment placements and the relationship between NUST and the company.

12.0 GUIDELINES FOR THE INDUSTRY ON THE TREATMENT OF THE STUDENT DURING THE INDUSTRIAL ATTACHMENT

12.1 The student will be subject to the company's regulations and is expected to function like a full time employee of the company.

12.2 For the period of the industrial attachment the student will have an insurance and medical aid cover from the University.

12.3 The company is requested to provide the student every opportunity to function like a full-time employee and permit him/her to actively participate in all aspects of the business including management and administration except where confidentiality constraints may not permit his/her participation.

12.4 Wherever possible, the company is requested to assist the student by providing welfare measures such as providing help in finding suitable accommodation close to the company, access to canteen facilities, company transport facilities etc.

12.5 If the company wishes to pay the student an extra allowance, the arrangement is only between the two parties, that is the student and the company involved.

13.0 APPEALS AGAINST TERMINATION OF STUDIES

13.1 Any candidate who, having failed to satisfy the Examiners, is required to withdraw from the University or discontinue a programme, has a right to appeal.

13.2 A committee shall be established by the Senate to consider such an appeal.

13.3 Any candidate who wishes to lodge an appeal against withdrawal or discontinuation must do so in writing to the Registrar within 21 days after the publication of the Examination results.

13.4 On appeal, the candidate must state clearly the grounds of the appeal. Medical grounds must be substantiated in writing by a medical practitioner registered in terms of the Health Professions Act. Any other evidence which the candidate wishes to submit in support of his/her case must also be lodged with the written appeal.

13.5 The Registrar will refer all timeous appeals to the Appeals Committee for consideration.

13.6 The Appeals Committee will consider, as legitimate grounds for appeal, new evidence of mitigating circumstances (except mere lack of diligence or other fault on the part of the student) which was not previously available to the Examiners. Extenuating circumstances of a force majeure' nature, which explain and are directly relevant to the student's academic performance and which he/she could not reasonably have been expected to have foreseen or avoided, will be considered.

13.7 The Committee shall be empowered to hear an appellant orally and to seek all such information or evidence as it may consider pertinent.

13.8 No right to automatic oral hearing is conferred upon appeals and the University will not reimburse any expenses incurred by an appellant in making a personal appearance before the Committee.

13.9 The Committee shall make recommendations in each case, as it deems appropriate. Its recommendations shall be submitted to the Senate for approval, or to the Academic Board or the Vice-Chancellor on behalf of the Senate for consideration.

14.0 AEGROTAT PROVISIONS

14.1. If a candidate, having completed a substantial component of a Part of his/her Programme, is prevented by serious illness or other sufficiently substantiated cause, from completing the prescribed requirements for that Part of the Programme, he/she may be deemed by the Senate to have satisfied the examiners for that Part upon the recommendation of the Board of Examiners concerned and upon such other conditions as the Senate may decide, provided that:-

14.1.1 The candidate will not normally be exempted from presenting a thesis or dissertation where such is prescribed.

14.1.2 The award of an Aegrotat Degree shall be without classification.

14.2 Where a student qualifies for an Aegrotat Degree, he/she may opt instead to write a special examination in order that an overall grade may be determined and formally credited to the student. Application for such an option must be submitted in writing to the Registrar not later than four weeks before the scheduled examinations.

14.3 The Senate may require any candidate, irrespective of his/her Programme or Faculty, whose examination performance has been adversely affected by sufficiently substantiated circumstances of 'force majeure' nature to write a special examination at an appropriate future date, normally not later than three months after the date of the last examination missed.

In such a case, unless otherwise stipulated by the Senate, the mark obtained in the special examination will be counted in the overall assessment for purposes of degree classification.

14.4 A candidate who wishes to be considered for an Aegrotat Degree must apply in writing, together with written substantiation for his/her case, to the Registrar normally within ten days of the end of the University Examinations for the Programme concerned. Appeals which are submitted on medical grounds must be supported by a certificate from a medical practitioner registered in terms of the Health Professions Act.

14.5 A candidate who is awarded an Aegrotat Degree may not re-enter the examination for that same degree, but shall be eligible to apply to proceed to an appropriate higher degree.

15.0 PLAGIARISM

15.1 Definition
Plagiarism is the unacknowledged use of another person's material or ideas. As such, plagiarism is an academic offence in the sense that theft is in ordinary daily life.

15. 2 Recommendations on the severity of the penalty shall be determined by the appropriate Departmental Board or Board of Examiners. Cases of plagiarism shall be handled in the following manner:-

15.3 **Minor Cases of Plagiarism**

15.3.1 **FIRST OFFENCE** : In the case of plagiarism being discovered in a piece of work such as an essay or laboratory report or Dissertation the student shall get a Chairman's warning but shall be given an opportunity to re-do and re-submit an acceptable piece of work after one week and shall be awarded a maximum of 50%.

15.3.2 **SECOND OFFENCE**: The student shall get a Dean's warning and shall be awarded a mark of zero for the submitted work.

15.3.3 **THIRD OFFENCE**: The Senate shall take disciplinary measures such as suspension or expulsion of the student who will have been awarded a mark of zero.

15.4 **Major Cases of Plagiarism**

15.4.1 In the case of plagiarism being discovered in a project at the end of the year the candidate shall be denied the opportunity to resubmit the project, but will be required to submit a new project.

15.4.1.1 The new project shall be submitted not later than June of the following year.

15.4.1.2 The new project will be awarded a maximum mark of 50%

15.4.2 In the case of plagiarism being discovered in a project for the second time and after re-submission, a mark of zero shall be awarded and recorded, and the Senate shall take disciplinary action either to suspend or expel the student.

16.0 MISCONDUCT AT EXAMINATIONS

16.1 Subject to Ordinance 30, any candidate found using unauthorised material, or attempting to obtain information from other candidates or their papers, or otherwise guilty of misconduct during the examination shall be disqualified not only in that examination and subject, but in the whole examination, and further disciplinary action may be taken by the University.

17.0 PUBLICATION OF RESULTS

17.1 The Registrar shall be responsible for the publication of the results of University Examinations as approved by the Senate.

17.2 Results lists shall be published individually to the student's web portal, and where necessary, shall be posted on University Notice Boards.

18.0 ACADEMIC TRANSCRIPT

On leaving the University each student may obtain, on application to the Registrar, one copy of a formal transcript of his/her complete academic record at the University.

19.0 AWARD OF DEGREES

The award of Degrees of the University shall be subject to approval by the University Council.

Candidates completing the requirements for such award will be entitled to receive a formal certificate of the University, bearing the University seal and signed by the Vice-Chancellor and the Registrar, confirming the award.

20.0 NUST COURSE CODING SYSTEM

The NUST coding system is based on a format of Three Alphabetical Letters and Four Figures **i.e.**

X	X	X	0	0	0	0

Three Letters are explained as follows:

- First letter stands for the Faculty.
- Subsequent two letters stand for the department.

The Four Figures are explained as follows:

The First "digit" or figure from the last letter denotes the year of study i.e.

PART I	CODE 1
PART II	CODE 2
PART III	CODE 3
PART IV	CODE 4
PART V	CODE 5

The Second "digit" or figure from the last letter denotes the semester, i.e.

0 - (Zero) whole year course
1 - First semester course
2 - Second semester course

The last two "digits" or figures denote the course number

However, it must be noted that fixing semesters for subjects does not deny the department flexibility to offer these subjects at any other point of the programme as long as it accords the relevant sequence in the teaching

The last two positions (figures) are designated for the different subjects offered by the departments. Each subject number is at the discretion and choice of the department concerned.

The need for two positions for each subject arose as a concern for department that have more than nine subjects on offer although normally not more than nine subjects can be on offer per given semester.

DEFERMENT AND LEAVE OF STUDIES POLICY

PURPOSE

The formulation of the policy on deferment of studies is an acknowledgement that students enrolled at the National University of Science and Technology (NUST) may apply for a deferment of studies and take leave from studies.

The policy is developed with the objective of ensuring that students are able to apply for deferment or leave of studies. In addition this policy will facilitate efficient and effective management of deferment of studies by the University.

SCOPE

This policy shall allow the Deferment and Leave of Studies in all programmes offered by NUST.
Students who have been formally offered a place to study at the University and have notregistered, have the option to defer the offer while students who have registered and havecommenced studies may apply to take Leave from studies at any time.
Applications by students with pending disciplinary cases shall be considered after finalisation of their disciplinary cases. Applications for Deferment and Leave of studies shall be considered by the University according to their respective individual merits. Conditions listed on the offer Letter of Admission must be satisfied before an application for Deferment or Leave of Studies is considered.

1. This Policy shall allow Deferment and Leave of Studies from the National University of Science and Technology Undergraduate and Postgraduate degree programmes.

2. Definitions

Deferment:	Postponement of studies for a period of up to 12 months, normally covering the Academic Year, for a person who has been offered a place, or a person who is allowed to proceed to the next part of the programme and has not registered.
Leave of Studies:	A period of 6 to 12 months covering the normal teaching period when a registered student is excused from formal study. Leave applies to students that have commenced studies.
Offer:	When an applicant is informed in writing that he has been offered a place in a programme to study.
Programme:	A plan of study lasting over a period of time which leads to the award of a diploma or a degree of the University.

DEFERMENT AND LEAVE OF STUDIES

3. Deferment

Applicants who have received a written offer of a place or applicants who have been allowed to proceed to the next part of the programme and have not registered, **MAY** be granted deferment of studies on application, a written application in the prescribed form must be submitted before the end of the registration period.

The maximum period of deferment shall be one Academic Year (12 months). A period of the semester of six months may be granted where appropriate. Deferment shall not be granted once a student is registered. Granting of a deferment of studies shall be on condition that the applicant has paid part of the prescribed fees. Application for deferment during the First Semester where there are course prerequisites for the Second Semester shall **NOT** be granted and the applicant shall not register for the Second semester.

4. Leave of Studies

When a student has registered and commenced studies, he may apply for Leave of Studies for a period of between one and two semesters in an academic year. An application in the prescribed form for Leave of Studies shall be granted upon recommendation of the Department and the Faculty. In the case of Higher Degrees, the Faculty Higher Degrees Committee shall consider the application for leave of Studies and recommend to the Academic Board in accordance with the General Academic Regulations for Higher Degrees. Application for Leave of Studies during the First Semester where there are course prerequisites for the Second Semester shall **NOT** be granted and the applicant shall not register for the Second semester. Such applicants shall apply for Leave of studies for the whole academic year (Semester I and Semester II)

IMPORTANT NOTES

The following are the circumstances under which Deferment or Leave of Study shall be considered:

1. Medical reasons and special circumstances (such as family crisis, tuition fees and national duty) are normally the acceptable reasons for Deferment or Leave of Studies.

2. A student may indicate in which semester he would like to resume his studies; however, the actual resumed semester will be subject to the discretion of the University. Normally the maximum Deferment or Leave of Studies period shall be two semesters.

3. If a student has completed some coursework requirements before Deferment or Leave of Study is granted, the Department offering the degree programme has the discretion to decide whether he shall be required to resubmit these requirements upon resuming his studies.

4. No refund of fees shall be given to students whose applications are approved. Students whose deferment is made before the start of a semester or Block shall have their fees credited to their accounts.

5. In the event that there is an increase in programme fees during the deferment period, a student will not be required to pay the difference if their deferment is approved.

6. A student should continue with their studies until a formal approval has been received from the University.

7. If the programme, for which Deferment or Leave of Study is approved, is not on offer when one is due to resume studies, the University reserves the right to transfer the student to another degree programme subject to the student meeting of entry requirements for this other programme.

8. A student may not defer a course but instead should defer studies for a whole semester.

9. Where a Leave of Study is granted, the fees paid shall be credited on a pro-rata basis. In a case of a student who has attended more than 75% of the lectures, the student shall not be credited with fees paid for the semester which a Leave of studies has been granted.

10. In the event of a curriculum review during a student's deferment or leave of study period, the student shall be required to sign for the new approved curriculum when the student resumes studies.

GENERAL REGULATIONS FOR POSTGRADUATE DIPLOMAS MASTERS DEGREES BY COURSEWORK,

MASTER OF PHILOSOPHY DEGREES

DOCTOR OF PHILOSOPHY DEGREES

HIGHER DOCTORATE DEGREES

1.0 PREAMBLE

1.1 The Senate shall be the final authority for the interpretation of these Regulations.

1.2 The Senate reserves the right to alter, amend, repeal, suspend or replace any of these Regulations.

1.3 The Senate has the power to exempt any student from any of the Regulations.

1.4 A student who has started a programme of study following one set of Regulations shall not be affected by Regulations subsequently adopted unless agreed to in writing by the student.

1.5 There shall be Academic Regulations for each Faculty which shall be subject to approval by the Senate and which shall include provision for admission to Programmes.

1.6 The General Academic Regulations shall take precedence over the Faculty Regulations.

1.7 In these Regulations the following terms shall be used as described:-

"Continuous Assessment"	-	Prescribed assignments to be completed within a given period and forming a part of a module.
"Module**"**	-	A component which is separately examinable within a subject.
"Part"	-	A defined portion of a Programme.
"Programme"	-	A plan of study lasting over a period of time which leads to the award of a diploma or

degree of the University.

"Project"	-	A defined practical assignment which is separately examinable.
"Subject"	-	A field of study offered by a Department.
"Credit"	-	Quantified means of expressing the volume of learning based on the workload students need in order to achieve the expected outcomes of a module.
"Credit Accumulation"	-	The process of collecting credits awarded for achieving the learning outcomes of a module component of a programme

A schedule of Programmes, Subjects and Modules and their codes shall be maintained by theRegistrar. These codes shall be alpha/numeric; alphabetical codes being used to identify Programmes and Subjects, with prefixing numerical module codes being used to indicate the level of study and individual examination components (units) within that module.

2.0 PROGRAMMES

2.1 Postgraduate Diploma Programmes

The University may offer Post Graduate Diploma Programmes in the following fields of study:

2.1.1 Faculty of Applied Science

Applied Biology
Applied Biochemistry
Applied Chemistry
Applied Mathematics
Applied Physics
Computer Science
Radiography
Sports Science and Coaching
Environmental Science and Health
Forest Resources and Wildlife Management

2.1.2 Faculty of Commerce

Accounting
Actuarial Science
Banking
Management
Marketing
Finance
Risk Management and Insurance

2.1.3 **Faculty of Engineering**
Chemical Engineering
Civil and Water Engineering
Electronic Engineering
Industrial and Manufacturing Engineering
Fibre and Polymer Engineering

2.1.4 **Faculty of the Built Environment**
Architecture
Construction Project Management
Landscape Architecture
Quantity Surveying
Urban Design

2.1.5 **Faculty of Communication and Information Science**
Journalism and Media Studies
Library and Information Science
Publishing Media Studies
Records and Archives Management

2.1.6 **Faculty of Science and Technology Education**
Art, Design and Technology Education
Science Mathematics and Technology Education
Technical and Engineering Education and Training

2.2 MASTERS DEGREE PROGRAMMES BY COURSEWORK

The Masters Degree Programmes by Coursework shall normally consist of prescribed lectures, practicals and assignments, a dissertation and written examinations.

The University may offer Masters Degree Programmes by Coursework in the following fields of study:-

2.2.1 **Faculty of Applied Sciences**

Master of Science in:

Applied Biology
Applied Biochemistry
Computer Science
Applied Mathematics
Operations Research and Statistics
Applied Physics
Radiography
Sports and Coaching
Environmental Science and Health
Forest Resources and Wildlife Management

2.2.2 **Faculty of Commerce**

Master of Business Administration

Development Studies
Disaster Management

Master of Science in:

Accounting
Actuarial Science
Banking
Finance
Management
Marketing
Risk Management and Insurance

2.2.3 **Faculty of Engineering**

Master of Engineering in:

Chemical Engineering
Civil and Water Engineering
Electronic Engineering
Industrial and Manufacturing Engineering
Fibre and Polymer Engineering

2.2.4 **Faculty of the Built Environment**

Architecture
Construction
Landscape Architecture
Quantity Surveying
Urban Design

2.2.5 **Faculty of Communication and Information Science**

Journalism and Media Studies
Library and Information Science
Publishing Media Studies
Records and Archives Management

2.2.6 **Faculty of Medicine**

Medicine
Midwifery

2.2.7 **Faculty of Science and Technology Education**

Accounting and Business Studies
Art
Biology
Chemistry
Civil and Construction Engineering
Clothing Textile
Computer Science
Design and Technology
Electrical and Electronic Engineering
Mechanical and Industrial Engineering
Mathematics
Physics
Technical Graphics
Wood Science

2.3 MASTER OF PHILOSOPHY DEGREE PROGRAMMES

The University may offer Master of Philosophy Degree Programmes in the following fields of study:-

2.3.1 **Faculty of Applied Science**

Applied Biology
Applied Biochemistry
Applied Chemistry
Applied Mathematics
Applied Physics
Computer Science
Operations Research and Statistics
Operations Research
Statistics
Radiography
Sports Science and Coaching
Environmental Science and Health
Forest Resources and Wildlife Management

2.3.2 **Faculty of Commerce**

Accounting
Actuarial Science
Banking
Finance
Management
Marketing
Risk Management

2.3.3 **Faculty of Engineering**

Chemical Engineering
Civil and Water Engineering
Electronic Engineering
Industrial and Manufacturing Engineering
Fibre and Polymer Engineering

2.3.4 **Faculty of the Built Environment**

Architecture
Construction Project Management
Landscape Architecture
Quantity Surveying
Urban Design

2.3.5 **Faculty of Communication and Information Science**

Journalism and Media Studies

Library and information Science
Publishing Media Studies
Records and Archives Management

2.3.6 **Faculty of Medicine**
Medicine

2.3.7 **Faculty of Science and Technology Education**
Accounting and Business Studies
Art
Biology
Chemistry
Civil and Construction Engineering
Clothing Textile
Computer Science
Design and Technology
Electrical and Electronic Engineering
Mechanical and Industrial Engineering
Mathematics
Physics
Technical Graphics
Wood Science

2.4 DOCTOR OF PHILOSOPHY DEGREE PROGRAMMES

The University may offer Doctor of Philosophy Degree Programmes in the following fields study:-

2.4.1 **Faculty of Applied Sciences**
Applied Biology
Applied Biology and Biochemistry
Applied Mathematics
Applied Physics
Computer Science
Radiography
Operations Research and Statistic
Operations Research
Statistics
Sports Science and Coaching

Environmental Science and Health
Forest Resources and Wildlife Management

2.4.2 **Faculty of Commerce**
Accounting
Actuarial Science
Banking
Finance
Management
Marketing
Risk Management

2.4.3 **Faculty of Engineering**
Chemical Engineering
Civil and Water Engineering
Electronic Engineering
Industrial and Manufacturing Engineering
Textile Technology

2.4.4 **Faculty of the Built Environment**
Architecture
Construction Project Management
Landscape Architecture
Quantity Surveying
Urban Design

2.4.5 **Faculty of Communication and Information Science**
Journalism and Media Studies
Library and information Science
Publishing Media Studies
Records and Archives Management

2.5 HIGHER DOCTORATE DEGREE PROGRAMMES

The University may offer Doctor of Science Degree in the following fields of study:-

2.5.1 **Faculty of Applied Sciences**
Applied Biology

Applied Biochemistry
Applied Chemistry
Applied Mathematics
Applied Physics
Computer Science
Operations Research and Statistics
Operations Research
Statistics
Radiography
Sports Science and Coaching
Environmental Science and Health
Forest Resources and Wildlife Management

2.5.2 **Faculty of Commerce**

Accounting
Actuarial Science
Banking
Finance
Management
Marketing
Risk Management

2.5.3 **Faculty of Engineering**

Chemical Engineering
Civil and Water Engineering
Electronic Engineering
Industrial and Manufacturing Engineering
Textile Technology

2.5.4 **Faculty of the Built Environment**

Architecture
Construction Project Management
Landscape Architecture
Quantity Surveying
Urban Design

2.5.5 **Faculty of Communication and Information Science**

Journalism and Media Studies
Library and information Science

Publishing Media Studies
Records and Archives Management

2.5.6 Other Higher Doctorates include the Doctor of Laws and Doctor of Literature (D.Litt.) which may be offered in the Faculties of Humanities and Commerce.

2.5.7 **Faculty of Medicine**
Medicine

2.5.8 **Faculty of Science and Technology Education**
Accounting and Business Studies
Art
Biology
Chemistry
Civil and Construction Engineering
Clothing Textile
Computer Science
Design and Technology
Electrical and Electronic Engineering
Mechanical and Industrial Engineering
Mathematics
Physics
Technical Graphics
Wood Science

3.0 ENTRY REGULATIONS

3.1 POSTGRADUATE DIPLOMAS

The normal minimum entry requirements shall be an appropriate First Degree or approved equivalent qualification.

3.1.1 Other qualifications may be considered by the Senate on the recommendation of the Department and Faculty concerned.

Normally, for such qualifications the University shall require proof of relevant experience and may require applicants to pass a qualifying examination to decide on their acceptability for admission.

3.1.2 For admission to a particular programme of study and/or for subjects/courses within the programme there may be specific restrictions on the choice of subjects in the general requirements and/or additional requirements shall prescribe such additional requirements.

3.2 MASTERS DEGREES BY COURSE WORK

The normal entrance requirement shall be an appropriate Honours Degree or approved equivalent qualification.

3.2.1 Other qualifications may be considered by the Senate on the recommendation of the Department and Faculty concerned.

Normally, for such qualifications the University shall require proof of relevant experience and may require applicants to pass a qualifying examination to decide on their acceptability for admission.

3.2.2 For admission to a particular programme of study and/or for subjects/courses within the programme there may be specific restrictions on the choice of subjects in the general requirements and/or additional requirements shall prescribe such additional requirements.

3.3 MASTER OF PHILOSOPHY DEGREES

3.3.1 The normal entrance requirements shall be an appropriate Honours Degree in the first or Upper Second Division.

3.3.2 An appropriate Honors Degree in the Lower Second Division or Third Division may be considered provided performance in the intended field of study was in the First or Upper Second Division.

3.3.3 Other qualifications may be considered by the Senate on the recommendation of the Department and Faculty concerned. Normally, for such qualifications the University shall require applicants to pass a qualifying examination to decide on their acceptability for admission.

3.4 TRANSFER FROM MASTER OF PHILOSOPHY TO DOCTOR OF PHILOSOPHY DEGREE

A student who is registered for the Master of Philosophy Degree may apply, after completing one year, if his/her Supervisor so recommends, to transfer his/her registration and to proceed to Doctor of Philosophy Degree programme. Retrospective registration may be permitted.

On recommendation of the Supervisor (s) the Departmental Board may recommend to Senate through the Faculty Higher Degrees Committee that a student, who is registered for the Master of Philosophy degree transfers his/her registration and proceeds to the Doctor of Philosophy programme.

3.5 TRANSFER FROM DOCTOR OF PHILOSOPHY TO MASTER OF PILOSOPHY

A student who is registered for the Doctor of Philosophy Degree but wishes to proceed to the Master of Philosophy Degree, may apply if his/her Supervisor so recommends, to transfer his/her registration and to proceed to the Master of Philosophy Degree Programme. The length of requisite further study, if any, shall be prescribed.

On recommendation of the Supervisor(s) the Departmental Board may recommend to Senate through the Faculty Higher Degrees Committee that a student who is registered for the Doctor of Philosophy degree transfers his/her registration and proceeds to the Master of Philosophy programme.

3.6 DOCTOR OF PHILOSOPHY

The normal entrance requirement shall be an appropriate Masters Degree.

3.7 HIGHER DOCTORATE DEGREES

Applicants shall be approved graduates in the tenth or subsequent year after the date of their graduation and must have published work of an exceptionally high standard such as would confer on them an authoritative and international standing in their subject and in their particular field of research.

4.0 FACULTY REGULATIONS

There shall be Faculty Regulations which should be read in conjunction with the General ` Academic Regulations.

For admission to a Programme of study and/or for Subject/Course within the Programme there may be specific restrictions on the choice of subjects and additional requirements for entry. Faculty Regulations may prescribe additional requirements

5.0 SUBMISSION OF APPLICATIONS

5.1 POST GRADUATE DIPLOMAS AND MASTERS DEGREES BY COURSEWORK

5.1.1 Applications shall be submitted on the official forms.

5.1.2 Application forms shall be submitted by the closing dates as advertised.

5.1.3 Late applications may be considered upon payment of the prescribed late application fee.

5.2 MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY DEGREES

5.2.1 Applications shall be submitted on the official forms.

5.2.2 There shall be no deadlines for the submission of applications.

5.2.3 Acceptances and rejections shall be determined by the Senate on the recommendations by the Departmental Board through the appropriate Faculty Higher Degrees Committee.

5.3 HIGHER DOCTORATE DEGREES

5.3.1 Applications shall be made on the official forms.

5.3.2 An eligible candidate may make an application at any time and shall, at the same time, submit evidence of his qualifications; such evidence shall consist of published work, papers or books containing original contribution to the advancement of knowledge.

5.3.3 Where a part of the work submitted is not in a candidate's sole name, the candidate shall produce satisfactory evidence of his/her part in the initiation, direction and conduct of the work.

5.3.4 A candidate shall indicate what part, if any, of the work has been submitted for a Degree in this or any other university, by himself/herself or in the case of joint work, by any of his co-authors.

5.3.5 The term 'published' in these Regulations shall mean printed in a periodical or as a pamphlet or book which has been available for criticism by relevant experts. The Examiners shall be given discretion to disregard any of the work submitted, if any, in their opinion, the work has not been so available for criticism either on account of its in access or because it has been submitted for the Degree at too short an interval after it publication.

5.3.6 The application and supporting documentation shall be submitted to the appropriate Departmental Board for preliminary consideration. The Departmental Board shall make recommendations to the Faculty Higher

Degrees Committee.

5.3.7 If the Faculty Higher Degrees Committee considers that the application has sufficient merit, it shall recommend to Senate the appointment of both Internal and External Examiners and that the applicant be formally registered as a candidate for examination.

6.0 STRUCTURE AND DURATION OF PROGRAMMES

6.1 POSTGRADUATE DIPLOMAS

The minimum duration of the Postgraduate Diploma Programmes shall be:-

Full-time	-	1 year
Part-time	-	2 years

6.2 MASTERS DEGREES BY COURSEWORK

The minimum duration of the Masters Programme by Coursework shall be:-

Full-time/modular	-	1 year
Part-time	-	2 years

6.3 MASTER OF PHILOSOPHY DEGREE

The duration of the Master of Philosophy Programmes shall be:-

Full-time	-	18 months
		3 years maximum
Part-time	-	3 years
		5 years maximum

6.4 DOCTOR OF PHILOSOPHY DEGREES

The duration of the Doctor of Philosophy Degree Programmes shall be:-

Full-time	-	3 years
		4 years maximum
Part-time	-	5 years
		6 years maximum

6.5 **Maximum Time Allowable for Postgraduate Degree Programmes by Coursework.**

The maximum limit of study allowable to complete a Postgraduate Degree by Coursework shall be as follows:

For a Full-time mode of study, the maximum limit of study allowable to complete shall be the normal duration period plus 1 year.

For a Part-time mode of study, the maximum limit of study allowable to complete shall be the normal duration period plus 1 year.

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6.6 **Process of Requesting for an Extension of Programme Time Limit for Postgraduate Degree Programmes by Coursework**

A student who reaches the maximum time limits allowed for a Programme shall submit an Application in writing for an Extension of the Programme Time Limit in the prescribed Form to the Department and payment of a fee determined by the University. The Department shall recommend its decision to the Faculty which in turn shall recommend to the Academic Board. The application shall be considered by the Academic Board on behalf of the Senate, which may approve or reject the application. The decision of the Academic Board shall be final.

A student who is differently abled may apply for a time limit extension for reasons directly related to their disability. Such an application shall be in the prescribed Form and must be accompanied by a supporting letter from a Medical Doctor. Such an application for an extension due to a disability shall be exempt from payment of an application fee.

An application to extend a time limit shall be submitted before the programme Time Limit expires.

6.7 **Process of requesting for an Extension of Programme Time Limit for Postgraduate Research Degree**.

6.7.1 If a student reaches his/her time limit and has not submitted his/her thesis, the student's registration status shall automatically lapse and may be withdrawn from the University. Only in very exceptional circumstances shall a student be granted a time limit extension after submitting an application.

6.7.2 An application for an extension using a prescribed Form, shall be considered on its merits by the Department and Faculty Higher Degrees Committee which shall recommend to the Senate through the Academic Board.

6.7.3 In his/her application, a student must clearly state the reason why he/she failed to submit the thesis on time and demonstrate how he/she shall use the requested extension period effectively in order to complete the writing of the thesis and meet the new deadline.

6.7.4 An application to extend a time limit shall be submitted three months before the programme Time Limit expires and shall be considered by the Academic Board on behalf of the Senate. The decision of the Academic Board shall be final.

If a student's application is approved and the student fails to submit the thesis at the end of the final extension period, the student shall be withdrawn. Any data or material gathered during the period of study prior to the withdrawal shall remain the property of the University.

7.0 PROGRAMME AND STUDY OF MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY DEGREES

7.1 Applications for the Master of Philosophy and Doctor of Philosophy studies shall not follow the normal University calendar. Faculty Higher Degrees Committees can receive and process these anytime of the Year.

7.2 Registration/Enrolment for the Master of Philosophy and Doctor of Philosophy Degrees shall follow after acceptance of submitted proposals and suggested supervisors by the Academic Board.

7.1 Each student shall be required to pursue a prescribed programme of study under the direction of a supervisor, who shall be a member of the academic staff of the University in the appropriate discipline. Normally, one or more Associate Supervisors will also be appointed.

7.3 Each student shall be required to pursue a prescribed programme of study under the direction of a Supervisor who shall be a member of the academic staff of the University in the appropriate discipline. If the need arises, a Co-supervisor and an Associate Supervisor(s) may also be appointed.

7.4 The appointment of all Supervisors shall be made by the Senate on the recommendations of the appropriate Faculty Higher Degrees Committee.

7.3 The Supervisor shall report on each student's progress every six months to the Faculty Higher Degrees Committee through the appropriate Departmental Board.

7.5 A student shall maintain regular contact with the supervising Department and shall be required to attend for certain periods at the University as directed by their approved Supervisor (s).

7.4 Students shall maintain regular contact with the supervising Department and shall be required to attend for certain periods at the University as directed by their approved Supervisor (s). Replaces 7.3 as above

7.6 The student shall complete the relevant Progress Report Form and submit it after every six months to the Supervisor. The Supervisor shall report on each student's progress every six months to the Faculty Higher Degrees Committee through the appropriate Departmental Board.

7.7 The Faculty Higher Degrees Committee shall recommend and submit the student's progress report to the Academic Board for publication.

7.8 A student who fails to submit a progress report within a six-month period of study shall receive a written warning from the Chairperson of the Department.

7.9 No break in the normal continuity of study shall be permitted, except by permission of the Senate on the recommendation of the Faculty Higher Degrees Committee.

7.10 A student who fails to submit a progress report within a twelve-month period of study shall be regarded as having had a break in the normal continuity of study and may be deregistered from the programme.

7.11 A full-time student may be engaged in limited teaching at the University.

7.12 A student who is employed outside the University, or a staff member employed in the University, other than on the research programme for which he/she proposes to be registered, may normally be accepted for registration only on a part-time basis.

7.13 If a student does not begin his/her studies for the Master of Philosophy or Doctor of Philosophy Degree within one calendar year from the date of approval, his/her registration shall lapse, and he/she will be required to re-apply to the University if he/she still desires to proceed.

7.14 A student may be required, as part of their Programme, to complete elements of course work to enhance their research studies, provided that such course work shall amount to not more than 25% of the minimum period allowed for the full programme.

The prescription of any coursework element shall require the approval of the Senate on the recommendation of the Departmental Board through the Higher Degrees Committee concerned. Where such course work is prescribed, the Department concerned shall ensure that the student is informed in writing of the precise requirements for satisfactory completion of the course work for reporting in due course to the Board of Examiners.

7.15 SUBMISSION OF THESIS

The Supervisor and the Chairman of the Faculty of Higher Degrees Committee shall satisfy themselves that the thesis is in a form suitable for submission for examination and that, where items of course work have been set, the candidate has satisfactorily completed these items.

The Chairman of the Department and the Chairman of the Faculty Higher Degrees Committee shall request that the thesis be subjected to professional proofreading and editing before submission.

Plagiarism is an academic offence in the sense that theft is in ordinary daily life hence every submission shall be checked for originality. An originality report showing the similarity index shall be submitted together with the thesis.

A thesis whose originality report shows an unacceptably high level of similarity index shall not be accepted for examination by the Faculty Higher Degrees Committee.

A soft copy, together with four hard copies of the thesis, in loose-bound form shall be submitted by the Department to the Deputy Registrar Academic Affairs for examination.

After examination, the Deputy Registrar Academic Affairs shall submit one corrected loose-bound copy of the thesis to the Academic Board.

After approval by the Academic Board, a soft copy together with five hard copies of the final thesis, in hard-bound form shall be submitted by the Department to the Deputy Registrar Academic Affairs.

8.0 MARKING SCHEME AND CLASSIFICATION

8.1 POSTGRADUATE DIPLOMAS AND MASTERS DEGREES BY COURSEWORK

Postgraduate diplomas and Masters Degrees by Coursework shall be awarded in the categories; distinction, merit, credit and pass.

The following Grading Scheme shall be used for the Modules and Programmes:

80% and above	-	DISTINCTION	(D)
70% - 79%	-	MERIT	(M)
60% - 69%	-	CREDIT	(C)
50% - 59%	-	PASS	(P)
Below 50%	-	FAIL	(F)

8.2 MASTER OF PHILOSOPHY DEGREES

The Master of Philosophy Degrees shall not be classified.

8.3 DOCTOR OF PHILOSOPHY DEGREES

The Doctor of Philosophy Degrees shall not be classified.

8.4 HIGHER DOCTORATE DEGREES

The Higher Doctorate Degrees shall not be classified.

9.0 ASSESSMENT OF CANDIDATES

9.1 MODE OF ASSESSMENT

9.1.1 Normally, evaluation shall be based on continuous assessment, dissertation and formal examinations. The percentage allocation of each component of the assessment shall be set by the Senate on the recommendation of the appropriate Faculty Board;

9.1.2 Satisfactory completion of modules may require submission of written work, attendance at lectures, seminars, tutorials, industrial attachment and other activities as stated in the Faculty Regulations;

9.1.3 Each Department shall determine which items of the module shall be included in the continuous assessment and shall define the relative weighting assigned to each item. Each Department shall inform the students of these details at the beginning of the module and shall maintain written records of each student's performance in these elements of continuous assessment. Items incorporated in the continuous assessment include assignments, tests, essays and projects;

9.1.4 External Examiners shall be appointed to moderate all formal examinations;

9.1.5 All matters relating to the conduct of formal examinations shall be the responsibility of the Registrar;

9.1.6 To be admitted to any formal examination, a candidate shall:-

a) be registered as a student of the University in accordance with the General Academic Regulations;
b) have satisfactorily completed approved modules of study at the University.

9.1.7 Exclusion from a formal examination shall require the authority of the Senate.

9.1.8 The Examiners may require any candidate to attend an oral examination and/or write a special examination.

9.2 CREDIT ACCUMULATION

9.2.1 The following Credit Accumulation regulations shall apply to all Modules and Programmes:
9.2.2 A Credit shall be equivalent to 10 notional study hours of learning.
9.2.3 All programmes offered by the University shall use an academic credit allocation system approved from time to time by the Senate. The University shall adopt the following SADC qualification framework as prescribed by the Zimbabwe Council for Higher Education for all programmes offered:

SADC-QF LEVEL	QUALIFICATION
10	Doctorate
9	Masters

9.2.4 A student who completes a module shall be awarded the credits approved for the module at the assigned level.

9.2.5 **Award of Credit**

A student who passes a module shall be awarded the approved credit for that module**.**

9.2.6 **Credit Accumulation and Degree Qualification**

A student shall progressively accumulate credits for modules that they successfully complete. A Student shall be required to accumulate sufficient credits to progress through the programme and shall be required to gain the total credits required for the award of the degree qualification as prescribed in the Faculty Regulations.

9.2.7 **Accreditation of Prior Learning**

A student who is exempted from the first year of study shall be awarded credit determined by the Faculty recognising prior learning that matches the learning outcomes of the programme gained from an accredited institution and relevant work experience.

9.3 MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY DEGREES

9.3.1 THESIS

9.3.1.1 TITLE OF THESIS

A candidate shall submit to the Faculty Higher Degrees Committee, the title of his/ her thesis for approval by Senate at least six months before final submission of the thesis. After the title has been approved, it may not be changed except with the permission of the Senate.

9.3.2 SUBMISSION OF THESIS

The Supervisor and the Chairman of the Faculty Higher Degrees Committee shall satisfy themselves that the thesis is in a form suitable for submission for examination and that, where items of coursework have been set, the candidate has satisfactorily completed these items. Four copies of the thesis, in loose-bound form shall be submitted to the Deputy Registrar (Academic Affairs).

9.3.3 After completing the study, a student shall submit a thesis which should comply with the following conditions:

9.3.3.1 The greater portion of the work submitted shall have to be done by the student after registration for the degree.

9.3.3.2 The presentation of the thesis shall be of an acceptably high standard.

9.3.3.3 A Master of Philosophy thesis shall provide evidence that the candidate has mastered relevant research techniques, has shown scholarship, has developed a capacity for criticism of his/her own and other work, and has widened his/her knowledge and understanding of literature of his field of study.

9.3.3.4 A Doctor of Philosophy thesis shall constitute an original and substantial contribution to the advancement of knowledge in the Subject chosen, and show evidence of a greater depth of scholarship than that required for the Master of Philosophy degree described above.

9.3.3.5 The length of the thesis shall normally be established in consultation with the Supervisor and the Faculty Higher Degrees Committee.

9.3.3.6 The thesis shall be written in English.

9.3.3.7 The literary form of the thesis shall be satisfactory.

9.3.3.8 The thesis shall consist of the candidate's own account of his/her research.

9.3.3.9 The thesis may describe work done in conjunction with the candidate's Supervisor(s), and include material obtained or produced with technical or other assistance, provided that the candidate shall state clearly his/her personal share in the investigation and specifically acknowledge all such assistance. This statement shall be certified by his/her Supervisor and bound as part of the preface of the thesis.

Work done jointly with persons other than the candidate's Supervisor(s) may be accepted as a thesis, or part of a thesis, in certain circumstances, provided the candidate's share is clearly certified.

9.3.3.10 Work already published, including that published in Joint names, may be included only if it forms an integral part of the thesis. A series of publications alone shall not be acceptable as a thesis.

9.3.3.11 An abstract of the thesis, in single spacing form, not exceeding one page shall be incorporated as part of the preface to the thesis.

9.3.4 A candidate shall not be permitted to submit as his/her thesis, a thesis which had been submitted to another university. However, a candidate shall not be precluded from incorporating work which he/she shall indicate on his/her thesis for entry to the examination and also in his/her thesis, any work which has been so incorporated.

9.3.5 The format of the thesis submitted for examination shall be as follows: Typed, or printed, double-spacing form or reproduced there from, (except for the abstract which shall be in single-spacing form) in the following format:-

9.3.5.1 Size of paper: International A4: (210 mm x 297 mm). No restriction shall be placed on the drawing of maps.

9.3.5.2 There shall be a margin of 40 mm on the left-hand side of the page, to allow for binding, a margin of 10 mm on the right-hand side and a margin of 20 mm at the top and at the bottom of the page.

9.3.6 A candidate may submit as subsidiary matter in support of his/her candidature, any publications or contributions to the advancement of his/her subject which he/she may have published independently or jointly. In the event of a candidate submitting such subsidiary matter, he/she shall be required to state fully his/her own share in any joint work. Where there is a substantial computing content in the thesis, a machine readable copy of the source programme shall be submitted together with the copies of the thesis.

9.3.7 After the completion of the examination process, a candidate shall submit four copies of the successful thesis which shall be bound in accordance with University Regulations.

10.0 DETERMINATION OF CANDIDATES' RESULTS

10.1 POSTGRADUATE DIPLOMA AND MASTERS DEGREE BY COURSEWORK

10.1.1 Results shall be determined by the Senate on recommendation of Faculty Boards of Examiners.

10.1.2 Departmental Panels of Examiners shall comprise all full-time lecturing staff in that Department, the External Examiner(s) and, where appropriate, as determined by the Departmental Panel, Part-time Lecturers for the course/subject concerned.

10.1.3 Faculty Boards of Examiners shall consist of the Dean and Deputy Dean of the Faculty, the Chairman of each Department, the External Examiner for the Department and normally one other academic member of the Department, nominated by the Departmental Panel from each Department involved in the subjects for that examination.

The Departmental Panel of Examiners shall:

10.1.3.1 agree, for each candidate, marks in terms of percentages, for continuous assessment, for the dissertation where applicable, for the formal examination and overall course work in terms of the Faculty Regulations for courses.

10.1.3.2 recommend to the Faculty Board of Examiners whether a candidate should pass or fail the relevant module(s) and subject(s) taken, and recommend the category of passing.

10.1.3.3 where subject/module prizes are available for award, make recommendations for the award these prizes.

10.1.4 The Faculty Board of Examiners shall:

10.1.4.1 consider the recommendations of the Panels of Examiners and recommend to the Senate an overall result for each candidate and any other conditions as it may deem appropriate;

10.1.4.2 make recommendations to the Senate with regard to the award of any prizes which may be available for candidates within the programme.

10.2 MASTER OF PHILOSOPHY AND DOCTOR OF PHILOSOPHY DEGREES

10.2.1 EXAMINATION AND DETERMINATION OF CANDIDATES' RESULTS

Results shall be determined by the Senate on the recommendation of the Faculty Board of Examiners which shall consists of the following:

10.2.1.1 the Dean or Deputy Dean of the Faculty (Chairman), the Chairman of the Faculty Higher Degrees Committee, the Chairman of Department concerned, Supervisor(s), one Internal Examiner who is an expert in the field.

THE EXTERNAL EXAMINER: The External Examiner need not be present at the Board of Examiners Meeting for the Master of Philosophy Degrees.

10.2.1.2 candidates shall be assessed on the merits of their thesis but where elements of course work have been prescribed, they shall also satisfy the examiners that this has been satisfactorily completed.

10.2.1.3 when a candidate is ready to submit his/her dissertation in detail for examination, the Departmental Board shall recommend to the Senate through the Faculty Higher Degrees Committee, the appointment of Examiners, one being an External Examiner and two being members of staff of the University who are specialists in the field of study concerned. These Examiners shall assess the dissertation in detail and shall each submit a written report with comments and recommendations to the Dean of the Faculty concerned. A member of staff who has been appointed as Supervisor for the dissertation may not be appointed as one of these Examiners.

10.2.1.4 on receipt of reports of the Examiners, the Dean of the Faculty concerned shall refer these reports to the Board of Examiners.

10.2.1.5 the Board of Examiners shall normally examine the candidate orally. The Board of Examiners may require further examination through written papers, or practical examination, or both, on the subject of the thesis and, if they see fit, subjects relevant thereto.

10.2.1.6 after the Board of Examiners has considered the written reports of the Examiners it may recommend to the Senate that the candidate be passed or failed.

10.2.1.7 If the thesis is adequate, but the candidate fails to satisfy the Examiners at the oral or other examination, the Board of Examiners may recommend to the Senate that the candidate be permitted to represent the same thesis and submit to further oral or other examination within a period of one calendar year.

10.2.1.8 the candidate may be required to make editorial amendments to his/her thesis to the satisfaction of the Chairman of the Board of Examiners, after consultation with the Chairman of the Department concerned before lodgement of the final bound copies of the dissertation.

10.2.1.9 if the thesis, though inadequate, shall seem of sufficient merit to justify such action, the Board of Examiners may recommend to the Senate that the candidate be permitted to represent his/her thesis in a revised form within one calendar year from the decision of the Senate with regard thereto. The Board of Examiners shall not, however, make such recommendation without submitting the candidate to any oral examination or, exceptionally, if an oral examination is impracticable, a written examination.

10.2.1.10 in the event of a disagreement between Examiners on the merits of the work, the Board of Examiners may refer the thesis to a second External Examiner.

10.3 HIGHER DOCTORATE DEGREES

10.3.1 The Board of Examiners shall consist of the following persons:

The Dean or Deputy dean of the Faculty (Chairman), All Professors in the Faculty, The Chairman of the Faculty Higher Degrees Committee, The Chairman of the Department concerned, The Internal Examiners and, where appropriate, one or more suitably qualified persons who shall, normally be members of the academic staff. Such persons may be appointed to the Board at the discretion of the Dean after consultation with the Chairman of the Department concerned.

10.3.2 Assessment of the work submitted by the candidate shall be made initially by two or more External Examiners and by two or more Internal examiners appointed by the Senate on the recommendation of the appropriate Faculty Higher Degrees Committee.

10.3.3 Each External Examiner shall be required to submit a formal written report on the submission, to the Deputy Registrar (Academic Affairs) with his/her recommendations.

10.3.4 On receipt of the report from the External Examiner(s), the Deputy Registrar (Academic Affairs) shall refer it to the Chairman of the Department concerned, through the Dean of the Faculty, for consideration by the Internal Examiners.

10.3.5 Having read the submission and the report(s) from the External Examiners, the Internal Examiners shall report formally and make recommendations to a Board of Examiners which shall, in turn, report and recommend to the Senate.

11.0 FAILURE TO SATISFY EXAMINERS

11.1 A candidate who fails to satisfy the examiners in terms of the Faculty Regulations may be required by the Senate to 'repeat' or to 'withdraw'.

11.2 'Repeat' means that the student may apply for readmission into the same Programme and his/her application shall be considered through the normal procedures.This measure would normally be taken in respect of a student who has failed in a Programme. Such a candidate shall be re-admitted only if a place is available after normal entry candidates have registered. If a student is repeating a module(s), he/she shall only be credited with the marks obtained during the 'repeat' examination. Nevertheless where this is provided in the Faculty Regulations a 'repeat' student may be exempted from re-attendance and re-examination in any module(s) in which he/she previously passed, or may take another approved course or other approved modules instead of the module(s) previously passed. Exemptions shall be granted only in those cases where a candidate has scored credit or better pass.

11.3 'Withdraw' means that the student shall withdraw from the University. This measure would normally be taken in respect of a student who has either failed in two programmes failed overall twice in one Part of one Programme. Once 'withdrawn' the student shall not apply again for admission until after a period of two years has elapsed.

11.4 Where a dissertation or a project is prescribed in any programme, candidates shall be informed in advance of the deadline for submission of such dissertation or project. Unless prior permission for an extension of this deadline has been granted by the Academic Board, any candidate who fails to meet this submission deadline shall normally fail and would be required to repeat the dissertation or project. A candidate who fails the dissertation or project but obtains a mark of 40% - 49% shall on the recommendation of the Examiners, be permitted to submit the dissertation or project at a later date, normally within three months of the publication of the results. Unless otherwise determined by the Senate, the maximum mark allowable for such referred work shall be 50%.

12.0 APPEALS AGAINST TERMINATION OF STUDIES

12.1 Any candidate who, having failed to satisfy the Examiners, is required to withdraw from the University or discontinue a programme, has a right to appeal.

12.2 A committee shall be established by the Senate to consider such an appeal.

12.3 Any candidate who wishes to lodge an appeal against withdrawal or discontinuation must do so in writing to the Registrar within 21 days after the publication of the Examination results.

12.4 On appeal, the candidate must state clearly the grounds of the appeal. Medical grounds must be substantiated in writing by a medical practitioner registered in terms of the Health Professions Act. Any other evidence which the candidate wishes to submit in support of his/her case must also be lodged with the written appeal.

12.5 The Registrar will refer all timeous appeals to the Appeals Committee for consideration.

12.6 The Appeals Committee will consider, as legitimate grounds for appeal, new evidence of mitigating circumstances (except mere lack of diligence or other fault on the part of the student) which was not previously available to the Examiners. Extenuating circumstances of a force majeure' nature, which explain and are directly relevant to the student's academic performance and which he/she could not reasonably have been expected to have foreseen or avoided, will be considered.

12.7 The Committee shall be empowered to hear an appellant orally and to seek all such information or evidence as it may consider pertinent.

12.8 No right to automatic oral hearing is conferred upon appeals and the University will not reimburse any expenses incurred by an appellant in making a personal appearance before the Committee.

12.9 The Committee shall make recommendations in each case, as it deems appropriate. Its recommendations shall be submitted to the Senate for approval, or to the Academic Board or the Vice-Chancellor on behalf of the Senate for consideration.

13.0 AEGROTAT PROVISIONS

13.1. If a candidate, having completed a substantial component of a Part of his/her Programme, is prevented by serious illness or other sufficiently substantiated cause, from completing the prescribed requirements for that Part of the Programme, he/she may be deemed by the Senate to have satisfied the examiners for that Part upon the recommendation of the Board of Examiners concerned and upon such other conditions as the Senate may decide, provided that:-

13.1.1 The candidate will not normally be exempted from presenting a thesis or dissertation where such is prescribed.

13.1.2 The award of an Aegrotat Degree shall be without classification.

13.2 Where a student qualifies for an Aegrotat Degree, he/she may opt instead to write a special examination in order that an overall grade may be determined and formally credited to the student. Application for such an option must be submitted in writing to the Registrar not later than four weeks before the scheduled examinations.

13.3 The Senate may require any candidate, irrespective of his/her Programme or Faculty, Whose examination performance has been adversely affected by sufficiently substantiated circumstances of 'force majeure' nature to write a special examination at an appropriate future date, normally not later than three months after the date of the last examination missed.

In such a case, unless otherwise stipulated by the Senate, the mark obtained in the special examination will be counted in the overall assessment for purposes of degree classification.

13.4 A candidate who wishes to be considered for an Aegrotat Degree must apply in writing, together with written substantiation for his/her case, to the Registrar normally within ten days of the end of the University Examinations for the Programme concerned. Appeals which are submitted on medical grounds must be supported by a certificate from a medical practitioner registered in terms of the Health Professions Act.

13.5 A candidate who is awarded an Aegrotat Degree may not re-enter the examination for that same degree, but shall be eligible to apply to proceed to an appropriate higher degree.

14.0 PLAGIARISM

14.1 Definition

Plagiarism is the unacknowledged use of another person's material or ideas. As such, plagiarism is an academic offence in the sense that theft is in ordinary daily life.

14. 2 Recommendations on the severity of the penalty shall be determined by the appropriate Departmental Board or Board of Examiners. Cases of plagiarism shall be handled in the following manner:-

14.3 Minor Cases of Plagiarism

14.3.1 **FIRST OFFENCE**: In the case of plagiarism being discovered in a piece of work such as an essay or laboratory report or Dissertation the student shall get a Chairman's warning but shall be given an opportunity to re-do and re-submit an acceptable piece of work after one week and shall be awarded a maximum of 50%.

14.3.2 **SECOND OFFENCE**: The student shall get a Dean's warning and shall be awarded a mark of zero for the submitted work.

14.3.3 **THIRD OFFENCE**: The Senate shall take disciplinary measures such as suspension or expulsion of the student who will have been awarded a mark of zero.

14.4 Major Cases of Plagiarism

14.4.1 In the case of plagiarism being discovered in a project at the end of the year the candidate shall be denied the opportunity to resubmit the project, but will be required to submit a new project.

14.4.1.1 The new project shall be submitted not later than June of the following year.

14.4.1.2 The new project will be awarded a maximum mark of 50%

14.4.2 In the case of plagiarism being discovered in a project for the second time and after resubmission, a mark of zero shall be awarded and recorded, and the Senate shall take disciplinary action either to suspend or expel the student.

15.0 MISCONDUCT AT EXAMINATIONS

15.1 Subject to Ordinance 30, any candidate found using unauthorised material, or attempting to obtain information from other candidates or their papers, or otherwise guilty of misconduct during the examination shall be disqualified not only in that examination and subject, but in the whole examination, and further disciplinary action may be taken by the University.

16.0 PUBLICATION OF RESULTS

16.1 The Registrar shall be responsible for the publication of the results of University Examinations as approved by the Senate.

16.2 Results lists shall be published individually to the student's web portal, and where necessary, shall be posted on University Notice Boards.

17.0 ACADEMIC TRANSCRIPT

On leaving the University each student may obtain, on application to the Registrar, one copy of a formal transcript of his/her complete academic record at the University.

18.0 AWARD OF DEGREES

The award of Degrees of the University shall be subject to approval by the University Council.

Candidates completing the requirements for such award will be entitled to receive a formal certificate of the University, bearing the University seal and signed by the Vice-Chancellor and the Registrar, confirming the award.

DEFERMENT AND LEAVE OF STUDIES POLICY

PURPOSE

The formulation of the policy on deferment of studies is an acknowledgement that students enrolled at the National University of Science and Technology (NUST) may apply for a deferment of studies and take leave from studies.

The policy is developed with the objective of ensuring that students are able to apply for deferment or leave of studies. In addition this policy will facilitate efficient and effective management of deferment of studies by the University.

SCOPE

This policy shall allow the Deferment and Leave of Studies in all programmes offered by NUST. Students who have been formally offered a place to study at the University and have notregistered, have the option to defer the offer while students who have registered and havecommenced studies may apply to take Leave from studies at any time.

Applications by students with pending disciplinary cases shall be considered after finalisation of their disciplinary cases. Applications for Deferment and Leave of studies shall be consideredby the University according to their respective individual merits. Conditions listed on the offerLetter of Admission must be satisfied before an application for Deferment or Leave of Studiesis considered.

1. This Policy shall allow Deferment and Leave of Studies from the National University of Science and Technology Undergraduate and Postgraduate degree programmes.

2. Definitions

Deferment: Postponement of studies for a period of up to 12 months, normally covering the Academic Year, for a person who has been offered a place, or a person who is allowed to proceed to the next part of the programme and has not registered.

Leave of Studies: A period of 6 to 12 months covering the normal teaching period when a registered student is excused from formal study. Leave applies to students that have commenced studies.

Offer: When an applicant is informed in writing that he has been offered a place in a programme to study.

Programme: A plan of study lasting over a period of time which leads to the award of a diploma or a degree of the University.

LIBRARY

1.0 INTRODUCTION

The Library is the nerve centre of academic activity, working to enrich the total study experience by utilising new and emerging technologies in the provision of information services. It creates learning spaces both physical and virtual using state of the art tools and methods to stimulate learning and respond to student needs.

2.0 HISTORICAL BACKGROUND

The NUST Library was established in 1992 with a small collection of 2000 books and two members of Staff. It has since grown to over 55 000 books, more than 54 electronic databases, 50 000 plus e-books and 50 members of staff. The Library computerised its systems by installing INNOPAC Millennium, an Integrated Library Management System in 2003 through the assistance from SIDA/SAREC which availed a grant to NUST.

3.0 Physical Address

The Main Library is located at 114 Fort Street, in the city centre of Bulawayo until the construction of a new-state- of- The-art Library is completed.

3.1 Physical expansion

Resources are not the only expansion witnessed at the NUST Library. Apart from the main Library, there has since been established 3 more branch libraries:

3.1.1The Graduate School of Business Library
3.1.2FOBE Library (Faculty of the Built Environment)
3.1.3Faculty of Medicine Library (located at Mpilo Hospital in Bulawayo)

3.2The Library is an institutional member of:

- ZIMLA (Zimbabwe Library Association),
- One of the inaugural Members of ZULC (Zimbabwe University Libraries Consortium),
- IFLA (International Federation of Library Associations and Institutions)
- AFLIA (African Library and Information Associations and Institutions) and
- EIFL (Electronic Information for Libraries)

4.0 Who Can Use the Library?

4.1.1. All full-time and part-time registered NUST students, NUST members of staff, visiting academics and NUST Members of Council are eligible for membership of the Library.

4.1.2. Students and staff from other Universities, researchers from both the private and public sectors can apply for readership.

4.2. **Is the Library easily accessible?**

Yes it is. The Library opens up to 2100hrs during the semester. Online services like electronic resources are accessible 24 hours a day through remote access.

5.0 SERVICES

5.1 Reference Services

The Reference Section or Help Desk provides personal assistance to library users. It is essentially concerned with helping patrons locate relevant information pertinent to their needs, either within or outside the Library. Queries range from patron registration, accessing past examination papers, using the Library catalogue and assistance in using the library's electronic databases.

5.2 Ask the Librarian facility

This is an e-mail based reference service for those seeking assistance with library and research related questions. This service is accessible via the Library website.

5.3 Library Chat facility

This is a virtual reference service that opens doors for students, faculty members and researchers to connect with the library's reference team and receive real time library and research assistance through chat. This service is accessible via the Library website.

5.4 E-Resources

The Library provides access to over 54 scholarly databases that comprise of e-journals and more than 50 000 electronic books. These resources can be accessed from within campus as long as you are on the NUST network. They are also accessible 'remotely OR off campus' as long as you are a registered NUST student or member of staff with a University I.D.
Advantages of using these resources are that:

- They are convenient, can be accessed from anywhere
- They provide both current and retrospective information in one click
- They allow multiple access to a single resource
- They are quicker to search or browse AND
- They come in mixed media, e.g images, video, audio and so on.

The Library also provides access to other numerous e-resources like thesis and dissertations, past examination papers, subject guides and the Institutional Repository access is 24/7 round the clock.

5.5 Faculty Liaison

The Library has a team that works in partnership with academic units. Their role is to:

5.5.1. Provide information services
5.5.2. Keep faculties up to date with library developments and activities
5.5.3. Engage in collection development
5.5.4. Conduct e-resources training
5.5.5 Conduct information literacy skills training
5.5.6. Ensure there is effective and efficient use of library resources by staff and students.

5.6 Institutional Repository

This is a digital depository of NUST's intellectual output. It

5.6.1. Creates global visibility to NUST's scholarly research.
5.6.2. Collects content in a single location.
5.6.3. Provides access to institutional research output by self archiving it.
5.6.4. Stores and preserves the other institution's digital assets.

5.7 Past Examination Papers

Past examination papers are accessible online from the Library homepage.

5.8 Information Literacy Skills (ILS)

The Library conducts ILS training programmes to equip students with the requisite skills necessary for the effective use of online information.

It enables students to:

- Identify the different sources of information
- Use online search strategies,
- Evaluate information and its sources critically
- Understand the economic, legal and social issues surrounding the use of information.

Faculty Librarians are responsible for organising and conducting training.

5.9 Circulation Services

The Circulation Services of the Library encompass activities offered at the circulation/issue desk and the reserve section of the library. The aim is to ensure the proper movement of library material among patrons. The following are some of the services in the unit:

5.9.1 Short loan/Reserve Service

Books in high demand can be placed on Short term Loan or Reserve at the recommendation of academic staff.

5.9.2 **Long Term Loans**

Library material that may be required for constant use in a department can be placed on Long Term Loan at the request of the chairperson of the department.

5.10 **Library Fines**

Reading material borrowed from the Library should be returned on or before the due date. Overdue material attracts a fine at a rate to be determined by the Library from time to time. Different levels of fines shall apply on Ordinary Loans, Short term Loans, Library use Only/Reserved Material, Overdue items (15 days) or more and lost material.

5.11 **Book Requests**

Academic units are to make requests for books to be purchased at the beginning of the year or upon introduction of a new course. The Library will only consider requests that have been signed and authorised by the chairperson of the department.

5.12 **Photocopying Services**

The Library has outsourced photocopying services for the convenience of library users. A small fee is levied for the service. All photocopying is subject to the Copyright Act.

6.0 RULES AND REGULATIONS

6.1 **General Rules**

6.1.1 Users must present a valid University Identity Card, to the Security Guard upon entering Library premises.
6.1.2 For security reasons, bags, cases, etc, do not go inside the Library. Bags should be left at the baggage bay accessible through the side entrance.
6.1.3 Smoking, eating, and drinking are strictly prohibited.
6.1.4 Cell phones must be switched off or put on silent so that they do not distract others
6.1.5 Viewing of pornographic sites is prohibited in the library.
6.1.6 Readers are expected to observe silence in the library. Conversation and any other behavior likely to disturb or inconvenience others must be avoided in the reading areas.
6.1.7 All losses of and damage to library materials must be reported to the Library promptly.
6.1.8 All items taken in or out of the Library are subject to a security check.
6.1.9 The Library will confiscate any material not belonging to NUST Library if there is no proof it was borrowed legally from the lending institution.
6.1.10 Users are required to comply with the provisions of the Copyright Law. The Library and its resources are to be used for the purpose of Academic Learning and Research and not for the other forms of commercial gain.
6.1.11 Results for students with overdue material and unpaid fines will be withheld until payment is received in full.

6.1.12 Breaking into the University Library Computer system will attract a heavy fine or suspension from the library.

6.1.13 Personal belongings may be brought into the library at the user's own risk. The Library will not be held responsible for loss of, or damage to personal property.

6.1.14 Repeated infringement of the above rules would result in the Librarian suspending and or referring the matter to the University Proctor.

6.2 Borrowing Regulations

6.2.1. Only registered users can borrow material from the Library.

6.2.2. All items taken out of the Library must bear the current Library Due Date Stamp and a receipt.

6.2.3. Fines will accrue on all overdue material.

6.2.4. Library material shall not be issued to persons who hold overdue books or with outstanding fines.

6.2.5. Items not in demand may be renewed once/except for Short loan books.

6.2.6. All items are subject to RECALL if in demand.

6.2.7. Periodicals, Reference Books, Thesis, Dissertations and material stamped 'Library Use Only' may not be taken out the Library.

6.2.8. Members of staff going for staff development must return all books before proceeding for study leave.

6.2.9. Library users terminating membership of the Library must return all outstanding material and clear all fines before they can be cleared.

For more information, visit us at: ***library.nust.ac.zw***