MARIAN UNIVERSITY COLLEGE
(Constituent College of St. Augustine University of Tanzania)

FACULTY OF NATURAL AND APPLIED SCIENCES

BACHELOR OF EDUCATION IN SCIENCE
DEGREE PROGRAMME

MAY 2015
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Part One: Programme Structure

1.0 Introduction

The Tanzania Development Vision 2025 aspires to attain a prosperous nation with a well educated and learning society. In line with this grand goal, the Tanzania Education and Training Policy of 2015 indicates a need to expand the numbers of qualified Scientific, Arts and technical personnel in order to support social, technical and economic development.

Pursuant to this noble objective, Secondary Education Development Programme (SEDP) was introduced which managed to substantially expand Secondary Education Subsector. While this development succeeded to increase the number of students, the challenge was to attain sufficient teachers to contain the increasing student population particularly in the Science subjects. It is in this regard Marian University College (MARUCO) wants to play its part in contributing to the provision of human resources to the education sector and related fields.

MARUCO has adopted a degree programme in science education from Mwenge Catholic University [formally Mwenge University College of Education- MWUCE] to contribute to economic and social development in Tanzania through educating science teachers with degree level qualifications, who are able to contribute to improving quality and quantity of science education at Secondary Education level. The aim is to offer a degree course in science education, which will educate and train students in strong pedagogical skills, high professional ethical standards, and sound practical skills in teaching science at secondary school form 1-6 levels.

Having provided background information for the need to provide science courses for teachers, this document provides a detailed course structure that aspiring teachers ought to take for a period of three years in order to qualify for the award of Bachelor of Education in Science -BEd (Science). The subjects combination for MARUCO students taking Bachelor of Science in Education will include Chemistry and Biology, Chemistry and Mathematics; Chemistry and Geography; Physics and Chemistry, Physics and Geography; Physics and Mathematics; Geography and Biology; Geography and Mathematics. The rest of this document describes the detailed course structure in the following manner: Degree Programme aims and objectives, Degree Requirements including Entry Requirements and Assessment Regulations, Distribution of courses and credits, as well as Course Descriptions.
1.1 Name of the Degree Programme and Capacity of Student Enrollment

The name of the degree programme will be Bachelor of Education in Science (BED Sci).

This three (3) year programme includes the study of two academic subjects together with general core courses and professional subjects required for teacher’s education. The subject combinations are described in the Table below:

<table>
<thead>
<tr>
<th>Name of the Programme</th>
<th>Subject Combination</th>
<th>Number of Students per programme</th>
<th>Total enrolment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Education in Science</td>
<td>Chemistry and Biology</td>
<td>50</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Chemistry and Mathematics</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geography and Biology</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physics and Mathematics</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physics and Chemistry</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physics and Geography</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry and Geography</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geography and Mathematics</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

2.0 Degree Programme Aims

The degree programme to be offered will prepare students in the knowledge and skills of two science subjects such that they can teach both subjects to Form 1-6 level, together with the required knowledge, skills, and values in educational professional subjects. The degree course is aimed specifically at producing science educators to work in secondary schools in Tanzania, not to train generic scientists able to work in other occupations such as research scientists, technical advisors or business people. Therefore there will be a major emphasis on pedagogy, classroom management, and school management to support high quality science education. In order to develop strong professional values and high standards of professional behaviour, ethics will be included in the taught courses. The course qualification offered will be BEd in Science.

3.0 General Degree Programme Objectives

i) To educate and train science teachers with excellent pedagogical skills, able to use a wide variety of active, participatory teaching and learning methods, in order to raise the standards of science education at secondary school level.

ii) To empower students to become high quality teachers with a strong ethical dimension to their professional lives and work.

iii) To be able to apply modern teaching and learning techniques using modern equipment when it is available, but motivated and able to improvise and adapt to the realities of Tanzanian Secondary schools when it is not available. This will result in creative pupils with good practical science skills.
iv) To produce educational managers and leaders, able to raise the quality of secondary education through their commitment, leadership skills, and vision of the important place of science education in the development process, together with the necessary values and commitment to develop a spiritual and ethical dimension to the education they offer.

v) To produce life-learners, able to update their knowledge and skills, and adapt to the rapid social, economic and technical changes that will occur in Tanzania over the next 50 years.

4.0 Degree Regulations

4.1 Entry Requirements

4.1.1 General University Minimum Regulations shall apply

These are:

a) **Direct Entry**
   Applicants under this scheme must fulfil the following conditions:
   - Must hold at least three “O” level credit passes in approved subjects, one of which must be English language
   - Must have at least two good (D and above) principal passes in appropriate subjects at “A” level education and must have grade points total of not less than 4.5, where A=5, B=4, C=3, D=2, E=1, S=0.5 and F=0

b) **Selection under equivalent qualification**
   Applicants must meet the following conditions before they can be selected:
   - Must hold at least three “O” level credit passes in relevant subjects, one of which must be English Language
   - Must hold a Diploma in Education, with at least grade A or Grade B, in the subjects they wish to study at degree level, and pass the college entrance examination
   - Diploma holders may be exempted from one year of the course provided they pass the College entry examination at credit level

c) **Selection under mature entry scheme**
   Applicants under the mature age entry schemes must fulfil the following conditions:
   - Must be 25 years of age or above
   - Must have either obtained at least three credits in approved subjects at “O” level or attended Form 6 at least 5 years before the year of which admission is sought
   - Must have attended and passed tests in extra mural classes, residential courses or courses offered by an adult education centre in at least two subjects relevant to the courses they wish to follow
   - Must have sat and passed the College mature age entry examination

4.1.2 Departmental Minimum Requirements
Category A
Direct Entry (Form 6)
   a) Two principal passes at the same sitting in the two academic subjects to be studied
   b) At least a subsidiary pass in General Studies or maths

Category B
Equivalent qualifications
   Minimum of grade B in academic subjects (optionals) to be studied

4.2 Assessment Regulations
Each course will be assessed by continuous assessment and by examination in the examination period at the end of the semester in which the course is completed. Assessment will be by a variety of methods, appropriate for the knowledge and skills required by the course – examinations, assignments, practical work, portfolios, dissertation and assessment of teaching skills in school-based settings. The weighting given to each of these various methods of assessment will vary with each course, and is specified in the assessment section of each course.

   a. The pass grade in each assessed course is C. The weighting given to each method of assessment, which will include examinations, written papers, assignments, practical assessments, tests etc., is specified in the assessment section of each course.
   b. Candidates will normally be required to pass all the courses examined during each year before proceeding to the next year of study.
   c. No candidate will be allowed to sit for the final examination(s) if s/he has not attended at least 75% of the classes for that course and passed all the course work. The pass mark for all course work is 50%, regardless of the actual percentage it contributes to the final mark.
   d. All candidates are required to be assessed in courses worth a total credit value of at least 30 credits in each academic year.
   e. Failing candidates
      i) Any candidate failing one or more courses will be allowed a supplementary assessment(s). A pass in a supplementary assessment will be recorded as no higher than grade C.
      ii) A failing candidate in the second and third year with a grade performance average of less than 1.8 will not be allowed to proceed. She/he can repeat a year and will be discontinued if s/he fails again.
      iii) A failing candidate, irrespective of year, who supplements and fails a course:
         - may, with the approval of the academic committee, be allowed to carry forward that course for assessment at the end of the following year.
         - may, with the approval of the academic committee, be allowed to repeat a year once if in the second or third year of study.
f. The grading system shall be as follows:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Letter Grade</th>
<th>Points</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-100</td>
<td>A</td>
<td>5</td>
<td>Excellent</td>
</tr>
<tr>
<td>60-69</td>
<td>B+</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>50-59</td>
<td>B</td>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>40-49</td>
<td>C</td>
<td>2</td>
<td>Pass</td>
</tr>
<tr>
<td>35-39</td>
<td>D</td>
<td>1</td>
<td>Fail</td>
</tr>
<tr>
<td>0-34</td>
<td>E</td>
<td>0</td>
<td>Bad fail</td>
</tr>
</tbody>
</table>

g. Calculation of grades for the final degree will be as follows:
   i) All first year courses must be passed and will be included in the calculation of the grade awarded.
   ii) The average weighted grade (weighted according to credit value of the course) will be calculated using the points awarded for each course taken in years 1 to 3. A weighted average of all points gained from courses taken during the 1st, 2nd, and 3rd year will be calculated, and the following scale shall be followed for classification.

<table>
<thead>
<tr>
<th>Points average</th>
<th>Classification</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0-4.5</td>
<td>First class</td>
<td>A</td>
</tr>
<tr>
<td>4.4-3.5</td>
<td>Upper Second class</td>
<td>B+</td>
</tr>
<tr>
<td>3.4-2.6</td>
<td>Lower second class</td>
<td>B</td>
</tr>
<tr>
<td>2.5-2.0</td>
<td>Pass (Third Class)</td>
<td>C</td>
</tr>
</tbody>
</table>

Courses taken as “Extra” shall not be taken into account when computing classification, but they will be recorded on the academic transcript.

5.0 Distribution of Courses and Credits

The programme for Bachelor of Education (Science) will be made up of three different groups of subjects - core subjects, academic subjects and professional subjects. Each subject is made up of one or more courses.

The core subjects are those taken by all undergraduates following the Bachelor of Education (Science) regardless of field of study. These will be Development Studies, Social and Professional Ethics, Communication Skills (English), Basic ICT, Research Methods and Research Project.

The Professional subjects will be Education, Educational Psychology, and Teaching Practice (TP). The Academic subjects will be Biology, Chemistry, Physics, Mathematics, and Geography. Each student will choose two academic subjects to be studied for the three years of the degree programme.

A course will be worth a minimum of 3 credits and a maximum of 6 credits, depending on the amount of teaching contact required by the course. A 3 Credits course will involve 45 hours of teaching contact time, except a 2 hour practical class will be worth 1 hour of lecturing, e.g. a 1 credit course could be 15 hours of lecturing and 30 hours of practical work. A 2, 3, or 4 credits course will be multiples of this. Students will also be expected to carry out assignments, reading and private study for each course, and as an approximate
guide, the time spent by the student in this type of work should be about the same as the teaching time for that course.

Some courses require prior knowledge and experience before a particular course can be taken, and if that is the case, the courses to be studied prior to taking that course are clearly specified in the detailed course write up. Each student is expected to accumulate a minimum of 26 credits per semester, a total of 52 credits per year, and a minimum of 156 credits over the whole 3 year programme.

The credit value of each component of the degree programme is shown in Table 1 below.

**Table 1: Credit Value of component courses of the B.Ed in Science degree programme**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Course</th>
<th>Credit Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Subjects</td>
<td>ICT</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Communication skills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Ethics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Development studies</td>
<td>3</td>
</tr>
<tr>
<td>Professional subjects</td>
<td>Education and Research</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>BTP</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Educational Psychology</td>
<td>9</td>
</tr>
<tr>
<td>Academic subjects</td>
<td>Academic Subject 1</td>
<td>36</td>
</tr>
<tr>
<td>(Biology, Chemistry, Geography, Mathematics, Physics)</td>
<td>Academic Subject 2</td>
<td>36</td>
</tr>
</tbody>
</table>

The degree programme is structured such that in many subjects introductory courses are taught in the first year, with increasing specialisation in subsequent years. Some courses specify that certain prior courses must have been completed before these courses can be taken, and this is indicated in the write-up of each course.

**Elective Courses**

There will be elective courses in all years of study, allowing a certain amount of specialisation. The elective courses will be determined by student interest and staff expertise available to offer a range of elective courses that complement the core courses offered. Examples of elective courses are given in this write up, but those offered will depend on staff expertise and student interest at the time, and will only be offered in the third year of the course, giving ample time for course development using the structures and processes put in place for the development of all other courses described in this document.

**5.1 Programme Schedule**

**5.1.1. First Year**

**Courses Offered by Biology Department (Academic Subject)**
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 101</td>
<td>Animal Form and Classification</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>BIO 102</td>
<td>Introduction to Biochemistry</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>BIO 103</td>
<td>Cytology and Cell physiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>BIO 104</td>
<td>Introduction to Microbiology and Mycology</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Chemistry Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 101</td>
<td>Basic analytical chemistry</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CHE 102</td>
<td>Physical chemistry I</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CHE 103</td>
<td>Systematic inorganic chemistry</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CHE 104</td>
<td>Basic organic chemistry</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Physics Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 101</td>
<td>Mechanics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>PHY 102</td>
<td>Electromagnetism</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>PHY 103</td>
<td>Vibrations and waves</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHY 104</td>
<td>Optics</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Mathematics Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 101</td>
<td>Foundations of analysis</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>MTH 102</td>
<td>Calculus I</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>MTH 103</td>
<td>Linear algebra</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>MTH 104</td>
<td>Calculus II</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Geography Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 101</td>
<td>Physical Geography</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>GEO 102</td>
<td>Climatology</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>GEO 103</td>
<td>Spatial organizations</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>GEO 104</td>
<td>Surveying, cartography and map analysis</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Education Department (Professional subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 101</td>
<td>Introduction to educational psychology</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>EDU 102</td>
<td>General teaching methods</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>EDU 103</td>
<td>Philosophy of Education</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>EDU 104</td>
<td>Educational media and technology</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

5.1.2. Second Year

**Courses Offered by Biology Department (Academic Subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 201</td>
<td>Introduction to Ecology</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Code</td>
<td>Title</td>
<td>Semester</td>
<td>Credit value</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------</td>
<td>----------</td>
<td>--------------</td>
</tr>
<tr>
<td>BIO 202</td>
<td>Introduction to immunology and parasitology</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>BIO 203</td>
<td>Plant Systematics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>BIO 204</td>
<td>Introduction to Genetics and Molecular Biology</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Chemistry Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 201</td>
<td>Descriptive chemistry of transitional metals</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CHE 202</td>
<td>Chemical thermodynamics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CHE 203</td>
<td>Physical chemistry II</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CHE 204</td>
<td>Descriptive chemistry of inorganic chemistry of s and p block elements</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Physics Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 201</td>
<td>Thermodynamics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>PHY 202</td>
<td>Analogue electronics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>PHY 203</td>
<td>Quantum mechanics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHY 204</td>
<td>Digital electronics</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Mathematics Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 201</td>
<td>Vectors and vector mechanics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>MTH 202</td>
<td>Ordinary differential equations</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>MTH 203</td>
<td>Probability and statistics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>MTH 204</td>
<td>Calculus III (Functions of several variables)</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses Offered by Geography Department (academic subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 201</td>
<td>Quantitative methods in geography</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>GEO 202</td>
<td>Environmental education and conservation</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>GEO 203</td>
<td>Population geography</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>GEO 204</td>
<td>Remote sensing</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses offered by Education Department (Professional subject)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 201</td>
<td>Chemistry teaching methods</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>EDU 202</td>
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**5.1.3. Third Year**

**Courses Offered by Biology Department (Academic Subject)**
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<td>BIO 303</td>
<td>Mechanisms of evolution and diversity of life</td>
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### Courses Offered by Chemistry Department (academic subject)

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### Courses Offered by Geography Department (academic subject)

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### Courses offered by Education Department (Professional subject)

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A summary of the complete programme is shown in a table on page 8 and 9 below.

### MARUCO Summary Degree Structure for Three Year B.Ed. (Science)Programme

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<td>EDU 209 Research methods 3 credits</td>
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<td>GST 101 Basic computer application programs</td>
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NB: Academic subjects offered from academic year 2015/2016 are Biology, Chemistry, Geography, Mathematics, and Physics. All other subjects are professional or common core courses must be taken by all students.

### 6.0 Methodology

The mode of delivery for each course will depend on the contents and topic, but will include lectures, group work, discussions, seminar presentations, assignments, microteaching and peer-teaching, practical work in laboratory and in the field, together with private study and research. Given the philosophy of the degree programme we believe that practical work, including fieldwork is of fundamental importance. Assessment of practical skills will be an integral part of the assessment system and will be given appropriate weighting in the assessment of each course.

Individual private study will form an important part of each course for background reading and consolidation of material presented in classes. As an estimated guide for students we recommend that the number of hours allocated for private study for each course should be equal to the number of hours of teaching for that course. This time should be used for background reading, writing up practical work, written assignments, consolidation of personal notes, and reflection on the main issues.
School based experiences will include structured observations, single lesson practice and Teaching Practice. Collectively these experiences will provide an induction into the teaching profession, opportunities to experience and reflect on the many complex processes involved in organising and managing an efficient school, and opportunities to observe and practice subject based teaching skills.

Each student will be required to carry out a research project during the final year. This research project will have an educational purpose within the context of the Tanzanian secondary school system, and a focus on some aspect of their Major subject. It is expected that the topic chosen will be one that is applicable to the secondary education system, and leads to data gathering and analysis that sheds light on an aspect of the system that will help solve a problem or allow others to improve educational quality.

7.0 Instructional Material and Equipment

The instructional materials will include handouts, lectures, reading lists, library visits, seminars and tutorials, practical classes, field work and school based experiences. Equipment such as chalkboards, whiteboards, flip charts, overhead projectors, video camera, video recorders and Television, CD ROMs and Internet sources will be required for instructional purposes.

Science subjects will need laboratories with all necessary facilities (electricity, gas, water, together with equipment, apparatus and chemicals) to carry out the practical work designated by the courses in the various science subjects. Networked computers will also be needed.

In view of the above requirements MARUCO has the minimum teaching and learning facilities to start up running the proposed degree programme.

8.0 Academic Staff for the First Academic Year 2015/2016

The following is a list of academic and technical staff recruited by MARUCO to run the degree programme.

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Name</th>
<th>Academic Qualification</th>
<th>Academic Rank</th>
<th>Remarks</th>
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<td>Dr. Jude P. Shunula</td>
<td>BSc (Bot Zool Edu) MSc (Biology) PhD (Biology)</td>
<td>Senior Lecturer</td>
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<tr>
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<td>Mr. Reuben Maghembe</td>
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<td>Ms. Tumikia Sanga</td>
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<td></td>
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<td>Rev. Dr. Luke Mbefo</td>
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<td>Mr. Kilango Dole</td>
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<td>5</td>
<td>Ms Lilian Sylvester</td>
<td>BSc Computer Science</td>
<td>IT Technician</td>
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Part 2: Course Descriptions

Format
Each subject is presented using the same format. The courses are presented separately, with course code, course title, prerequisite course(s), goal, learning outcomes, course contents, teaching and learning methodologies, instructional materials and equipment, methods of assessment, and ends with course books and books for further reading. The courses are presented in order according to their status as core courses, professional courses or academic subject courses.

Note on Elective Courses
The elective courses offered will depend on staff expertise and student interest at the time, thus allowing a degree of specialisation, and complement knowledge and skills developed in the other courses of the academic subject.

BIOLOGY COURSE CONTENT

BIO 101: Animal Form and Classification 3 Credits
Prerequisite Course: None

Goal
To equip students with knowledge on the biology of major invertebrate and vertebrate phyla and skills required for zoological investigation.

Learning outcomes
At the end of this course the students will be able to:
1. Describe various organisms within the major vertebrates and their adaptations to the respective habitats.
2. Explain the naming systems and criteria used in the classification of organisms.
3. Recognize different types of kingdoms and challenges encountered when dividing organisms in their respective kingdoms.
4. Construct different classification keys and use them in identifying organisms.
5. Recognise the distinguishing characteristics of the major phyla of the animal kingdom, and understand the taxonomic and evolutionary relationships between them
6. Collect, identify, preserve and maintain invertebrates and vertebrates for use in school laboratories or for display in school museums

Course Contents
1. Characteristics and adaptations of the major vertebrate groups to various environments - problems and solutions (adaptation to aquatic and terrestrial life, including adaptation for flight)
2. Binomial and hierarchical systems of classification, differences between artificial and natural classification systems, the goal of classifying by evolutionary relationships, and the construction of phylogenetic trees.
3. Problems of dividing organisms into different kingdoms, the use of different taxonomic systems and reasons for their specific design
5. A survey of the main invertebrate and vertebrate phyla based on recent classification systems (from sponges – calcarea and silicea to chordates)
For each phyla a selection of species from different classes and orders with reference to classification, morphology, ecological and/or economic importance and adaptations to the environment. Major evolutionary concepts and relationships between different phyla. Within major phyla, evolutionary relationships between classes and orders. Evidence for evolutionary pathways and relationships between vertebrate groups.

6. Methods of collection, identification and preservation of a variety of invertebrates and vertebrates common in Tanzania

Teaching and Learning Methodologies
Lectures, seminars and practical classes

Instructional Materials and Equipment
Chalkboard, OHP, computers, Cd ROMs, INTERNET sites, laboratory apparatus and chemicals

Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course Books

Textbooks and journal for further readings

BIO 102: Introduction to Biochemistry
3 Credits
Prerequisite courses: None

Goal
To enable the learner to analyse the nature and functions of the cell and cellular macromolecules so as to understand the basic nature of life and the mechanism of energy productions in cells.

Learning outcomes
At the of the study the student will be able to:
1. Identify different structures of cellular macromolecules and the principle underlying their structures.
2. Describe importance of macromolecules.
3. Explain the relevance and structure and the four main classes of macromolecules.
4. Describe the nature and classification of enzymes and the factors that affect their activities.
5. Explain the nature of coenzymes and their functions.
6. Describe the structure and functions of vitamins and their application in nutrition.
Course Contents
1. The basic principles of the structure and function of cellular macromolecules with an emphasis to eukaryotic cells.
4. Enzymes-classification, properties, mechanisms, kinetics and regulations.
5. Cofactors: Coenzymes and prosthetic groups; Lipids and eicosanoids; Nucleotides and the Nucleic acids.
6. Vitamins and trace elements.

Teaching and Learning Methodologies
Lectures, seminars, assignments and practical classes

Instructional Materials and Equipment
Chalkboard, OHP, computers, Cd ROMs, INTERNET sites, laboratory apparatus and chemicals

Course Assessment Methods
20% Practical
20% Written assignments
60% Final examination

Course textbooks

Textbooks and journals for further reading

BIO 103: Cytology and cell physiology 3 Credits
Prerequisite courses: None

Goal
To enable the learner understand the nature and the functions of the basic unit of life the cell, and its components.

Learning outcomes
At the of the study the student will be able to:
1. Describe the structure and functions of the cell.
2. Relate the structure of organelles to their functions and understand the relationships among them
3. Explain how a single cell meets the basic criteria that differentiate living organisms from nonliving objects and chemical reaction.
4. Describe the basic structure of the membrane in the cells and describe the roles of these membranes in determining the organization and functions of the cells and their organelles.
5. Describe the various physiological processes carried out by each of the three basic types of cells.

Course contents
1. Basic aspects of cell structure and function: Structural organization of the cell.
2. Defining features of eukaryotic and prokaryotic cells: Major cellular components, organelles typical to of plants, organelles typical of animals.
3. Cell surface specialization: Matrix between animal cells, cell to cell junction.

Teaching and Learning Methodologies
Lectures, seminars, practical work

Instructional Materials and Equipment
Chalkboard, OHP, computers and INTERNET access, digital projector

Course Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course books

Textbooks for further Reading

BIO 104: Introduction to microbiology and mycology 3 Credits
Prerequisite courses: BIO 101

Goal
To enable the student in identifying and differentiating types of microorganisms especially those with economic connotations so as to know how to prevent and embrace their negative and positive implications respectively.

Learning Outcomes
At the end of the study the learner will be able to:
1. Define the term microbiology and describe the historical background of the subject
with the individual scientists” contributions.
2. Describe the principle and types of sterilization and the various techniques that are used for staining.
3. Explain the basis of microbial classification.
4. Describe the classification of different types of viruses and bacteria and the ultra-structure of bacterial cells.
5. Explain the mechanism of food decaying process and the technique of microbial isolation, culture and identification.

Course Contents
1. Introduction and scope of microbiology: Definition and history of microbiology, contributions. Importance and scope of Microbiology as a modern Science and Branches of microbiology. Microscopy: working principles of different types of microscopes –
3. Microbial Taxonomy: Concept of microbial species and strains, Classification of bacteria based on – morphology, staining reaction, nutrition and extreme environment.
4. General Account of Viruses, Bacteria and fungi; structure, physiology, genetics, microbial pathogenicity and infectious diseases.
5. Food decay, food poisoning and preservation of food by microorganisms. Industrial and general applications of microorganisms. Basic techniques of isolation, culture, quantification and identification of microorganisms.

Teaching and Learning Methodologies
Lectures, seminars and practical classes

Instructional Materials and Equipment
Chalkboard, OHP, computers, CDs, internet sites, laboratory apparatuses and chemicals.

Course Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course books

Books and journals for Further Reading
3. House,

**BIO 201: Introduction to Ecology 3 Credits**
**Prerequisite courses:** BIO 101, BIO 102, BIO 104

**Goal**
To enable students to acquire knowledge on the relationship between living organisms (individuals and populations) and their environments and develop practical skills on how to design and execute independent ecological studies as well as collect, analyze and interpret ecological data.

**Learning outcomes**
At the end of the course students shall be able to:
1. Define various terms related to ecology and their application.
2. Explain the meaning of population and parameters that measure the growth of a particular species population.
3. Describe how energy flows in an ecosystem.
4. Describe biochemical cycles and how they are related to the ecosystem.
5. Evaluate different ways in which human beings contribute to pollution to the ecosystem and how pollution can be analysed using computer technology.

**Course contents**
4. Energy flow in ecosystems; energy fixation by autographs and energy flow beyond the producers.
5. Biochemical cycles and ecosystems: gaseous and sedimentary nutrients. Community ecology, its structure, function, stability and change.
6. Human ecology, the human population and anthropogenic contamination of environmental systems. Impact of pollutants on human health and other living systems. Techniques used in terrestrial and aquatic environment to gather ecological data and quantitative data analysis using computers.

**Teaching and Learning Methodologies**
Lectures, seminars, fieldwork and laboratory practical work.

**Instructional materials and Equipment**
Chalkboard, Overhead Projector and/or beamer, Laboratory and field apparatuses and chemicals.

**Assessment methods**
20% Practical
20% Written assignments
60% Final examination

**Course Textbooks**


**Textbooks for Further Reading**


**BIO 202: Introduction to immunology and parasitology  3 credits**

**Prerequisite courses:** None

**Goal**

To equip the student with the understanding of the mechanism of the immune defence system and the etiology of various diseases together with their prevention.

**Learning outcomes**

At the end of the study the student will be able to:

1. Describe the history, development, structure and organization of the immune system.
2. Describe various tissues, cells and organs that are associated to the immune system.
3. Explain the role of cytokines and their participation in hypersensitivity reactions.
4. Identify the role of major histocompatibility in relation to transplantation immunology.
5. Describe the basic mechanism of vaccination and the evasion of the HIV (AIDS) against the immune surveillance.
6. Outline the life cycles of protozoa, major diseases they cause in Tanzania, prevention, symptoms and treatment of these diseases.

**Course Contents**

1. Biological concepts of immunology, historical landmarks in immunology, innate and acquired immunity, components if the immune system.
2. Cells, tissues and organs of the immune system, Humoral immunity /immunoglobulins, molecular structure and nature of antibodies and diversity. Molecular basis of antigens, complement system, B and T-cell receptors.
3. Cytokines and other soluble mediators; cell adhesion molecules and co-receptor, cell activation, cell mediated immunity, hypersensitivity reactions; immediate hypersensitivity, delayed hypersensitivity, inflammation.
4. Major Histocompatibility complex (MHC) antigens, HLA system. Transplantation and immunology and immunological assays.
5. Immune regulation, autoimmunity, Vaccines and immune response to infectious diseases, Immune deficiency diseases (AIDS).
6. The study of parasitic protozoa and worms. Comparative morphology, systematic and life history of protozoan and invertebrate parasites of human, host parasite interaction and host examination and diagnostic procedure.

Teaching and Learning Methodologies
Lectures, seminars and practical classes

Instructional Materials and Equipment
Chalkboard, OHP, computers, CDs, internet sites, laboratory apparatuses and chemicals.

Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course Textbooks

Textbooks and journals for Further Reading

BIO 203: Plant Systematics 3 Credits
Prerequisite courses: BIO 101

Goal
To acquaint students with the underlying knowledge necessary for the identification and classification of plants, the importance of nomenclature and factors that influence speciation

Learning outcomes
At the end of this course the student will be able to:
1. Apply the taxonomic systems used to classify plants into their major divisions.
2. Use ICBN rules in collecting and preserving plant specimens as well as naming plants.
3. Evaluate evidences given to support plant evolution.
4. Classify plants into their particular taxons
5. Construct floral diagrams, floral formulae and half flower diagram
6. Construct and use artificial keys to identify local plant species and collect, identify, prepare and preserve specimens for a herbarium

Course Contents
1. **Aim and the role of plant taxonomy**: taxonomic characters, taxonomic hierarchy and species concepts
2. Introduction to botanical nomenclature – ICBN
4. A survey of the main nonvascular and vascular plant divisions, adaptation and life cycles
5. Half flower diagram, floral formula and floral diagram
6. Collection, identification, preparation and preservation of herbarium specimens.

Teaching and Learning Methodologies
Lectures, seminars, practicals and fieldwork

Instructional Materials and Equipment
Chalkboard, compound microscopes, hand lens, plant presses, blotters, plant drier.

Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course textbooks

Books and journals for further reading

**BIO 204: Introduction to Genetics and Molecular Biology** 3 Credits

Prerequisite courses: BIO 102

Goal
To equip the learner with the knowledge of the exact nature of genetic materials, their origin and how they are passed from one generation to another so as to understand their usefulness application and benefits to mankind.

Learning Outcomes
At the end of the study the student will be able to:
1. Explain Mendelian”s laws of inheritance and various terminologies employed in gene interactions.
2. Describe the mechanism of gene mutations, types of mutations and chromosomal abnormalities.
3. Describe the cell division processes that ensure gene recombination and variation and the mechanism of cancer and tumour induction.
4. Analyse the experimental proofs of the DNA as the genetic material and DNA models.
5. Describe the mechanism of DNA replication, DNA replication and the nature of the genetic code.
6. Explain the various applications of genetics especially in human social and economic activities.
7. Describe the process of recombinant DNA technology biosafety regulation.

Course Contents
3. Mitosis and meiosis as mechanisms to ensure genetic continuity and variation and molecular basis cancer and tumour production.
4. Molecular basis of life; Experimental proof of the existence of DNA and RNA as genetic materials. Nucleic Acids Structure and functions (DNA and RNA). Watson and Crick model of DNA.
5. DNA Replication; transcription and translation processes – Enzymes and proteins involved in replication and the genetic code. DNA repair. Nature and relationships between genes, proteins and phenotype.
6. Application of genetics in; agriculture and food production, health, politics, law, human genetics and counselling.

Teaching and Learning Methodologies
Lectures, seminars and practical classes

Instructional Materials and Equipment
Chalkboard, OHP, computers, CDs, internet sites, laboratory apparatuses and chemicals.

Course Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course Books

Books and Journals for Further Reading

BIO 301: Synecology and Environmental Management 3 Credits
Prerequisite course(s): BIO 104, BIO 203
Goal
To enable students to acquire knowledge on the flows of energy and matter between the components of living communities and between biotic and abiotic components of ecosystems and apply the knowledge thus gained to institute environmental conservation practices.

Learning outcomes
At the end of the course students shall be able to:
1. Describe the nature of the community in an ecosystem and the processes that shape these communities.
2. Explain the setting of ecosystems and climatic factors that influence the availability of nutrients in an ecosystem.
3. Describe different types of biome and their nature.
4. Identify different ways through which the biological system can be conserved and restored.
5. Evaluate different ways through which the ecosystem has been polluted and the dangers posed by environmental exploitation.

Course contents
1. Definition and nature of Communities. Community characteristics: similarity and dissimilarity of community stands; dynamic and distributional relations of species populations; classification of communities. Community structure: biological structure; vertical structure; growth forms; life forms; seasonality and Processes that shape communities.
2. Definition and nature of Ecosystems. The biotic and abiotic components: Producers, consumers and decomposers. Primary and Secondary Production: influence of climate, nutrient availability and time on ecosystem productivity.
3. Biomes: tropical rain forest biome; temperate evergreen forest biome; temperate deciduous forest biome; grasslands and savannah biome; Tundra and Taiga biome; Chaparral biome; Desert biome; lakes and ponds biome; freshwater wetlands biome; streams and rivers biome; Oceans biome; intertidal and coral reefs biome; Estuaries, salt marshes and mangrove forests biome
5. Threats to Biodiversity: Environmental pollution - global environmental change, ozone layer depletion, acid rain formation, heavy metals and chlorinated hydrocarbon discharges; the Gaia hypothesis; habitat loss; introduced species and species overexploitation. Landscape and Regional Conservation. Ecosystem restoration: bioremediation and biological augmentation.

Teaching and Learning Methodologies
Lectures, seminars, fieldwork and laboratory practical work.

Instructional materials and Equipment
Chalkboard, Overhead Projector and/or beamer, Laboratory and field apparatuses and chemicals

Assessment
20% Practical
20% Written assignments
60% Final examination
Course Textbooks

Books and journals for Further reading

**BIO 302: Animal Physiology 3 Credits**

**Prerequisite course(s):** BIO 101, BIO 102

**Goal**
To acquaint students with the knowledge of maintenance systems and its associated diseases in animals

**Course Objectives**
At the end of this course the student will be able to:
1. Describe the basic anatomical and physiology of different animals
2. Explain factors involved in homeostatic processes and how feedback control loops maintain the internal environment in animals.
3. Analyze the contribution of the various organs of the body to the overall physiology of the mammalian body.
4. Identify the main causes of physiological and functional disorders in humans, the possible treatment, and prevention especially of those causing problems in Tanzania.
5. Carry out a range of practical work, including experiments, to illustrate how animals and the human body carry out vital life functions, and how they are affected by environmental variables.

**Course Contents**
1. Organisation of the animal body systems.
3. Outline of the most important maintenance systems: Integration and coordination, Senses and sense organs –sensory receptors, internal and external, chemical, vision, hearing, proprioceptors and skin senses. Role of endocrine system in coordination. Links between nervous and endocrine system. Muscular tissue, cardiovascular system, Respiratory system, Digestive system, Excretory system, Reproductive system.
4. Common disorders and diseases related to human maintenance systems.
5. Different practicals related to animals and human physiology.

**Teaching and Learning Methodologies**
Lectures, practicals and seminars

**Instructional Materials and Equipment**
Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course Textbooks

Books and journals for further reading

BIO 303: Mechanisms of Evolution and Diversity of Life 3 Credits
Prerequisite course(s): BIO 104, BIO 203, BIO 301

Goal
To enable students to acquire knowledge on the possible origin of species and the possible mechanisms by which they may have evolved into the present day diversity of species and the theories that have been formulated to account for the changes in the species that dominated the earth over its geological history.

Learning outcomes
At the end of the course students shall be able to:
1. Explain the meaning of evolution and the natural processes that bring about evolutionary changes.
2. Describe how mutation contribute to variations and evolutionary changes..
3. Elaborate on the effect of land masses on the evolutionary changes.
4. Explain the effect of climatic changes on the distribution of species.
5. Account for biodiversity and evolution.

Course contents
1. Definition of Evolution. Theory of evolution and evidence for evolution: Types of evolution (allopatric and sympatric evolution; co-evolution; fitness. Natural selection as the process that brings about evolutionary changes.
2. Mutation, recombination and chromosomal abnormalities as sources of genetic variation within populations which is the raw material upon which natural selection operates to bring about evolutionary changes in populations.
4. Effect of climate change on the evolution and distribution of species globally.
5. Island patterns of evolution.
6. Evolution and Biodiversity

Teaching and Learning Methodologies
Lectures, seminars, fieldwork and laboratory practical work.
Instructional materials and Equipment
Chalkboard, Overhead Projector and/or beamer, online student access kit, computers and internet access

Course assessment methods
20% Practical
20% Written assignments
60% Final examination

Course Textbooks

Books and journal for further reading

BIO 304: Plant Physiology and Structure 3 Credits
Prerequisite courses: BIO 102, BIO 203

Goal
To introduce the learner to the structure and physiological processes in plants.

Learning outcomes
At the end of this course the student will be able to:
1. Relate plant structure to functions.
2. Describe the main stages of plant growth, development and response to the external environment.
3. Describe resource acquisition and transport in vascular plants
4. Demonstrate that photosynthesis is an energy fixation process and show plant nutritional adaptations in relation to soil and other organisms.
5. Analyze reproductive adaptations in plants – alternation of generation, dormancy, seed dispersal
6. Differentiate C3 and C4 plants
7. Prepare anatomical and cytological material for microscopic study and interpretation.

Course contents
1. Cell types, and plant tissues
2. Growth and development in plants: Primary and secondary growth of roots and stem; morphogenesis and differentiation; plant hormones, signal reception, transduction and response in plants
3. Transport and modes of transport systems found in plants
4. Nutrition in plant: macro and micronutrients; plant nutritional adaptation; photosynthesis and photosynthetic pigments, light reaction photosynthesis, cyclic and non-cyclic phosphorilation, dark reaction photosynthesis and the Calvin cycle.
5. Reproduction and life cycles in plants – alternation of generation, germination, dormancy, seed dispersal
6. Significance and differences between C3 and C4 plants
7. Preparation of temporal plant slides to study cell and tissue features.

Teaching and Learning Methodologies
Lectures, seminars, practical work

Instructional Materials and Equipment
Chalkboard, OHP, computers and INTERNET access, digital projector, online student access kit (Pearson, Mastering Biology)

Assessment methods
20% Practical
20% Written assignments
60% Final examination

Course Textbooks

Books and journals for Further reading

CHEMISTRY COURSE CONTENT

CHE 101: Basic Analytical Chemistry
Prerequisite Course: None

Goal
To introduce the learner with a strong background in chemical analytical skills for the application in the other field of science and chemistry

Learning outcomes
At the end of the course the student will be able to:
1. Identify and distinguish the different branches and principles of analytical chemistry
2. Use statistical method in solving different analytical problems in a higher degree of accuracy and precision
3. Develop practical analytical skills for carrying out chemical analysis
4. Apply the principle of analysis by using volumetric and gravimetric techniques in chemistry and other fields of science
5. Explain the principles of chromatographic techniques and their applications
6. Develop skills in presenting, interpretation, synthesize and evaluating analytical data correctly
7. Develop skills in computation and processing of the analytical data
8. Appreciate the role of chemical analysis in protection of environmental resources.

**Course Contents**
1. Introduction to branches of analytical chemistry quantitative and qualitative, principles of analytical chemistry
2. Statistical treatment of data, sampling technique, error analysis, accuracy, precision, reliability and presentation of data
3. Data analysis, elimination test, t-tests, f-test, regression and correlation analysis
4. Introduction to volumetric analysis (acid-base titration, complexometric titration, redox titration and precipitation titration) and gravimetric analysis
5. Introduction to separation techniques: solvent extraction liquid separations chromatography techniques, paper chromatography, thin layer chromatography.
6. In the practical classes, student will present, interpret and evaluate analytical data obtained during the exercises from the above analytical techniques

**Teaching methodologies**
Lectures, tutorials and practicals

**Instructional materials and equipments**
Chalkboard, power point, laboratory apparatus, reagents and chemicals

**Assessment methods**
Practical reports, assignments, continuous assessment tests and end of semester examination

**Assessment scheme**
20% Practical work
20% Tests and Written assignments
60% Final examination

**Books and journals for the course**
2. Analytical Chemistry
3. Analytica Chimica Acta

**Books and journals for further reading**
4. Journal of American Chemical Society
5. International Journal of Environmental Analytical Chemistry
CHE 102: Physical Chemistry I

Prerequisite Courses: None Goal

To equip the student with fundamental principles of Physical chemistry and their application

Learning Outcomes
At the end of this course students will be able to:
1. Identify the characteristics of states of matter and the theories governing them
2. Apply the knowledge of gas laws to explain the behaviour of ideal and real gases
3. Apply mole concept in calculating reactants and products in solutions
4. Describe principles of chemical equilibrium in relation to chemical reactions, driving forces in reactions, Le Chatelier’s principles
5. Demonstrate effects of intra and intermolecular attractive forces on the physical properties of fluids and solids.
6. Apply the knowledge on gas laws to explain the behaviour of ideal and real gases

Course Contents
1. Characteristic states of matter (solids, liquids, gases and plasma)
2. Gas laws: Gay-Lussaacc’s, equation of state, ideal gas equations, Dalton’s laws Real gases, deviation from ideal behaviour, gas densities and determination of molecular weights, diffusion of gases-Graham’s law of diffusion, heat capacity and the kinetic theory of gases (C_v and C_p for monoatomic gases and polyatomic molecules)
3. The mole concept, calculations involving amount of products and reactants, reaction in aqueous solutions and preparations of molar solutions
4. Solubility and solubility product including Raoults” law and Henry’s laws, pH concept, theory of acid-base indicator and buffer solutions
5. Intra and Intermolecular forces, mole concepts, calculations involving amount of reactants and products
6. A review on the nature of atoms, ions and molecules, mass relationship-stoichiometry (atomic and formula masses)

Teaching methodologies
Lectures, tutorials, practicals and class practice

Instructional materials and equipments
Chalkboard, power point, laboratory apparatus, reagents and chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Tests and written assignments
20% Practicals assignments
60% Final examination

Books and journals for the course
2. Journal of Physical Chemistry B
3. Journal of Physical Chemistry C
Books and journals for further reading

CHE 103: Systematic Inorganic Chemistry
Prerequisite course: None

Goal
To equip the learner with various fundamental principles, theories, concepts and structures of atoms and shapes of molecules in inorganic chemistry

Learning outcomes
At the end of this course students will be able to:
1. Explain fundamental chemical principles and basic concepts of inorganic chemistry
2. Describe various fundamental theories, models and general properties of elements in inorganic chemistry
3. Describe the Hydrogen atom, solution of Schrödinger equation, and the polyatomic atom
4. Analyse different bonding models in inorganic chemistry and the structure and reactivity of molecules
5. Demonstrate the ionic compounds, ionic bond energy and lattice energy, size effects and covalent characteristics of predominantly ionic bonds
6. Describe theories for valency bond, atomic orbitals and molecular orbitals for simple molecules and ions.

Course Contents
1. Early theories of atomic structure: Thompson, Rutherford, Bohr, Bohr atom and the hydrogen spectrum, Hydrogen atom, Schrödinger equation
2. The dual nature of matter, photoelectric effect, Compton effect, de-Broglie wave and general properties of elements: atomic size, electronegativity, electron affinity and ionization energy
3. Quantum numbers and qualitative treatment of atomic orbitals (s, p, d and f), the Aufbau principle and Paul principle
4. Basic principles of chemical bonds: covalent, ionic and metallic, Co-ordinate bond, hydrogen bond and van der Walls forces.
5. Born Haber cycle and calculations based on it
6. Valence bond and molecular orbital theories for simple molecules and ions
7. Hybridization of atomic orbitals and shapes of simple molecules and ions, resonance structure of common ions, definitions and concepts of acids, Arrhenius, Bronsted-Lowry, Lewis acids and bases.
8. Practicals on acids and bases

Teaching methodologies
Lectures, tutorials, practicals and class practice
Instructional materials and equipments
Chalkboard, power point, laboratory apparatus and chemicals

Assessment methods
Practical reports, assignments, continuous assessment, tests and end of semester examination

Assessment scheme
20% Tests and written assignment
20% Practical work
60% Final examination

Books and journals for the course
3. European Journal of Inorganic Chemistry

Books and journals for further reading

CHE 104: Basic Organic Chemistry
Prerequisite courses: None

Goal
To equip the student with fundamental principles and theories of Organic Chemistry so that they may use the knowledge to tackle problems related to the field in day to day lives in a scientific approach.

Learning outcomes
At the end of this course the student will be able to:
1. Describe the general principles of organic chemistry
2. Classify organic compounds basing on the functional groups
3. Name the organic compounds by applying the IUPAC system
4. Demonstrate the movement of electrons by using curved arrows in reaction mechanism
5. Compose correctly chemical reactions to fulfil the carbon valence.
6. Explain the chemistry of benzene and its derivatives
7. Appreciate the role of organic chemistry in everyday life

Course contents
2. Introduction to atomic structure and bonding, hybridization of carbon atom (sp3, sp2, sp hybrid bonds)
3. Electronic structures of atoms
4. Study on simple organic functional group chemistry: Alkanes, Alkenes, Alkynes, alkyl halides, alcohols, ethers, thiols, sulfides, glycols
6. Chemistry of benzene and its derivatives. Aromaticity, Hückel’s rule
7. The derivatives include Allylic, Benzylic aryl halides, ninylic halides, phenols, aldehydes, ketones, carboxylic acids, enols, enolate ions and amines

Teaching methodologies
Lectures, tutorials, practicals and class practice

Instructional materials and equipment
Chalkboard, power point, laboratory apparatus and chemicals

Assessment methods
Practical reports, assignments, continuous assessment, tests and end of semester examination

Assessment scheme
20% Tests and written assignment
20% Practical work
60% Final examination

Books and journals for the course
4. Indian Journal of Organic Chemistry Section B

Books and journals for further reading
5. Organic Process Research and Development

CHE 201: Descriptive chemistry of transitional metals
Prerequisite course: CHE 103

Goal
To equip the student with basic knowledge of transition elements and their compounds
Learning outcomes
At the end of this course student will be able to:
1. Describe the general physical and chemical behaviour of transitional elements.
2. Account for the descriptive chemistries of d and f- block elements with respects to trends in differences and similarities
3. Examine the mineralogy and metallurgy of transition groups
4. Assess the stability of oxidation state of transitional elements
5. Summarise the uses of transitional elements and their compounds
6. Describe important catalytic processes

Course Contents
1. Introduction to transition elements-position in the periodic table, classification of the transition element
2. Transition metals, general properties, electronic configuration, oxidation states, ionization energy, standard reduction potentials, 3d, 4d and 5d transition metals
3. Minerology, and metallurgy and general properties of various transition groups
4. Stability of various oxidation states across the period and down the group as illustrated by halides and oxides
5. Practical uses of transition elements and compounds
6. Selected catalytically important processes

Teaching Methodologies
Lectures, demonstrations, tutorials, practicals

Instructional materials and equipment
Chalkboard, power point, class practice and tutorials

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Tests and written assignment
20% Practical work
60% Final examination

Books and journals for the course
Journal of inorganic and organometallic Organometallics

Books for further reading
Catalysis Transition metals

CHE 202: Chemical Thermodynamics
Prerequisite course: CHE 102
Goal
To equip the learner with thermodynamic principles and mathematical techniques for problem solving in physical chemistry

Learning outcomes
At the end of this course the student will be able to:
1. Describe introductory concepts in chemical thermodynamics and properties that characterize solid, liquids and vapour phases.
2. Portray various statements of the laws of thermodynamics and factors to various processes with their applications (1st, 2nd and 3rd)
3. Explain concepts of thermodynamic system as well as properties used to describe them
4. Classify thermodynamic processes in various systems and conditions (state the concept of entropy and apply it to the analysis of open and closed thermodynamic systems)
5. Explain the concepts of energy change in the various processes and systems of thermodynamic (thermodynamic equilibrium balance for a closed system and the mechanisms for transferring work and heat into or out of thermodynamic systems)
6. Calculate mass and energy balance for a volume under steady state and transient conditions
7. Describe pure substances and mixtures of phases in thermodynamic equilibrium
8. Use the concept of second law in machines (carnot engine) and in calculating carnot efficiency of thermodynamic cycles, compressors, pumps etc

Course Contents
1. Definitions of introductory concepts in chemical thermodynamics such as thermodynamics, system, state functions etc.
2. Properties of solid, liquids and vapour phases (volume, shapes, densities and conductivity/transfer of temperature, heat, electricity etc)
3. First law of thermodynamics, pressure-volume work (PV-work), isothermal and adiabatic expansions, control volume energy analysis
4. Irreversible and reversible processes for isothermal and adiabatic expansions
5. Three forms of energy (enthalpy/heat, workdone and internal energy), pressure and heat capacities
6. Second law of thermodynamics and second law of entropies of substances, Carnot cycle and its application, definition of standard reaction entropy, entropy concept in terms of Boltzman’s formula and energy transfer
7. Combining the First Law and the second law, Maxwell relations, applications and determination of entropy and deviations of Clausius inequalities
8. Definition of Helmholts and Gibbs functions including Gibbs-Helmholtz, Clausius-Clayperon and Gibbs-Duheim
9. Chemical equilibrium and its factors, equilibrium constants (Kp and Kc), reaction quotients, Vant-hoff’s equation (equilibrium involving ideal gases ), equilibrium, phase equillibrim and phase diagrams.
10. The third law of Thermodynamics and third law of entropies of substances, and the consequences of thermodynamic principles
11. Practicals on heat change, effect of temperature in reactions, potentiometric determination of equilibrium constants, dissociation constant and kinetics of reactions

Teaching methodologies
Lectures, tutorials, practicals and class practice

Instructional materials and equipments
Chalkboard, power point, laboratory apparatus and chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Tests and written assignments
20% Practical work
60% Final examination

Books and journals for the course
Journal of physical chemistry A
Langmuir

Books and journals for further reading
Journal of physical chemistry B
Journal of physical chemistry C

CHE 203: Physical Chemistry II
Prerequisite courses: None

Goal
To equip the student with the knowledge of thermo energy in relation to phases of matter

Learning Outcomes
At the end of this course the student will be able to:
1. Derive phase rule and identify its constituents (variances, components and degrees of freedoms) in various phases” systems.
2. Demonstrate effects of intermolecular attractive forces on the physical properties of liquids and solids
3. Describe basic properties of solutions based on the intermolecular forces between the solution components
4. Perform calculations based on enthalpy, thermo chemistry and Hess” law
5. Explain the concept of temperature dependence of the reaction rates, perform rates” law calculations and derive integrated kinetic equation. Apply kinetic studies to account for the mechanism of enzymatic reactions
6. Explain the principles of spontaneity and relationship between the entropy, enthalpy and free energy
7. Explore various types and properties of chemical equilibrium, perform all calculations and problem solving of equilibrium systems, control rates of chemical reactions and effect in equilibrium to enhance reaction products

Course contents
1. Phase rule equation, variances, components and degree of freedom to various phases’ systems.
2. Types of intermolecular forces and behaviours of liquids and solids to form phase diagrams
3. Colligative properties of electrolyte and non electrolyte solutions (vapour pressure solutions)
4. Review on the first law of thermodynamics, characteristics of a function of state, enthalpy, thermochemistry and Hess’s law, heat capacity, Kirchhoff’s equations, ideal gas calculations, isothermal and adiabatic changes
5. Chemical Kinetics, reaction rates, rate laws, reaction mechanisms activation energies and catalysis.
6. A brief introduction to the second law of thermodynamics, Gibb’s free energy and equilibrium
7. Chemical equilibrium conditions and concepts, calculations and problem solving, Le Chatelier’s principle
8. Practicals on different topics covered – electrolytic conductivity, partial molal enthalpy, phase diagram for binary alloy etc.

**Teaching methodologies**
Lectures, tutorials, practicals and class practice

**Instructional materials and equipments**
Chalkboard, power point, laboratory apparatus and chemicals

**Assessment methods**
Practical reports, assignments, continuous assessment tests and end of semester examination

**Assessment scheme**
20% Tests and written assignment
20% Practical assignments
60% Final examination

**Books and journals for the course**
Journal of physical chemistry A
Journal of physical chemistry B

**Books and journals for further reading**
Physical Chemistry C
Journal of Physical Letters

**CHE 204:** Descriptive chemistry of inorganic chemistry of s and p blocks elements

**Prerequisite courses:** CHE 103
Goal
To give an overview of trends and properties of S and P block elements

Learning outcomes
At the end of this course student will be able to:
1. Demonstrate the chemical periodicity, reaction behaviour and structural interrelationships within the frame work of a systematic treatment of the main group elements.
2. Describe types, production and uses of hydrogen and hydrides
3. Evaluate specific properties of some elements including three-centre bonding in Beryllium compounds, triple bond in the nitrogen molecules and major compounds of phosphorus

Course Contents
1. A survey of the representative elements; atomic size and group anomalies, abundance and preparation
2. The group one elements; hydrogen and its compounds – hydrides of group IA, IIA, IIIA, IV A, VA, VIA and hydrogen halides.
3. Systematic presentation of the representative elements S and P block (Group IIA to VIIA); physical and chemical properties, preparation and reactions of the elements and the importance of the various characteristic compounds.
4. Practical session will include introduction to basic preparative and characterization techniques in inorganic chemistry.

Teaching methodologies
Lectures, power point, practical classes, tutorial

Instructional materials and equipments
Chalk board, white board, Laboratory apparatus and chemicals.

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Tests and written assignment
20% Practical work
60% Final examination

Books and journals for the Course
Inorganic Chemistry
Inorganica Chimica Acta
European Journal of Inorganic Chemistry

Books and journals for further reading
ELBS with Oxford University Press.
Dalton Trans.
Polyhedron

CHE 301: Coordination chemistry and organometallic compounds
Prerequisite courses: CHE 103 and CHE 204

Goal
To equip the learner with principles of co-ordination chemistry

Learning outcomes
At the end of this course student will be able to:
1. Define terms used in coordination chemistry and name coordination compounds according to IUPAC rules
2. Illustrate localized electron model, crystal field model, and the molecular Orbital model in explaining specific properties of complex compounds
3. Explain the function and structure of some biologically important coordination complexes
4. Differentiate S, P, and D block organometallic compounds
5. Demonstrate major aspects, synthetic pathways and chemical reactions of organometallic compounds.
6. Describe principles of the 18-electron rule, catalytic cycles and their application
7. Analyze properties and methods of handling the organometallic compounds

Course Contents
1. Principles of modern coordination compounds: definitions, rules for naming coordination compounds, ligands, coordination number and isomerism in complex compounds
2. Structural-Optical activity relationship: localized electron model to explain metal ion ligand interaction.
3. Crystal field model, tetrahedral, octahedral complexes and spectro chemical series
4. Molecular orbital model overlap and relative orbital energies, electron spectrum and Nephelauxetic effect
5. Biological importance of co-ordination complexes
6. An overview of structure, bonding, synthesis and reactions of organometallic compounds, of S, P block metals
7. Electron counting and the 18-electron rule
8. Introduction to d-block organometallic, carbonyl complexes synthesis, structure, properties and reactions
9. The ligand types, alkyl, alkanilide (arsine) alkylidyne (carbene), alkyl, dienes, cyclopentadienyl, cyclohexadiene and cyclohexatriene and their complexes
10. Catalytic cycle: oxidative-additional, reductive-elimination , insertion, β -hydrogen element and CO- insertion
11. Practicals on preparation and properties of coordination compound

Teaching Methodologies
Lectures, practicals, tutorials
Instructional materials and equipment
Chalkboard, powerpoint, laboratory apparatus and chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Tests and written assignments
20% Practical assignments
60% Final examination

Books and journals for the Course

Books and journals for further reading
European Journal of inorganic chemistry
Dalton Trans.

CHE 302: Electrochemistry
Prerequisite courses: CHE 101, CHE 102 and CHE 203

Goal
To equip the learner with the basic principles in electrochemistry and their applications in the modern world.

Learning Outcomes
At the end of this course the student will be able to:

1. Define the important terminologies used in electrochemistry
2. Explain the theory of electrochemical processes and the concept of activity, ionic strength and activity coefficient.
3. Describe electrochemical reactions, characteristics, principles and procedures used in electrochemical analysis and their mechanisms.
4. Explain properties of electrodes, description of the electrochemical behaviour and understand the different electrochemical reactions.
5. Apply principles of thermodynamics to electrochemistry
6. Carry out major procedures in analytical electrochemistry and the kinetics of electrochemical reactions and mechanisms
7. Evaluate, interpret and derive electrochemical information and data.

Course Contents

1. Introduction to electrochemistry: electrode, electrolytes, oxidation-reduction reactions.
2. Electrochemical cells: Daniel cell, standards cells, E.M.F of a cell and its measurement
4. Single electrode potentials; the Nernst equation, calculation of electrode potential. Electrochemical series, applications of electrochemical series.
5. Overvoltage: Hydrogen and oxygen overvoltage, determination of hydrogen overvoltage and application of overvoltage.
6. Concentrated cells: types, concentrated cells without transference, with transference. Liquid junction potential. Fuel cells and thermodynamics of cell reactions
9. Chemistry of metal corrosion and passivity of metals.
10. Polarography: the dropping mercury electrode, limiting diffusion current, residual current, half-wave potential and Illkovic equation.
11. Practical’s will be on potentiometric, redox titration, diffusion and electrolysis

Teaching Methodologies
Lectures, class practice, tutorials

Instructional materials and equipment
Chalkboard, power point, laboratory apparatus and chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Tests and written assignments
20% Practical assignments
60% Final examination

Books and journals for the Course
Electro-catalysis
Journal of Applied electrochemistry Ionics

Books and journals for further reading
Journal of solid state electrochemistry
Journal of electro-ceramic

CHE 303: Instrumental Methods of Analysis
Prerequisite courses: CHE 101
Goal
To equip the student with an understanding and skill of the analytical instruments used in chemical analysis.

Learning outcomes
At the end of this course the student will be able to:-
1. Define terminologies used in spectroscopy and identify the relation of the radiation with the instrumental method.
2. Describe the function of an instrument and illustrate the different components of the instrument.
3. Explain the theoretical principles of the various instruments used in chemical analysis.
4. Interpret and analyze the analytical data generated by the instrument to elucidate the structure of organic compounds.
5. Appreciate the use of instrumental methods in other fields of science for the qualitative and quantitative analysis of materials.

Course Contents
1. Introduction to spectroscopic methods; Electromagnetic radiations, introduction to absorption spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy.
2. Instrumental methods: components of instruments function of an instrument, steps for signal generation and calibration of instrument.
3. Basic theory and instrumentation of Infra-red spectroscopy, UV spectroscopy and NMR spectroscopy with their applications.
4. Mass spectrometry; the mass spectrometer, mass spectra, identification of pure compounds by mass spectrometry, quantitative application of mass spectroscopy
5. Structure elucidation using VIS-UV, IR, NMR and MS spectrum of simple organic compounds.
6. Potentiometric methods; reference electrode, metallic indicator electrodes, membrane indicator electrodes, direct potentiometric measurements, potentiometric titration.
NB. Practicals will include use of instrumental method for both quantitative and qualitative analysis.

Teaching Methodologies
Lectures, demonstrations, tutorial and class practice

Instructional materials and equipment
Chalkboard, power point, advanced measuring instruments.

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Practical assignment
20% Tests and written assignment
60% Final examination

Books and journal for the course
Journal of American chemical society
Analytical chemistry
Analytica chimica Acta

**Books and journals for further reading**
Indian journal of analytical chemistry

**CHE 304: Advanced Organic Chemistry**

**Prerequisite courses:** CHE 104

**Goal**
To introduce to the student the knowledge on shapes, basic principles, nomenclature, stereogenic elements and spectroscopic characterization of organic compounds

**Learning outcomes**
At the end of the course the student will be able to:
1. Describe the concepts of stereochemistry.
2. Distinguish between structural isomers and stereoisomers using the building models
3. Differentiate the chiral and achiral molecules
4. Assign (R) – and (S)- descriptions to stereogenic centers in chiral molecules
5. Identify different organic functional groups by using the organic spectroscopy (IR and NMR spectroscopy)

**Course Contents**
1. Stereochemistry and chemical reactions
2. Stereo isomerism
3. Fischer Projectios (R) / (S) notation and Cohn- Ingold- Prelog priority rules
4. Spectroscopy characterization of organic functional groups (IR and NMR)

**Teaching methodologies**
Lectures, tutorials and self study

**Instructional materials and equipments**
Chalk board, OHP, Stick and ball models

**Assessment methods**
Practical reports, assignments, continuous assessment tests and end of semester examination

**Assessment scheme**
20% Tests and written assignments
20% Practicals
60% Final examination

Text Books and journals for the course
Journal of Organic Chemistry
European Journal of Organic Chemistry
Indian Journal of Organic Chemistry Section B

Books and journals for further reading
Journal of Asian Natural Products Research
Organic Letters
Organic Process Research and Development

Required Models

CHE 305: Introduction to Polymer Chemistry
Prerequisite courses: CHE 122 and CHE 212

Goal
To equip the student with insights in polymers and their importance in daily life

Learning outcomes
At the end of this course the student will be able to:-
1. Explain terminologies, nomenclature and classification of polymers
2. Distinguish polymers from other lesser molecules (oligomers, dimers and monomers)
3. Describe chemistry involved in synthesis kinetics, analysis and importance of polymers
4. Demonstrate the knowledge and understanding of essential facts, concepts and principles related to polymer chemistry
5. Investigate sources (extraction, purification and processing) of naturally occurring polymers such as rubber.
6. Work in polymer industry.

Course Contents
1. Study of polymer: definition, classification, structure/morphology, nomenclature, stereochemistry, interaction, conditions and states of polymerization and linkages
3. Step reaction polymerisation general reactions, monomer reactivity, repetitive units, citing examples of polymers (polyalkenes, polystyrenes, polyamides, polyesters, polypeptides, polysaccharides), polymerization processes: Additions and condensation techniques
4. Study of requirements and conditions for polymerization example free radicals, chain reaction sequence, steady state kinetics, copolymerization
5. Practicals on simple diene condensations and chain additions, ionic and coordination polymerization.

Teaching Methodologies
Lectures, visit to plastic industry or guest speaker, tutorials and class practice

Instructional materials and equipment
Chalkboard, power point, Video, chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Written assignments
20% Practical work
60% Final examination

Books and journals for the course

Books and journals for further reading

CHE 306: Environmental Chemistry
Prerequisite courses: None

Goal
To equip the student with a basic understanding of the environmental chemistry in relation to environmental issues

Learning outcomes
At the end of this course the student will be able to:
1. Explain the basic principles of environmental chemistry
2. Describe the composition of atmosphere and biogeochemical cycles
3. Evaluate the impact of environmental pollution on our environment
4. Analyze chemical reactions in the atmosphere and their effects on the environment.
5. Appreciate the need for sustainable development of natural resources and take part in pollution reduction in the environment.

Course contents
1. Composition of atmosphere, vertical temperature and bi-geochemical cycles C, N, P, S of the earth atmospheric system
3. Hydrosphere chemistry of water pollution, inorganic minerals such as As, Cd, Be, B, Cr, Cu, F, Pb, Mn, Hg, Mo, Se, and Zn. Sedments, Radioactive substances, Heat, Oil, Detergents, pesticides, agricultural, industrial sewage, oil spills. Water quality parameters, dissolved oxygen, biochemical oxygen demands: water treatment
4. Atmosphere:
   Chemical composition of the atmosphere particles, ions, and radicals and their Major gaseous pollutants, oxides of N, C, S, and their effects.
   Ozone depletion CO and CFC in relation to global warming.
5. Disasters. Bhopal gas tragedy, minamata disaster and mexco oil spill and their impacts.
6. Waste disposed material and environmental regulation and management.

Teaching methodologies
Lectures, demonstrations, field work and class practice

Instructional materials and equipment
Chalkboard, power point, chemicals, pristine and polluted environment

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% fieldwork
20% Tests and written and assignment
60% final examination

Books and journals for the course
Toxicological and Environmental Chemistry
International Journal of Environmental Analytical Chemistry

Books and journal for further readings
Journal of Environmental Chemistry

CHE 307: Natural Products
Prerequisite courses: CHE 104, CHE 201, CHE 302 and CHE 304
Goal
To equip the student with basic understanding of the existence, extraction, analysis and uses of some natural products and their chemistry

Learning outcomes
At the end of this course the student will be able to:-
1. Name or make a list of some natural products and their structures
2. Explain natural sources synthesized drugs
3. Design a way of extracting and purifying natural products based on the structure
4. Investigate the types of natural products present in locally available flora and fauna

Course Contents
1. Introduction to natural products and their structures (eg polyketides, alkaloids, shikimates, tannins, lignins, terpenoids, steroids, prostaglandins, prostacyclins, thromboxanes, vitamins, cholesterol, Hb etc)
   - Study of synthesized drugs like paracetamol, Tylenol, tetracycline, quinine, chloroquine, liquid of magnesium and commonly used drugs for medicine
   - Study of some toxins like pesticides, fungakites, dyes
   - Compare their structures with those of natural products
2. Acid-base (PH- bases) medium of extraction for natural products and appropriate solvents used (eg CH₂Cl₂, CHCl₃, , ∨ , ^ , alcohols, acrotone, hexanes etc)
3. Study of enzymes, coenzymes, protein, and other natural products and analyse them using IR, NMR, mass spectrometry, x-ray defractometry

Teaching Methodologies
Lectures, demonstrations and experiments

Instructional materials and equipment
Chalkboard, OHP, locally available raw materials, laboratory apparatus and chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Practical work
20% Tests and written assignment
60% Final examination

Books and journals for the course
Journal of Asian Natural Products Research
Organic Letters
Organic Process Research and Development

Books and journals for further reading

CHE 308: Chemistry of Heterocyclic Compounds
Prerequisite courses: CHE 104 and CHE 302
Goal
To introduce the student to the knowledge on the structure, properties, reactions and the applications of heterocyclic compounds.

Learning outcomes
At the end of the course the student will be able to:
1. Describe the structure, properties and reactions of pyroles, furans, thiophenes, pyrines and their condensed rings such as azoles, quinolines, isoquinolines, carbazoles, acridines, diazines purines and pyrazines.
2. Describe the structure and properties of three, four, five and six member rings
3. Heterocyclics such as hemipyrrole, furfural, 2-furoic acid, beta – lactams, pyrones and pyrylium salts
4. Classify the heterocyclic compounds.
5. Identify the importance of the heterocyclic compounds in pharmaceutical and industrial uses

Course contents
1. Survey of structure and properties of pyroles, furans, thiophenes and pyrines
2. Nomenclature, synthesis and properties of three, four, five and six member ring
3. Heterocyclics
4. A study on the condensed furans, pyroles thiophenes such as azoles, quinolines, isoquinolines, carbazoles, acridines, diazines, purines and pyrazines
5. Different classification methods of heterocyclic compounds
6. Importance of heterocyclic compounds in the pharmaceutical and commercial purposes
7. Practicals related to some of the topics.

Teaching methodologies
Lectures, class practice, demonstrations and experiments

Instructional materials and equipment
Chalkboard, Power Point, laboratory equipment and chemicals

Assessment methods
Practical reports, assignments, continuous assessment tests and end of semester examination

Assessment scheme
20% Practicals
20% Tests and written assignment
60% Examination

Books and journals for the course
Journal of Organic Chemistry
European Journal of Organic Chemistry
Indian Journal of Organic Chemistry Section B

Books and journal for further reading
PHYSICS COURSE CONTENT

PHY 101: Mechanics 3 credits
Prerequisite courses: None

Goal
- To equip students with knowledge of physics laws mathematically describing the motion of bodies geometrically distributed within certain boundaries and the action of a system of forces

Learning Outcomes
At the end of this course the student will be able to:
- Differentiate between scalar and vector quantities and apply vectors in solving problems of mechanics
- Solve practical problems using Newton’s and conservation laws
- Describe and quantify the motion of planets
- Explain how pseudo-forces arise and reconciled in classical mechanics
- Explain the motion of rigid bodies as an extension of single particle motion

Course Contents
1. Units and Measurement: Units and standards of physical quantities, SI units, Standards of time, length and mass, Dimensions of physical quantities
2. Linear Motions: Kinematics of particles, Average velocity, Instantaneous velocity, Motion under Acceleration, Free fall bodies
3. Vectors: scalar & vector, Vector algebra and applications,
4. Two and three dimensional Motion: position vector, Velocity and acceleration of a particle, Uniform circular motion, Relative motion
6. Single particle dynamics: Force of friction, dynamics of a particle moving in a circle, motion under non-constant force, motion of a projectile in a resistive medium
7. Work, Energy and power, Impulse and linear momentum: Work, work and kinetic energy, conservative and non conservative forces, power, Impulse and momentum
8. Rotational dynamics: Kinematics of rotation, kinetic energy of rotation, moment of inertia and torque, calculating moment of inertia, angular moments, combined rotational and translational motion
9. Mechanics of fluids: pressure and density in fluids, variation of pressure with depth, Pascal’s principle and Archimedes principle, fluid flow, streamlines and continuity equation
11. Motion in a non-inertial reference frame, Systems of Particles, Coordinate rotation and matrices
12. Rigid bodies
Teaching Methodologies
Lectures, tutorials, presentations, discussions and practical,

Instructional Materials and Equipment
Chalkboard, OHP, handouts, audio tapes, laboratory equipment, internet and library searches

Assessment scheme
Practical assignments 20%
Written tests & Assignments 20%
Final examination 60%

Text books and journals for this Course
Physics Review A. General Physics, American physical society

Text books and Journals for Further Reading

PHY 102: Electromagnetism 3 credits

Prerequisite courses: None

Goal
- To equip students with knowledge of electromagnetic phenomena in terms of few relatively simple laws

Learning Outcomes
At the end of this course the student will be able to:
- Analyse the concept and structure of the electric field
- Explain Gauss”s law and its application
- Calculate the electric potential, potential difference and the electrostatic potential of a system of point charges
- Discuss the concept of electrostatic energy and the effect of a dielectric on the capacitor
- State Ohm”s law and discuss the concept of electric current, current density and passive components
- Analyze various d.c circuits using Kirchhoff”s laws
• Calculate the magnetic force on a current element and on a moving charge and discuss the Hall effect
• State Biot-Savat law and Ampere’s law and discuss its use and limitation
• Describe Faraday’s law and Lenz’s law and discuss
• Describe electromagnetic induction and its applications
• Explain the interaction of electromagnetic waves and non-conducting materials

Course Contents
1. Electric field; electric field strength $\mathbf{E}$, line of force, calculation of $\mathbf{E}$, A point charge in an Electric field, A dipole in an Electric field
2. Gauss” law: Flux of Electric field, Gauss’s law and coulomb’s law, An insulated conductors, Charge and field at conductor surfaces, Application of Gauss’s law
3. Electric potential: potential and field strength, potential due to a point charge, A group of point charge, potential due to a dipole, Electric potential energy, Calculation of $\mathbf{E}$ from potential difference $V$, An insulated conductor
4. Capacitors, Dielectrics and Electrostatic energy: capacitance, calculating capacitance, Parallel plate capacitor, A cylindrical capacitor, A spherical capacitor, An isolated sphere, Combination of Capacitors, Capacitors with dielectrics, Electrostatic energy stored in a capacitor
5. Current and Resistance: Current and current density, Resistance and Ohm’s law, Combination of Resistors, Energy in electric circuits, Conduction in Liquids and Gases
6. Passive components such as resistors, colour coding, types, standard values, and capacitor
7. Direct Current circuits: Electromotive force, Kirchhoff’s laws and application, Multi loop circuits, Charging & discharging a capacitor in RC circuits
8. Magnetic field: Definition of B, Magnetic force on a current, Torque on a current loop, The Hall effect, Circulating charges,
11. Electromagnetic waves: Transmission line, Coaxial cable – fields and currents, Waveguide, Radiation, Travelling waves and Maxwell’s equation

Teaching Methodologies
Lectures, tutorials, presentations, discussions and practical

Instructional Materials and Equipment
Chalkboard, OHP, handouts, audio tapes, laboratory equipment, internet access and library searches

Assessment scheme
Practical assignments 20%
Written tests & Assignments 20%
Final examination 60%

Text books and Journals for this Course

**Text books and Journals for Further Reading**

**PHY 103: Vibrations and Waves**

**Prerequisite courses:** None

**Goal**
To develop a clear understanding of basic concepts of oscillations and waves in both mechanical and electrical systems.

**Learning outcomes**
At the end of this course the student will be able to:
- Differentiate between oscillations and waves
- Solve the physical problems for free, forced, damped and coupled oscillations using Newton’s laws
- Analyse differences between particle, phase and group velocities of the waves
- Describe the applications of Doppler Effect in human life.
- Derive Fresnel’s equations for oblique incidence of electromagnetic waves at the boundary
- Explain interference patterns in thin films due to multiple reflections
- Outline uses of ultrasound waves and technology in animals and human lives.
- Describe the structure and functioning of human ear in perception of sound waves.

**Course Contents**
1. The concepts of oscillations and waves
2. Simple and damped harmonic motion, coupled oscillations
3. Transverse waves and longitudinal waves, the wave equation and its solutions, Phase velocity and group velocity
4. Doppler effect, superposition, standing and travelling waves, energy, reflection and transmission of waves at boundaries
5. Reflection and transmission of electromagnetic waves at boundary: normal incidence, oblique incidence and the Fresnel's equations for dielectrics.
6. Multiple reflections in thin films
   - Characteristics of the sound waves, Ultrasonic sounds and applications
Hearing and ear structure and hearing damage.

Teaching Methods
Lectures, tutorials, class discussions, and practical

Instructional Materials and Equipment
Chalkboard, OHP, beamers, handouts, laboratory equipment, internet and library searches

Assessment scheme
Practical assignments 20%
Written tests 20%
Final examination 60%

Text books and Journals for this course

Text books and Journals for Further Reading

PHY 104: Optics 3 credits
Prerequisite courses: None

Goal

- To equip students with knowledge of basic laws of light and their applications in optical instruments

Learning outcomes
At the end of the course the student will be able to:

- List and identify sources and detectors of light in local environment
- Describe how fibre optical devices make use of total internal reflection to visually inspect internal sites of a human body.
- Describe the use of lenses in correcting defects of vision and optical aberrations
- Analyse the images formed by mirrors, lenses, and optical instruments.
- Associate the nature and characteristics of light waves and other electromagnetic waves.
- Explain patterns produced by both interference and diffraction of light waves.
- Explain the significance of interferometer in accurate measurement of lengths
- Point out the principles involved in holographic recording of an image.
- Explain the theory of laser operation
- Appreciate the uses of laser technology in human life.

Course Contents

1. Light sources and detectors
2. Reflection and refraction of light: Snell's law, total internal reflection, Fermat’s principle
3. Spherical mirrors and refracting surfaces, lenses, and aberrations
4. Geometrical optical instruments and human eye
5. Electromagnetic waves: Propagation and dispersion,
6. Superposition; Polarization: by reflection, double refraction, and scattering; Interference: Young's double slits, Newton's rings.
7. Diffraction: Optical gratings, dispersion and resolving power.
8. Fresnel and Fraunhofer types of diffraction
9. Michelson and Fabry-Perot interferometers,
10. Holography
11. Absorption and dispersion of light by matter.

Teaching Methods
Lectures, tutorials, class discussions, and practical

Instructional materials and equipment
Chalkboard, OHP, handouts, beamers, practical equipment, internet and library searches

Assessment scheme
Practical assignments  20%
Written tests  20%
Final examination  60%

**Text books and Journals for this course**

**Text books and Journals for Further Reading**

**PHY 201: Thermodynamics**  
3 credits

**Prerequisite courses:** None

**Goal**
- To equip students with fundamentals of thermodynamics and their applications in a variety of physical situations

**Learning Outcomes**
At the end of this course the student will be able to:
- Differentiate between specific and latent heat capacities
- Apply the ideal gas laws to solve for the unknown pressure, temperature, or volume;
- Explain basic modes of heat transfer; conduction, convection and radiation, and their application to simple situations
- Derive kinetic theory of ideal gas and deduce Avogadro’s hypothesis from it
- Define thermodynamic systems and their states, and explain how thermal processes affect the systems
- Explain the relationship among internal energy, heat, and work as expressed by the first law of thermodynamics
- Describe the thermodynamic processes, cyclic, reversible, non-reversible, adiabatic, isentropic, throttling, polytropic processes etc.
• State and apply the second law of thermodynamics
• Explain the concept of heat engine and compute thermal efficiency, and explain the concept of a thermal pump and compute coefficient of performance
• Explain how the Carnot cycle applies to heat engines, compute the ideal Carnot efficiency, and state the third law of thermodynamics
• Explain the significance of statistical thermodynamics

Course Contents
1. Heat capacity, specific heat capacity, latent heat
2. Gas laws: Boyle’s law, Dalton’s law, Charles law
3. Heat transfer: conduction, radiation, convention
4. Kinetic theory of ideal gas
5. Specification of state of a system, Equation of state, principle of equal a priori probabilities, reversibility and irreversibility, density of states
6. Thermal interaction between macroscopic systems, the Zeroth’s law
7. First law of thermodynamics: internal energy, heat supply, and work done
8. Thermodynamic processes (isothermal, adiabatic, isovolumetric, and isobaric); work done, heat flow, and change in internal energy in the processes
10. Heat engines; thermal pumps, and thermal efficiency
11. Carnot’s ideal heat engine, Third law of thermodynamics
12. Applications of statistical thermodynamics to a variety of physical phenomena

Teaching methodologies
Lectures, tutorials, presentations and discussions

Instructional materials and equipment
Chalkboard, OHP, handouts, audio tapes, internet and library searches

Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Text books and Journals for this course

Text books and Journals for Further Reading

**PHY 202: Analogue Electronics**  
**3 credits**

**Prerequisite courses:** None

**Goal**
- To equip students with knowledge and skills which will enable them to understand, analyze and design the basic analogue electronic circuits

**Learning Outcomes**
At the end of this course the student will be able to:
- Describe the passive electronics components
- Explain and use the laws and rules of d.c. electric circuits
- Build simple electronic circuits containing analogue components
- Describe the basic types of passive filters and design low and high pass filters
- Differentiate the energy bands in solids and describe the Fermi levels in semiconductors
- Explain different types of semiconductors and how these types are used to fabricate semiconductor devices
- Explain the characteristic curves of a diode, BJT transistors, and FET transistors and their applications as amplifiers and switches
- Read and recognize analogue circuit diagrams and explain the functions of various building blocks used
- Explain the functions of different photoelectric devices
- Describe the fabrication techniques for the Integrated circuits
- Describe the principles of operations of active filters and operational amplifier oscillators
- Explain the basics of analogue communication systems such as Radio and TV systems

**Course contents**
1. Passive electronics components: inductors, switches, relay.
2. Electric circuit laws: Ohms law, Kirchhoff’s Current Law (KCL), Kirchhoff’s Voltage Law (KVL), Thevenin, Norton, Superposition, reciprocity, compensation, maximum power transfer and Miller theorems
5. Semiconductor theory: Bond model, n-type and p-type doping, intrinsic and extrinsic, p-n Junction diode
6. Bipolar Junction Transistor: pnp & npn types, transfer characteristics, operating point stabilization
7. Field effect transistor: JFET, channel depletion, MOSFET, n-channel enhancement and depletion, transfer characteristics
8. Photo-electric devices: photodiode, phototransistors, high gain light detectors, solar cells, light emitting diode (LED)
9. Integrated circuits: fabrication technology, operational amplifiers characteristics, inverting and non-inverting
10. Active filters: Butterworth, Bessel and Tschebyscheff low-pass, high-pass
11. Oscillators: theory, types, Hatley, Colpitt, crystal and RC oscillators
12. Analogue communication systems: Radio waves, Transmitting Aerials(Antenna), Receiving Aerials, Modulation (AM &FM), Colour TV (transmission & receiver)

Teaching methodologies
Lectures, tutorials, presentations, practical, discussions

Instructional materials and equipment
Chalkboard, OHP, handouts, audio tapes, practical equipments, internet and library searches

Assessment scheme
Practical assignments 20%
Written tests & Assignments 20%
Final examination 60%

Text books and Journals for the course

Text books and Journals for Further Reading

PHY 203: Quantum Mechanics 3 credits
Prerequisite courses: PHY 101, PHY 102

Goal
- To equip students with the theory of atomic and nuclear systems developed out of classical physics due to its inadequacy in describing atomic systems.
Learning Outcomes
At the end of this course the student will be able to:

- Explain the failures of classical physics and the origin of the quantum theory
- Explain emission spectra of the hydrogen atom using Bohr's theory
- Explain the concept of matter waves and calculate the de Broglie wavelength of particles
- Interpret the wave-particle duality of matter
- State and apply the Uncertainty principle
- Describe the time –independent Schrödinger equation to standard potential
- Interpret and apply the wave function to simple quantum mechanical systems
- Explain the quantization of angular momentum

Course Contents
1. Origins of quantum theory: Blackbody radiation, Photoelectric effect, Compton effect
2. The Bohr’s theory of Hydrogen atom, de” Broglie Waves and Wave-particle duality and Uncertainty Principle.
3. Fundamental quantum mechanics: Wave mechanics, Wave packets, Uncertainty relations, Probability interpretation, Schrödinger equation
4. Applications of quantum mechanics to simple systems: Particle in a box, Barrier penetration, Tunnel effect, Bound states, Harmonic oscillator
5. Angular momentum: Angular momentum operator, The eigen-values of the angular momentum,
6. Perturbation theory

Teaching Methodologies
Lectures, tutorials, presentations, discussions

Instructional materials and equipment
Chalkboard, OHP, handouts, audio tapes, internet and library searches

Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for this course

Textbooks and Journals for Further Reading

PHY 204: Digital Electronics 3 credits
Prerequisite courses: PHY 202
Goal
- To equip the students with the fundamental concepts of digital electronic circuits and their applications in digital communication systems

Learning Outcomes
At the end of this course the student will be able to:
- Differentiate the number systems used in digital electronics
- Perform the arithmetic operation using different number systems
- Discuss different codes used in digital systems
- Predict the behaviour of circuits containing logical gates, such as NOT, AND, NAND, OR, XOR etc.
- Describe the Boolean laws, theorems and postulates and apply them in solving different Boolean expressions.
- Use the karnaugh method in simplifying Boolean expression
- Explain the functionality of different combinational logic circuits
- Explain the principle operation of sequential logic circuits
- Build simple digital electronic circuits containing digital components
- Read digital electronic circuits, recognize and explain the function of the various building blocks used
- Describe the basic functions of digital computers
- Discuss the technology used in digital communication

Course Contents
1. Number systems: binary, decimal, octal, hexadecimal and base conversion
2. Binary arithmetic: addition, subtraction, signed and complemented binary numbers, multiplication and division
3. Codes: hexadecimal, binary-coded-decimal, gray and ASCII codes, and parity.
4. Logic gates: NOT, AND, OR, NAND, NOR, XOR, XNOR
5. Boolean Algebra: constants and variables, algebraic representation of logic circuits, truth tables, Boolean expressions, postulates and theorems, DeMorgan’s Theorems, logic circuits and Boolean expressions, universality of NAND and NOR gates
6. Karnaugh Maps: minterms and maxterms, simplification using Boolean expression, and Karnaugh maps
7. Combinational logic circuits: properties, multiplexers, de-multiplexers, half and full adders, encoders and decoders
8. Sequential logic circuits: latches, flip-flops, D, RS, JK, T flip flops, counters and registers
9. Sequential logic circuits design procedure
10. Pulse circuits: Multivibrators, timers and clock generating circuits
11. PC Elements: arithmetic circuits, Random Access Memory (RAM), Read Only Memory (ROM), Microprocessors, inputs and outputs elements
12. Digital communication: Communication revolution, pulse code modulation, Representing text, compressing digital data, Digital bandwidth, Digital communication system, Introduction to optical fibre systems.

Teaching Methodologies
Lectures, tutorials, presentations, practical and discussions

Instructional Materials and Equipment
Assessment

Practical assessments 20%
Written tests & Assignment 20%
Final examination 60%

Text books and Journals for this course

Text books and Journals for Further Reading

PHY 301: Atomic Physics 3 credits
Prerequisite courses: PHY 101, PHY 102, PHY 104, PHY 201

Goal
- To equip students with skills to formulate theoretical modelling of atomic structure and use them to interpret experimental observations

Learning Outcomes
At the end of this course the student will be able to:
- Describe the Rutherford model of the atom
- Explain emission spectra of the hydrogen atom using Bohr's theory
- Determine three quantum numbers of hydrogen like atoms from solution of the Schrödinger’s equation 3 dimension
- Derive the quantization of angular momentum magnitude from the wave function \( \psi \)
- Calculate the electron probability density
- Explain the Zeeman effect as the valid confirmation of space quantization
- Evaluate the states of multi-electron atoms in terms of the four quantum numbers
- Relate the periodic table to the electronic structure of atoms using the Pauli”s Exclusion Principle
- Describe the Stern – Gerlach experiment
- Explain the Hund”s rule
- Explain the origins of the three different types of fine structure
- Explain the basic mechanisms for production of X-rays, laser light, and fluorescent and phosphorescent light

Course Contents
1. Rutherford model, Bohr theory of Hydrogen atom
2. Quantum mechanical description of one-electron atoms: Schrödinger”s equation for the hydrogen atom, separation of variables, Quantization of energy, quantized orbital angular momentum, Electron probability densities, Allowed transitions, and associated magnetic dipole moments, and Zeeman Effect
3. Many-electron atoms: identical half-integer spin particles, The Pauli”s exclusion principle, Periodic Table, Total angular Momentum, Optical and X-ray spectra
4. Stern-Gerlach experiment and the electron spin, Spin-spin interaction and Hund’s rules, Spin-orbital interaction and fine structure

Teaching Methodologies
Lectures, tutorials, presentations and discussions

Instructional Materials and Equipment
Chalkboard, OHP, handouts, audio tapes, internet and library searches

Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Text books and Journals for this course

Text books and Journals for Further Reading
New Delhi S.Chand and Company

PHY 302: Geophysics 3 credits
Prerequisite courses: None

Goal
- To equips students with knowledge and skills on the structure and composition of the solid earth, the atmosphere and the oceans; and the relationship between them.

Learning Outcomes
At the end of this course the student will be able to:
- Explain using different models how the universe evolved
- Discuss and account for the structure, composition, and temperature distribution of different layers of earth’s atmosphere.
- Discuss the significance of ozone layer in the atmosphere; the causes of greenhouse effect and its impact to global warming and climate change.
- Explain the structure and processes in the earth’s interior and oceans
- Account for the occurrence and mechanism of earthquakes and volcanoes; their detection, measurements and precautions.
- Explain the origin and behaviour of the earth’s magnetic field
- Define and describe the measurements of angle of declination and angle of dip, and their applications.

**Course Contents**

1. Brief review of the evolution of the universe
2. The earth’s atmosphere: structure, composition and temperature distribution
3. The ozone layer, greenhouse effect, global warming and climate change
4. The oceans, movements, tides and waves
5. The solid earth: evolution, structure, composition and temperature distribution
6. Volcanoes: origin, types and consequences
7. Earthquakes: origin, types, and magnitude, the Richter scale, consequences and precautions
8. Seismic waves: Secondary, Primary and Longitudinal (S, P, and L) waves, properties, detection and measurement, Prediction of earthquakes
9. The earth’s magnetic field: existence, origin and position, effect of the Allen- Belt atmospheric current, short and long term variations
10. Measurement: components, angle of dip and declination, applications

**Teaching Methods**

Lectures, tutorials, presentations and discussions

**Instructional materials and equipment**

Chalkboard, OHP, handouts, beamers, internet and library searches

**Assessment scheme**

- Written assignments 20%
- Written tests 20%
- Final examination 60%

**Text books and Journals for this course**


**Text books and Journals for Further Reading**


PHY 303: Nuclear Physics  
Prerequisite courses: PHY 301

Goal
- To equip the students with theoretical basis for understanding the structure of nuclei and their constituents.

Learning Outcomes
At the end of this course the student will be able to:
- Correlate the binding energy per nucleon and the nuclear stability
- Calculate the Q-values of endothermic and exothermic nuclear reactions
- Explain the theoretical basis for and applicability of the predominant nuclear models
- Analyze the radioactive decay processes, both natural and induced
- Evaluate the role of nuclear reactors in converting nuclear energy to other useful forms of energy
- Describe the properties of plasma and elementary particles
- Explain the application of nuclear physics, their limitations and their possible extensions

Course Contents
1. Nuclear structure and properties: atomic masses, binding energy, and nuclear stability
2. Nuclear reactions: Cross-sections, the Q-value, and reaction mechanisms
3. Nuclear models: Strong interaction between nucleons, liquid drop model and applications to fission and isobaric transformations, Shell model and prediction of selected nuclear properties
4. Natural radioactivity: decay chains, radioactive equilibrium and Bateman equations, Conservation laws for radioactive decay and nuclear particle energies and artificial radioactivity
5. Nuclear energy: Breeder reactors, fusion and fission as energy sources, the atomic bomb, the hydrogen bomb
6. Introduction to plasma physics and elementary particle physics

Teaching Methodologies
Lectures, tutorials, presentations and discussions

Instructional Materials and Equipment
Chalkboard, OHP, handouts, audio tapes, internet and library searches

Assessment scheme
Written assignments 20%
Written tests 20%
Final examination 60%

**Text books and Journals for this course**

**Text books and Journals for Further Reading**
Ghoshal S.N *Nuclear physics.* New Delhi: S. Chand & Company.
Sponner N., *Nuclear Physics, Lecture notes* [http://www.shef.ac.uk/physics/teaching/phy303/](http://www.shef.ac.uk/physics/teaching/phy303/)

**PHY 304: Energy and Environment** 3 credits
**Prerequisite courses:** PHY 302, PHY 201

**Goal**
- To equip students with knowledge and skills about the current world energy supplies and consumption, and the related environmental problems

**Learning Outcomes**
At the end of this course the student will be able to:
- List down a number of world and local energy resources
- Describe the world’s fossil fuel resources, their depletion, and the environmental impact of their use
- Explain the usefulness and possible risks of nuclear energy
- Analyse renewable energy resources with emphasis on their strengths and weaknesses for practical energy supply, and environment conservation.
- Discuss the availability and limitations of ocean wave as the energy resource
- Evaluate the uses of Biomass as the renewable energy resource

**Course contents**
1. Energy Resources and World Energy Use: Analysis of current world energy supplies and Tanzania energy consumption, Trends in energy consumption, Fossil fuel reserves and related environmental problems
2. Nuclear Energy: Energy release by fission of uranium and plutonium, advantages and disadvantages of nuclear fission for power production, operation of a nuclear fission reactor, Nuclear waste and radiation hazards

3. Renewable Energy Resources: The sun as the earth’s major source of renewable energy, solar radiation, active and passive solar heating, solar thermal electric power generation, photovoltaic conversion of solar to electrical energy, wind energy and available wind power, practical wind turbines and wind farms, hydroelectric power generation and pumped storage schemes, advantages of hydropower and environmental costs of large dams

4. Ocean wave energy: Wave energy availability and limitations, devices for extraction of wave energy, tidal energy, tidal barrages and tidal streams, limitations of wind, wave and tidal power

5. Biomass as a renewable energy source: Importance of energy storage for transport and electricity supply, Hydrogen as a secondary fuel

**Teaching Methodologies**
Lectures, tutorials, presentations, discussions, guest speaker, field trips

**Instructional materials and equipment**
Chalkboard, OHP, handouts, beamers, internet and library searches

**Assessment scheme**
Written assignments  20%
Written tests 20%
Final examination 60%

**Text books and Journals for this course**

**Text books and Journals for Further Reading**
MATHEMATICS COURSE CONTENT

MTH 101: Foundations of Analysis 3 credits
Prerequisite courses: None

Goal
To equip the student with the basic mathematical ideas in the area of analysis and its application in the formal study of the central foundations of Mathematics.

Learning Outcomes
At the end of the course the student will be able to:
1) Carry out operations involving sets and to apply set theories to solve Mathematical problems involving sets
2) Apply different number systems and work with them
3) Determine logical equivalences and valid arguments by applying truth tables and the algebra of propositions
4) Use and distinguish between the various methods of proof including mathematical induction
5) Apply concepts of limits, continuity and uniform continuity

Course Contents
1) Sets, Relations, Functions and Groups: sets, subsets, set operations, Venn diagrams, Algebra of sets, Relations, Equivalent Relations and Partition, Functions and Groups
3) Logic: propositions, logical connectives (negation, conjunction, disjunction, conditional, biconditional, parentheses), truth tables, tautologies, contradictions, logical equivalences, algebra of propositions, validity of arguments, quantifiers
4) Proofs: mathematical statements, methods of proof, mathematical induction

Teaching Methodologies
Lectures, seminars, Individual, partner and small group works

Instructional Materials and Equipment
Chalkboard, coloured chalks, OHP power point, screen, worksheets, charts

Assessment
Assignments, tests, group work, presentations

Assessment scheme
1) Assignments 20%
2) Timed tests 20%
3) End of course examination 60%
Textbooks and Journals for the course

Textbooks and Journals for further reading

MTH 102: Calculus 1 3 credits
Pre-requisite course: None

Goal
To equip the learner with skills and knowledge to solve problems related to differentiation of functions and its applications.

Learning Outcomes
At the end of this course the student will be able to:
1. Differentiate simple expressions from first principle
2. Differentiate polynomials, trigonometric, exponential, logarithmic and composite functions.
3. Perform implicit differentiation
4. Apply differentiation knowledge to solve various life problems like those related to maximum and minimum values, rates of change in velocity and acceleration, estimation of errors and comprehensive graphing.

Course contents
1. Derivatives
   - Slope of a curve and the derivative of a function
   - Differentiation from first principle
   - Second derivative of a function
   - The mean value and the extreme value theorems.
2. Differentiation of various functions
   - Differentiation formulae
   - Differentiation of trigonometric and composite functions
   - Implicit differentiation
   - Higher derivatives
3. Application of the derivatives
   - Maxima and minima problems
   - Rates of change
   - Estimations of errors
   - Comprehensive graphing
4. Definite Integrals
   - Fundamental theorem of calculus
   - The computational of areas as limits
   - The area under the curves

Teaching methodologies
Lectures, Group discussion, presentations and independent study.

**Instructional materials and equipments**
Chalkboard, Overhead projectors, computers, Calculators, worksheets.

**Assessment methods**
Assignments, tests, group work, presentations

**Assessment scheme**
Presentations – 20%
Written tests – 20%
End of semester examination – 60%

**Textbooks for the course**

**Textbooks and Journal for further readings**

**MTH 103: Linear Algebra**

3 credits

**Prerequisite courses:** None

**Goal**
To equip the student with the skill to solve real-life problems using the knowledge of linear systems, vector spaces and linear transformation.

**Learning Outcomes**
At the end of this course the student will be able to:
1. Solve systems of linear equations using various methods
2. Evaluate determinants
3. Apply linear transformations
4. Use eigenvectors and eigenvalues to determine whether a given matrix is diagonalizable
5. Explain the concept of vector spaces and their properties

**Course Contents**
1. **Systems of linear equations**: homogeneous and non-homogeneous systems, matrix form, solution by row reduction (Gauss and Gauss-Jordan elimination methods) and their applications
2. **Matrices**: definitions, properties of matrix operations, special types, elementary row operations, reduction to row echelon forms, computation of the inverse matrix by elementary row operations, rank of matrix

3. **Determinants**: definition, evaluating of determinants by row and column, properties, finding the inverse of a matrix by using the determinant, Cramer’s rule

4. **Linear transformations and Eigenvectors and Eigenvalues**: definitions and properties, Kernel and Range, linear transformations from R to R, matrices of linear transformations, similarity, characteristic equation, diagonalization, eigenvectors and linear transformations, complex eigenvalues.

5. **Vector spaces and Orthogonality**: definition and examples, Subspaces, Linear Independence, Basis and Dimension, Change of Basis, Row Space and Column Space, the scalar Product in Rn, Orthogonal Subspaces, Inner Product Space, Least Squares Problems, Othonomal Sets, The Gram-Schmidt Orthogonalisation process

**Teaching Methodologies**

Lectures, seminars, individual and small group work

**Instructional materials and equipment**

Chalkboard, coloured chalks, OHP, screen, worksheets

**Assessment**

Assignments, tests, group work, presentations

**Assessment scheme**

Written assignments 20%
Written tests 20%
Final examination 60%

**Textbooks for the course**


**Textbooks and Journal for further reading**


**MTH 104: Calculus II**

**3 credits**

**Pre requisite course**: MTH 102

**Goal**

To equip the learner with the knowledge of calculus, sequence and its application in solving real – life problems.

**Learning outcomes**

At the end of this course the student will be able to:
1. Explain different techniques that can be used to integrate transcendental functions
2. Integrate various functions by direct substitution, by parts, by trigonometric substitution, by partial fraction, or by mixed bag strategy
3. Apply definite integrals to solve real life / physical problems; example, problems related to volumes of revolution, arc lengths, surface of revolutions, mass and centre mass.
4. Evaluate improper integrals
5. Exhibit comprehension of sequence and series.

Course contents
1. Integration
   - Anti –derivates and Indefinite integration
   - Integration by substitution change of variables
   - Area ,Riemann Sums and the Definite integrals
   - The Fundamental Theorem of Calculus
   - Improper integrals
2. Further techniques of Integration
   - Review of elementary Integration formulae and techniques
   - Integration by parts
   - Integration by Trigonometric substitution
   - Integration by Partial fraction decomposition
   - Integration of Inverse functions ( Exponential, logarithmic ,and trigonometric functions)
   - Mixed bag strategy ( Strategy for dealing with integrals of Miscellaneous types )
3. Application of the Definite Integral
   - Volumes of revolution (Disc /washer method and Shell methods )
   - Arc lengths and Surface of revolution
   - Mass and Centre of mass problems
   - Area of a region between two curves(point of Intersection and Sketch)
4. Sequences and Series
   - Infinite sequences and series
   - Convergence and Divergence of series
   - Maclaurin’s and Taylor series
   - Differentiation and Integration of power series
   - Applications of Taylor polynomials and Taylor series.

Teaching Methodologies
Lectures, Seminar presentations, Independent studies and group tasks.

Assessment methods
Assignments, tests, group work, presentations

Assessment scheme
Seminar presentations 20%
Tests 20%
End of semester examination 60%

Instructional materials and equipment
Worksheets , chalkboard ,Mathematical packages eg Autograph ,Overhead projectors, computers, Calculators, worksheets.

Textbooks for the course

Textbooks and Journal for further readings

MTH 201: Vectors and Vector Mechanics 3 Credits

Goal
To deepen knowledge of polar coordinates, conic sections and vectors in space and their applications

Learning outcomes
At the end of the course the student will be able to:
1. Demonstrate knowledge of polar coordinates and conic sections
2. Use dot products, scalar products and scalar triple products to solve problems using vectors in R³
3. Develop the ability to derive some solvable Mathematical formulation of Physical problems in Mechanics
4. Define Newton’s and Kepkler laws of motion
5. Use these laws in problems of particle motion

Course Contents
1. Polar coordinates: areas of regions using polar coordinates, tangent lines to curves, lengths of curves
2. Conic sections: parabolas, ellipses, hyperbolas, rotation of axis, polar equations of conic sections
3. Vectors in R² and R³: geometric vectors, vectors in coordinates systems, dot and cross product of vectors, lines and planes in R³, scalar triple product
4. Vector mechanics: vector differentiation, velocity and acceleration of objects in space, motion in a straight line, relative motion, projectile motion on non-inclined plane, Newton and Keppler’s laws of motion, power, energy, momentum
5. Applications of vectors in kinematics and mechanics

Teaching Methodologies
Lectures, seminars, presentations, Individual, partner and small group work

Instructional Materials and Equipment
Chalkboard, coloured chalks, OHP, screen, models, computer, worksheets

Assessment methods
Assignments, tests, group work, presentations

Assessment scheme
• Assignments (20%)
• Timed tests (20%)
• End of course examination (60%)
Textbooks for the course

Books for further reading
   Dar es Salaam University Press.

Other resources
Web-sites and CD ROMs
Autographs

MTH 202: Ordinary Differential Equations 3 credits
Prerequisite courses: MTH 102, MTH 104

Goal
To engage the student in logical and critical thinking as well as to acquire a proficiency in the topics covered in the ordinary differential equations.

Learning Outcomes
At the end of this course the student will be able to:
1. Use separation of variables to solve differential equations
2. Solve first order differential equations with constant coefficients
3. Apply methods of solving first order differential equations in physical problems
4. Demonstrate skills in using numerical methods to solve first order and initial value problems
5. Apply the Laplace transform in working with differential equations
6. Translate written languages into mathematical statements, interpret information, analyze given information and formulate appropriate mathematical statements.
7. Identify methods for finding particular solutions to PDEs that are needed in physical applications.
8. Show how the right choice of initial and boundary conditions can give a particular solution to a PDE.

Course Contents
1. First Order Ordinary Differential Equations: definition and classification of differential equations, order, degree, linearity, solution of first order ordinary differential equations, separation of variable, homogenous equations, exact equations, Bernoulli equation, applications (Examples include; physical process, Chemical process like radioactive process and Biological process), application to Eigen Values.
2. **Second and higher order linear ordinary differential equations**: Real roots, Complex roots, existence and uniqueness theorem, method of undetermined coefficient, variation of parameters, Cauchy-Euler equations, applications, linear constant coefficient differentials of order $n$, Difference Equations, Linear independence and the Wronskian method of order reduction

3. **Numerical methods**: for first order initial-value problems


5. **First Order Partial Differential Equations**: Characteristic/auxiliary equations, Boundary conditions and Formation of PDE, Non-linear first order PDEs, Separation of Variables


8. **Boundary Value Problems**: solution by Fourier Series, Solution by Bessel/Legendary functions

**Teaching Methodologies**
Lectures, seminars, individual and small group work

**Instructional materials and equipment**
Chalkboard, coloured chalks, OHP, screen, worksheets

**Assessment methods**
Assignments, tests, group work, presentations

**Assessment scheme**
Written assignments 20%
Written tests 20%
Final examination 60%

**Textbooks for the course**

**MTH 203: Probability and Statistics**
**Prerequisite courses**: None

**Goal**
To equip the student with knowledge and skills of basic probability theory and elementary statistics

**Learning Outcomes**
At the end of the course the student will be able to:
1. State and use probability laws to solve probability problems
2. Use binomial, poisson and normal distribution to calculate probabilities
3. Apply binomial approximation to normal and poisson distributions
4. Estimate the population parameters
5. Describe significance testing
6. Apply Chi – squared in testing goodness of fit
7. Use regression and correlation to perform statistical analysis

**Course Contents**
1. **Probability:** Probability laws, permutation and combination, Bayes’ theorem, finite probability spaces, finite stochastic process.
2. **Probability distributions:** Probability distribution function, discrete and continuous random variables, expectation, variance and standard deviation, binomial distribution, recurrence formula, Poisson distribution, rectangular distribution, normal distribution, normal approximation to binomial and poisson distribution, sums and differences of random variables, distribution of sample mean and sample proportion.
3. **Estimation of population parameters:** point estimator, consistent estimator, pooled estimators, confidence intervals, t – distribution, F – distribution
4. **Significance testing:** null and alternative hypothesis, critical regions, critical values one tailed and two – tailed tests, testing the mean, testing the proportion.
5. **Chi – squared test:** Chi – squared distribution, goodness of fit tests
6. **Regression and correlation:** scatter diagrams, regression function, least square regression lines.

**Teaching Methodologies**
Lectures, seminars, individual, partner and small group work.

**Instructional materials and Equipments**
Chalkboard, colored chalks, OHP, Calculators, Computer

**Assessment methods**
Assignments, tests, group work, presentations

**Assessment scheme**

1) Assignments 20%
2) Timed tests 20%
3) Final examination 60%

**Textbooks for the Course**
Books for further readings

**MTH 204: Calculus III (Functions of several variables) 3 Credits**

Prerequisite course: MTH 201

**Goal**
To equip the student with basic concepts, techniques and applications of differential and integral calculus of several variables.

**Learning outcomes**
At the end of the course the student will be able to:
1. Demonstrate understanding of functions of several variables
2. Demonstrate understanding of space coordinates, their interpretation and related graphs
3. Apply differential and integral calculus to various functions
4. Apply Green’s, Stoke’s and Gauss theorems to evaluate surface integrals

**Course Contents and Methods**
1. Functions of several variables: definition, functions of two variables and level curves, functions of three variables and level surfaces and quadratic surfaces, cylindrical and spherical coordinates in \( \mathbb{R}^3 \)
2. Differential calculus of several variables: differentiation of functions of several variables, partial derivatives, directional derivatives and gradients, tangent planes and normals, extrema, Lagrange multipliers
3. Integral calculus of several variables: double and triple integrals, center of mass, moments of inertia / rotation about a fixed axis, surface area, application of triple integrals
4. Vector integral calculus: line integrals and physical applications, surface and volume integrals, Green’s Theorem
5. Integral theorems: the Gauss divergence and Stoke’s theorems, change of variables in multiple integrals, applications of integral transformations

**Teaching Methodologies**
Lectures, seminars, Individual, partner and small group work

**Instructional Materials and Equipment**
Chalkboard, coloured chalks, OHP, screen, autographs, worksheets

**Assessment methods**
Assignments, tests, group work, presentations

**Assessment scheme**
1. Assignments 20%
2. Timed tests 20%
3. End of course examination 60%

**Textbooks for the course**

**Books for further reading**

**MTH 301: Mathematical Statistics**

**3 credits**

**Prerequisite courses:** MTH 203

**Goal**
To equip the student with knowledge and skills of more theories in statistics.

**Learning Outcomes**
At the end of the course the student will be able to:
1. Describe discrete and continuous data
2. Construct frequency distribution
3. Calculate measures of central tendency and measures of dispersion
4. Use freehand or graphical method in computing time analysis
5. Calculate measurements of cyclical and irregular variations
6. Perform an Analysis of Variance
7. Describe experimental designs

**Course Contents**
1. **Descriptive Statistics:** Discrete and continuous data, frequency distribution, histograms, general rules for forming frequency distribution, types of frequency curves, measures of central tendency (mean, median, mode, weighted mean geometric mean, harmonic mean, root mean square), measures of dispersion (range, variance standard deviation by coding, Sheppard’s correction method for variance, charlier’s check), quartiles, deciles, percentiles of grouped and ungrouped data, moments, skewness and kurtosis.
2. **Analysis of time series:** utility of time series, freehand or graphical method, semi average method, least squared method, measurement of cyclical variation (residual method), measurement of irregular method in calculation of correlation in time series.
3. **Analysis of Variance (ANOVA):** techniques of ANOVA, total variation, ANOVA by coding, one way and two way classification ANOVA.
4. **Experimental design:** introduction, complete randomization, randomized block, Latin square.

**Teaching Methodologies**
Lectures, seminars, individual, partner and small group work.

**Instructional materials and Equipments**
Chalkboard, colored chalks, OHP, Calculators, Computer

**Assessment**
Assignments, tests, group work, presentations

**Assessment scheme**

1) Assignments  20%
2) Timed tests  20%
3) Final examination  60%

**Textbooks for the Course**


**Books for further reading**


**MTH 302: Linear Programming**

**Goal**
To equip the student with the knowledge of linear programming models and its application in solving real life problems such as agriculture and economics

**Learning outcomes**
At the end of this course the student will be able to:
1. Deepen understanding of linear programming and to study the simplex algorithm
2. Introduce the student to mathematical modeling in linear programming and the concept of systems
3. Introduce the student to a compute system and the use of linear programming packages
4. Study in detail various techniques and algorithms for solving problems and reaching optimality
5. Write and/or use computer programmes to implement these techniques
6. Study the concept of shadow prices, marginal analysis and sensitivity analysis
7. Interpret and solve transport and assignment problems

Course Contents
1. Introduction and graphical method: background, history of linear programming, problem formulation for linear programming
2. Graphical representation and solution of linear programming problem
3. Simplex method: introduction, standard linear programming form, the simplex algorithm
4. Primal and dual in simplex
5. Shadow prices and marginal analysis
6. Sensitivity analysis
7. Transport and assignment problems

Teaching Methodologies
Lectures, Seminars, Individual, partner and small group work

Instructional Materials and Equipment
Chalkboard, coloured chalks, worksheets, OHP screen, computers, autographs

Assessment
Assignments, tests, group work, presentations

Assessment scheme
- Assignments 20%
- Written tests 20%
- Examination 60%

Course textbooks

Textbooks for further reading

MTH 303: Numerical Analysis 3 credits
Pre requisite course: None

Goal
To equip the learner with necessary knowledge and skills required to solve mathematical problems which are related to numerical analysis.

Learning Outcomes
At the end of this course the student will be able to:
1. Determine the level of accuracy of numerical approximations.
2 Solve non linear equation by different methods
3 Calculate roots of functions using iterative procedures
4 Apply forward –backward formula to perform numerical differentiation
5 Apply various techniques to perform numerical integration
6 Illustrate / demonstrate how various mathematical packages can be used to perform numerical calculations.

Course Contents
1. Errors
   • Sources of errors
   • Round –off errors, Absolute errors and percentage errors.
   • Effects of errors on the basic operations of arithmetic
   • Statistical treatment of errors
2. Solution of Non Linear Equations
   • Need for numerical solution
   • Definition and location of root
   • Order of Convergence of the Iterative methods.
3. Numerical Differentiation
   • Definition and properties of Forwad ,Backward and Shift Operators
   • Forward /Backward –difference formula
   • Derivatives from L'angräge’s Interpolating polynomials: Three-point formulas and Five –point formulas.
   • Construction of Difference Tables
   • Use of Difference Tables to detect / correct errors
4. Numerical Integration
   • Newton –Cotes formulas
   • Trapezoidal rule
   • Simpson’s three –eights rule
   • Composite trapezoidal rule
   • Composite Simpson’s rule
5. Interactive Computing – the use of Mathematical packages ( eg MATLAB, MAPPLE, AUTOGRAPH , MATHEMATICA) in finding roots of a polynomial or performing numerical integration .

Teaching Methodologies
Lectures, Seminar presentations, Independent studies and group tasks.

Assessment
Assignments, tests, group work, presentations

Assessment scheme
Seminar presentations 20%
Tests 20%
End of semester examination 60%

Instructional materials and equipment
Worksheets , chalkboard ,Mathematical packages eg Autograph ,Overhead projectors, computers, Calculators, worksheets.
Textbooks for the course

Books for further readings

MTH 304: Complex Analysis  3 credits
Prerequisite courses: None

Goal
To equip the student with basic knowledge of complex numbers to complex variables and its relevance in science subjects or in life.

Learning Outcomes
At the end of the course the student will be able to:
1. Solve complex number problems of Advanced level
2. Explain the concept of continuity and differentiability of complex functions
3. Describe functions of complex variables
4. Solve the problem of analytic and harmonic functions
5. Evaluate complex integrals using Green’s theorem and Cauchy Integral formula
6. Apply Cauchy, Laurent and residue theorems to solve various numerical problems of complex variables

Course Contents
1. Complex numbers: operations of complex numbers, Argand diagram, argument and modulus, De Moivre’s theorem, locus, Euler’s formula, relationship between complex numbers and trigonometric functions
2. Complex functions: Limits, continuity, L” Hospital rule
3. Complex differentiation: Derivatives, analytic functions, Cauchy – Riemann equations, Harmonic functions, gradient, divergence, curl and Laplacian
4. Complex integration: Line integrals, Green” theorem Cauchy’s theorem, Cauchy – Goursat theorem, Cauchy”s integral formula
5. Infinite series: Laurent series, Taylor series convergence.
6. Residual theorem: calculation of residuals, application of residuals, singularities, poles

Teaching Methodologies
Lectures, seminars, individual, partner and small group work.

Instructional materials and Equipments
Chalkboard, colored chalks, OHP, Calculators, Computer

Assessment
Assignments, tests, group work, presentations

Assessment scheme
1) Assignments 20%
2) Timed tests 20%
3) Final examination 60%

Textbooks for the Course

Textbooks for further readings

GEOGRAPHY COURSE CONTENT

GEO 101: Physical Geography
Prerequisite Courses: None

Goal
To equip the student with knowledge of fundamental concepts of physical geography, which form the basis for the advanced and applied courses in the geography programme.

Learning Outcomes
At the end of this course the student will be able to: -
i. Describe basic elements of physical geography, the geomorphology, soils and vegetation.
ii. Examine physical, chemical and biological processes on the surface of the earth.
iii. Examine oceanography and coastal processes
iv. Assess nature and properties of soils
v. Assess nature and distribution of plants

Course Contents
1. Earth Processes and Landforms
   • Internal processes and movements
   • Rock forming processes
   • Geomorphic processes and land forms
   • Desert processes and landforms
2. Oceanography and Coastal Processes
   • Ocean floor profile
   • Ocean floor processes
Coastal processes
Coastal landforms

- Concept of soil
- Soil profile and genesis
- Physical properties of soils
- Chemical property of soils
- Soil organic matter

4. Nature and Distribution of Plants
- Soil-plant relationship
- Communities and Ecosystems
- Plant succession
- Distribution of plants over space

Teaching methodologies
Lectures, seminars, and information searches

Instructional materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for the Course
Upper Saddle River, NJ

Text Books and Journals for Further Reading
Miller, G. (1990). Living in the Environment; An Introduction to Environmental Science. 6th
Publishing House.

GEO 102: Climatology
Prerequisite Course: None

Goal
To enable the student acquire the fundamental concepts of climatology.

Learning outcomes
At the end of this course the student will be able to: -
i. Describe various concepts of climatology such weather and climate, climate change and influence of climate on resources.

ii. Classify world climate

iii. Discuss the process of global warming and climate change

iv. Analyse the effects of climate on resource distribution

Course Contents
1. Weather and Climate
   - Elements of Climate
   - Solar radiation and heat balance
   - Atmospheric pressure and wind
   - Transient atmospheric flow and disturbances
   - Atmospheric moisture

2. General Climatology
   - Climatic classification
   - Modification of climate
   - Climatic hazards

3. Global Warming and Climate Change
   - Paleoeclimatology
   - Theories of climatic change
   - Climatic cycles
   - Recent trends in climate change
   - Impacts of Climate change

4. Climate and Resources
   - Vegetation and soils
   - Water Resources
   - Agriculture
   - Transportation and industry
   - Housing and human comfort

Teaching methodologies
Lectures, seminars, practical classes and information searches

Instructional materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Text Books and Journals for the Course
GEO 103: Spatial Organizations
Prerequisite Course: None

Goal
To equip students with knowledge on the concepts of spatial organization, that is, human being’s attempts to use space efficiently.

Learning outcomes
At the end of this course the student will be able to:

i. Introduces to students geography as a spatial science.
ii. Explain scope and subject matter of spatial organization.
iii. Describe evolution of geographical thought will be presented as well as the concepts of location and space.
iv. Elaborate Spatial interaction and organization, based on the use of natural resources by humans and the resultant spatial diffusions.

Course Contents
1. Geography as a Spatial Science
   • The scope and subject matter of Geography
   • Evolution of Geographical thought
2. Location and Space
   • Explanations of concepts of location and space
   • Points
   • Distribution
   • Patterns
3. Natural Resources
   • Concept of resources
   • Renewable and non-renewable resources
   • Resource endowment and spatial differentiation
4. Human Activities and Settlements
   • Primary activities
   • Secondary activities
   • Tertiary activities
   • Human settlements (types, locations and patterns)
5. Spatial Interaction and Organization
   • Theory of spatial interaction
   • Spatial diffusion theories
   • Gravity model
   • Transport and trade

Teaching methodologies
Lectures, seminars, and information searches

**Instructional materials and Equipment**
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

**Methods of Assessment**
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

**Scheme of Assessment**
Written assignments 20%
Written tests 20%
Final examination 60%

**Textbooks and Journals for the Course**

**Textbooks and Journals for Further Reading**

**GEO 104: Surveying, Cartography and Map Analysis**
**Prerequisite course:** None

**Goal**
To equip students with surveying, cartographic and mapping knowledge and skills.

**Learning outcomes**
At the end of this course the student will be able to: -
- Use different survey techniques to conduct land survey
- Practice cartography
- Read, analyse and interpret maps
- Analyse photographs

**Course Contents**
1. **Surveying**
   - Introduction to surveying
   - Surveying instruments
   - Surveying techniques
2. **Cartography**
   - Introduction to cartography
• Co-ordinate system  
• Map projections  
• Map production  

3. Map Reading & Interpretation  
• Map classification  
• Map components  
• Map measurements  
• Map reading  
• Map interpretation  

4. Photo Interpretation & Photogrammetry  
• Importance of aerial photograph  
• Aerial photograph production  
• Elements of aerial photographs  
• Aerial photograph interpretation  
• Photogrammetry  

Teaching methodologies  
Lectures, seminars, practical classes and information searches, case studies  

Instructional materials and Equipment  
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer  

Methods of Assessment  
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation  

Scheme of Assessment  
Written assignments 20%  
Written tests 20%  
Final examination 60%  

Textbooks and Journals for the Course  

Textbooks and Journals for Further Reading  

GEO 201: Quantitative Methods in Geography  
Prerequisite: None  

Goal  
To equip students with statistical skills for analyzing research data, formulate hypotheses, test variable relationships; analyze point, line and areal distributions.  

Learning outcomes  

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At the end of this course the student will be able to: -
Calculate computation and application of numerical measures of variable relationships for numerical distributions, and measures of point, line and areal distributions.

Course Contents
1. Introduction to Inferential Statistics
   - Types of distributions and their properties
   - Estimation methods and Hypothesis formulation and testing
2. Measures of variable relationships/associations
   - The scatter diagram
   - Correlation analysis
   - Regression analysis
   - Chi-squared analysis
3. Measures of point distributions
   - Mean centre and median centre
   - Index of dispersal and standard distance
   - Nearest neighbour analysis.
4. Measures of Line Distributions
   - Transport Network analysis
   - Indices of accessibility
   - Indices of connectivity
   - Description of shape.
5. Measures of area distributions
   - The Lorenz curve
   - Index of concentration
   - Index of dissimilarity.

Teaching methodologies
Lectures, seminars, and information searches

Instructional materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for the Course
Textbooks and Journals for Further Reading
Englewood Cliffs.
Annals of the Association of American Geographers
International Journal of Geographical Information Science

GEO 202: Environmental Education and Conservation
Prerequisite course: None

Goal
To equip students with knowledge and skills on environmental conservation so as to enhance students’ awareness and attitude towards conservation of the environment.

Learning Outcomes
At the end of this course the student will be able to: -
  i. Discuss the society – environmental interaction and the environmental concerns that call for environmental conservation.
  ii. Examine environmental conservation techniques.

Course Contents
1. Society – Environment Interaction
   • The role of culture in society – environment interaction
   • Use and misuse of environmental resources
   • Poverty – environment linkages
2. Human Impact on the Environment
   • Impact on land, Impact on water and Impact on the atmosphere
3. Environmental Conservation
   • The relevance of environmental conservation
   • Incentives and Disincentives to environmental conservation
   • Property regimes (common property, communal property and open access) and Indigenous knowledge on environmental conservation
4. Education and Environmental Conservation
   • Principles and approaches in environmental conservation education
   • Enhancing public awareness on environmental conservation, Socio-economic, cultural and political influences on environmental conservation education
   • Opportunities and impediments to environmental conservation education
5. Practices in Environmental Conservation
   • Soil and Water, Energy resources
   • Wetlands, Biodiversity and Lakes and Water basins

Teaching methodologies
Lectures, seminars, and information searches

Instructional materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

Assessment
Written assignments 20%
Written test 20%
Final examination 60%

Text Books and Journals for the Course
The Journal of Education for Sustainable Development (JESD)

Text Books and Journals for Further Reading
Journal of Education for Sustainable Development

GEO 203: Population Geography
Prerequisite course: None

Goal
To equip students with knowledge on the relationship between population, environment and development.

Learning outcomes

At the end of this course the student will be able to:

   i. Discuss population issues in general.
   ii. Examine population distribution, redistribution and the factors that influence these processes.
   iii. Discuss population distribution.
   iv. Interpret population data and structures
   v. Discuss models and theories of migration.
   vi. Examine population redistribution in Tanzania
   vii. Discuss the international migration.

Course Contents
1. Global Population distribution
   - Global World population dynamics and distribution
   - Factors which influence global population growth and distribution
   - Population dynamics and density in Africa
   - Population dynamics and density in Tanzania

2. Population data, Structure and Theories
   - Nature and sources of population data
   - Age and sex population composition; dependency ratios
   - Determinants of age and sex composition; sex ratios
   - Measures of Population: Fertility and Mortality
   - Basic Population Theories
• Population projections

3. Models and theories of migration
• Classical models/theories of migration
• Neo-classical migration theories/models
• The political economy migration theories
• Spatial mobility migration theories

4. Population redistribution in Tanzania
• Sources of migration data
• Inter-zonal and interregional migration
• Micro-level migration (plantation)
• Mines development schemes and urbanisation

5. International migration
• Types and Measures of international migration
• Trends of contemporary international migration
• The brain drain and International migration policies

Teaching methodologies
Lectures, seminars, and information searches, case studies

Instructional materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Text Books and Journals for the Course
International Journal of Population Geography

Text Books and Journals for Further Reading
Population Geography, Association of Population Geographers of India, India.

GEO 204: Remote Sensing
Prerequisite Course: None

Goal
To equip students with knowledge and skills of remote sensing, remotely sensed data and their applications on real life situation.

**Learning outcomes**
At the end of this course the student will be able to: -
1. Describe various concepts of remote sensing, scope of remote sensing and the remote sensing systems
2. Interpret remotely sensed images
3. Discuss applications of remotely sensed data.

**Course contents**
1. **Principles of Remote Sensing**
   - Scope of remote sensing
   - Electromagnetic spectrum
   - Energy interaction with atmosphere
   - Energy interaction with earth surface features
2. **Remote Sensing Systems**
   - Remote sensing platforms
   - Visible and Infrared systems
   - Thermal remote sensing systems
   - Microwave and Radar remote sensing systems
3. **Satellite Image Interpretation**
   - Visible imagery interpretation
   - Infra-red imagery interpretation
   - Thermal imagery interpretation
   - Microwave imagery interpretation
4. **Application of Remote Sensing**
   - Weather forecasting
   - Land resources mapping
   - Marine resources monitoring
   - Geological exploration

**Teaching methodologies**
Lectures, seminars, practical classes and information searches, case studies

**Instructional materials and Equipment**
Chalkboard, OHP, screen, video player and TV, worksheets CD Rom and computer

**Methods of Assessment**
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

**Scheme of Assessment**
Written assignments 20%
Written tests 20%
Final examination 60%

**Text Books and Journals for the Course**

**Text Books and Journals for Further Reading**

**GEO 301: Population and development**

**Goal**
Equip students with knowledge on the relationship between population and development

**Learning Outcomes**
At the end of this course the student will be able to: -

i. Examine the relationship between population, resources and development. Globally

ii. Explain the relationship between changes in mortality and development while at regional levels it explains the fertility transitions and evolution of population policies in Africa

iii. Explain the root causes of displaced persons in Africa.

**Course contents**

1. **Epidemiological Transition Theory**
   - Classical model
   - Accelerated variant of the classical model
   - Delayed model
   - Transition variant of the delayed model

2. **Fertility Transition**
   - Determinants of fertility transition
   - Global fertility transition
   - Fertility transition in Africa
   - Future trends: Caribbean and East Asian models.

3. **Evolution of the Population Policies**
   - World Population Conferences
   - Regional Population Conferences
   - Steps for formulation of population policies
   - Evolution of population policy in Tanzania

4. **Population and Natural Resources Management**
   - Global concerns on natural resources management
   - Relationship between population and natural resources
   - Linkages between population and environment
   - Population and environment in the national policy of Tanzania

5. **Population Displacement**
   - Concept of displaced persons and refugees
• Spatial distribution of displaced persons and refugees
• Causes of persons displacement and refugees
• Impact of displaced persons
• Conflict resolutions

Teaching Methodologies
This course will use lectures, seminars, and information searches

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for the Course
International Journal of Population Geography

Textbooks and Journals for Further Reading
Population Geography, Association of Population Geographers of India, India.

GEO 302: Geographical Information Systems (GIS)

Goal
To equip students with skills of the Geographical Information System for the purpose of processing and analyzing Geographical data.

Learning outcomes
At the end of this course the student will be able to: -
  i. Analyze the generic of GIS, data base structure, processing and analysis as well as application tools for analyzing geographic data.
  ii. Demonstrate the use of GIS for environmental and resource evaluation, planning and management, and for making decisions related to resource allocation.
Course Contents
1. Introduction to GIS
   • History of GIS
   • Components of GIS
   • Functions
2. Database
   • Database Structure
   • Database development
   • Database management
   • Database maintenance
3. Geographical Data Analyses with GIS
   • Database query
   • Derivative mapping
   • Process simulation and modelling
4. GIS applications
   • Decision making
   • Change and time series analysis
   • Land-cover mapping
   • Urban Planning
   • Public Participation and GIS

Teaching Methodologies
This course will use lectures, seminars, practical classes and information searches.

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for the Course
International Journal of Geographical Information Science

Textbooks and Journals for Further Reading
GEO 303: Environmental Disaster Management

Goal
To enable students to examine environmental disasters management and how it’s linkage with development

Learning Outcome
At the end of this course the student will be able to examine the causes, processes and management measures of disasters in the context of development

Course Contents
1. Typology of Disasters
   - Basic concepts and processes
   - Disaster classification systems
2. Causes and Impacts of Disasters
   - Causes of disasters
   - Impact of disasters on socio-economic and environmental systems
   - Disaster-development nexus
3. Disaster Management
   - Early warning systems
   - Disaster assessment
   - Response
   - Mitigation
   - Preparedness
   - Sustainable development
4. Disaster Management Policies and Legislation
   - Human adjustments to Disasters – Rural and Urban dichotomy
   - The Role of Public, Private and Informal sectors in disaster management.
   - Sub-national, national and international policies and conventions
   - Disaster legislation
5. Case Studies in Disaster Management
   - Examples form developed countries
   - Examples from developing countries
   - Examples form Tanzania

Teaching Methodologies
This course will use lectures, seminars, and information searches.

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%
Textbooks and Journals for the Course
Santos, M. "*Society and Space: Social Formation as Theory and Methods*" Antipode: a radical Journal of Geography

Textbooks and Journals for Further Reading

GEO 304: Natural resources management

Goal
To enable students analyse the principles, approaches and tools for natural resources management.

Learning Outcomes
At the end of this course the student will be able to:

i. Describe management of natural resources.
ii. Examine Inventorying and monitoring techniques
iii. Discuss protected area management and policies and practices in natural resources management.

Course Contents
1. **Principles and approaches**
   - Defining the concepts of natural resources and natural resources management
   - Principles of natural resources management
   - Approaches to natural resources management

2. **Inventorying and Monitoring**
   - Forests
   - Rangelands
   - Wildlife

3. **Natural Resource Management Issues and strategies**
   - Resource degradation and depletion
   - Resource use conflicts and conflict management
   - Integrated natural resources management

4. **Protected Area Management**
   - Rationale for establishment of protected areas
   - Categories of protected areas
   - Criteria for selection of areas for protection
   - Preparing management plans for National Parks

5. **Natural Resources Management Policies and Practices**
   - Property rights and regimes
   - Natural Resources Policies
   - Legislation and International Conventions
Management Regimes and Practices

Teaching Methodologies
Lectures, seminars, and information searches.

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for the Course
Eastern Africa Social Science Research Review. Addis Ababa: OSSREA

Textbooks and Journals for Further Reading

GEO 305: Project Planning and Management

Goal
To provide to students knowledge and skills in project planning and management.

Learning outcomes
At the end of this course the student will be able to: -

i. Discuss the basic concepts and principles underlying the planning and management of development projects in developing countries.

ii. Analyze social projects with a focus on poverty alleviation, environmental conservation and rural development.

Course Contents
1. Development and Development Projects
   - Types of projects
   - The role of projects in policy implementation
   - The need for project approach in development intervention
2. Project Framework and Project environment
• Project framework
• Project environment
• Stakeholder identification and analysis

3. Project Planning and Implementation
• Historical Background of project planning
• The project cycle
• Institutional framework for project implementation

4. Tools in Appraisal of Development Projects
• The Rapid Rural Appraisal
• Participatory Rural Appraisal
• Logical Framework Approach
• Cost Benefit Analysis
• SWOT Analysis
• Problem tree

5. Project Management and the Project Manager
• The concept and types of management
• The nature of project management
• The role of the project manager
• The function of the management
• Financing development projects

Teaching Methodologies
Lectures, seminars, and information searches.

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Text Books and Journals for the Course

Textbooks and Journals for Further Reading

**GEO 306: Urban Planning and Management**

**Goal**
To enable students explore various issues, approaches and strategies pertaining to urban planning and management strategies.

**Learning outcomes**
At the end of this course the student will be able to: -

i. Analyse “Urban planning and Management” deals with the planning and management of land use and other functions of an urban space economy.

ii. Evaluate models of the internal structure of urban centres,

iii. Examines urban planning and current global urban problems, the metabolism of cities, theoretical underpinnings of urban land use; urban planning in developing countries, new approaches to urban planning – ecological and sustainable cities approaches and the environmental planning and management strategy (EPM) process.

**Course Contents**
1. **Urban Planning: An Overview**
   - Urban Planning and current global problems
   - Understanding urban or city metabolism – linear and circular
   - Urban planning – theoretical underpinnings of land use planning:
     - (activity systems, land development systems, environmental systems)
   - Land use planning guiding system

2. **Town/Urban Planning**
   - The town/urban planning process to final adoption of land use plan
   - Master plans and shift from master planning
   - Emergence of local communities and civil society in urban governance
   - Participatory system of urban planning and management, services provision, housing, food, sanitation etc.

3. **Urban Ecology and Environment**
   - The Resource base for urban development
   - Ecological components of the human ecosystem
   - Urban growth and its impact on natural resources
   - Urban economy as urban ecology

4. **Ecological Approaches to Urban Systems - Sustainable Perspectives**
   - Replacement of traditional planning approaches
   - Sustainable development - principal objectives in urban planning
   - The Compact city model, healthy city model and green city model
   - Ecosystem approach to urban land use planning and management

5. **Contemporary Urban Planning and Management**
   - Participatory urban planning and management – UMP strategy
   - Sustainable cities programmes (SCP) principles and sustainable cities
   - The environmental management (EPM) process
   - Role of agriculture in urban development – urban agriculture
   - Waste generation, disposal and re-use/cycling
- Secondary and intermediate cities and small towns

**Teaching Methodologies**
Lectures, seminars, and information searches

**Instructional Materials and Equipment**
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

**Methods of Assessment**
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

**Scheme of Assessment**
Written assignments 20%
Written tests 20%
Final examination 60%

**Textbooks and Journals for the Course**

**Textbooks and Journals for Further Reading**

**GEO 307: Environmental Policy and Planning**

**Goal**
To raise the awareness of students on the need for environmental management and sustainable development

**Learning Outcomes**
At the end of this course the student will be able to: -
  i. Examines the principles of environmental management and policy
ii. Explain the importance of improved management of the environment
iii. Discuss the link between environment and development, the environmental policy formulation process, environmental planning and the legal and institutional framework.

Course contents
1. Environmental Management and Policy Analysis
   - Basic concepts of Environmental management
   - Integrating Environment and development
   - Sustainable development policies
   - Reconciling development policies with environmental objectives
2. Environmental Policy
   - Objectives of public policy in Environmental Management
   - The Policy context
   - Principles of environmental policy
   - Policy Formulation and the Role of Government
   - Environmental policy – experiences from Africa
3. Environmental Planning
   - Perspectives on Environmental planning
   - Conservation strategies and Environmental Action Plans
   - Plan of Action to Combating Desertification
   - Environmental planning – experiences from Africa
4. The Legal and Institutional Framework for Environmental Policy
   - Nature and scope of Environmental Law
   - Developing a legal framework
   - Global, regional and national policy initiatives
   - Role of Stakeholders in policy advocacy

Teaching Methodologies
This course will use lectures, seminars, and information searches.

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

Scheme of Assessment
Written assignments 20%
Written tests 20%
Final examination 60%

Textbooks and Journals for the Course

Textbooks and Journals for Further Reading


**GEO 308: Environmental Assessment**

**Goal**
To provide students with knowledge about various techniques of environmental assessment.

**Learning outcomes**
At the end of this course the student will be able to:

i. Analyse methods and techniques in economic assessment and valuation of the environment


**Course Contents**

1. **Background to Environmental Assessment**
   - Introduction to environmental assessment
   - Environmental problems in developing countries
   - Environment and sustainable development

2. **Economic Assessment and Valuation of Environment**
   - Economic costs and environmental losses.
   - Risk and Uncertainties
   - Externalities
   - Environmental valuation techniques
   - Environmental accounting

3. **Environmental Impact Assessment (EIA)**
   - The Nature of Environmental Impact Assessment
   - The Environmental Impact Assessment Process
   - Environmental Impact Assessment practices: Case studies

4. **Strategic Environmental Assessment (SEA)**
   - SEA and Sustainable development
   - Principles of SEA
   - The SEA Process
   - Case studies

**Teaching Methodologies**
Lectures, seminars, and information searches.

**Instructional Materials and Equipment**
Chalkboard, OHP, screen, video player and TV, worksheets, CD Rom and computer

**Methods of Assessment**
Direct observation, Oral assessment and questioning, projects and assignments and seminar presentation

**Scheme of Assessment**
Written assignments 20%
Written tests 20%
Final examination 60%

**Textbooks and Journals for the Course**

**Textbooks and Journals for Further Reading**

EDUCATION COURSE CONTENT

**EDU 101: Introduction to Educational Psychology**

**Goal**
To introduce the student into Educational Psychology in terms of content, methods and application to education

**Learning Outcomes**
At the end of the course the student will be able to:
1. Use psychological terms correctly.
2. Demonstrate an understanding of the different approaches to psychology.
3. Explain the biological basis of behaviour.
4. Analyse critically the behavioural and cognitive approaches to learning.
5. Evaluate the three models of memory.
6. Design a small scale psychological research project to gather data to help solve a problem in Tanzania secondary schools.

**Course Contents**
1. Meaning of Psychology and Educational psychology
2. Psychology as applying to the use of the scientific method and therefore different from other subjects studying behaviour.
3. Biological basis of behaviour.
4. Genetic aspect of behaviour and individual differences in psychological make up of the individual.
5. Gender sexuality and Adolescence
6. Information processing and decision making leading to action, thoughts and feelings.
7. Behavioural approaches to learning – learning as conditioning.
10. Memory and learning.
11. Language and learning.
12. Intelligence and learning.
13. Culture and psychology

Teaching Methodologies
Lecture, practical classes, group work, seminars.

Instructional material
Chalkboard, practical equipment, OHP, computers.

Assessment methods
Observation, oral/written questions during the lesson, worksheets, quizzes and tests, take-homes assignments

Assessment scheme
20% Written assignments
20% Written tests
60% Final examination

Text books for the Course

Text Books for Further Reading
British Journal of Psychology
British Psychological Society website.

EDU 102: General teaching methods

Goal
To prepare teachers equipped with a wide range of expertise in using variety of teaching methods and techniques for effective classroom instruction.
Learning outcomes
At the end of the course the student will be able to:
1. Explain the concepts: teaching, learning, training, instruction, approaches and techniques
2. Create a positive classroom climate for effective learning
3. Explain the characteristics of an effective classroom teacher
4. Manage, control and organise the classroom for effective teaching and learning to take place.
5. Handle student misbehaviour appropriately
6. Demonstrate good teacher-student relationship
7. Demonstrate teacher platform skills when teaching
8. Describe different methods of teaching
9. Apply various teaching methods and techniques in teaching at secondary school and Teachers colleges.
10. Assess the effectiveness of the various teaching methods.
11. Develop schemes of work and lesson plans for their lessons.

Course contents
1.0 Introduction: Definitions of terms and concepts: effective teaching and learning
2.0 Classroom climate: school thoughts on classroom management and control, principles of good classroom control.
3.0 Characteristics of effective classroom teacher.
4.0 Nature of student misbehaviour: Causes and ways of handling learners” misbehaviour.
5.0 Teacher –student relationship
6.0 Teacher platform skills and effective communication
7.0 Lecture methods:
   • Strengths and weaknesses, improvement of lecture method.
8.0 Group discussion
   • How to form groups
   • organizing group work for effective learning
   • Advantages and disadvantages of this method
9.0 Question-Answer method
   • Purposes of questioning
   • Effective questioning techniques
   • Handling of students questions and responding to answers.
10.0 Demonstration method
     • How and when to use the method
     • Advantages and disadvantages
11.0 Problem-Solving Method
    • When to apply this method?
    • Problems solving process (stages)
12.0 Resource Based Learning (Discovery method).
    • Role of students and teacher in this method
    • Changes facing the use of this method in Tanzanian secondary schools.
13.0 Project Method
    • When and how to apply this method? Advantages and disadvantages
14.0 Field trip Method
    • When to use this method?
    • Procedure for using this method.
15.0 Role play and Simulations
    • Situations where these methods are applicable
• Steps in using the role-play method

16.0. Dramatization Method
• Difference between drama and a role play
• Steps in using dramatization method

17.0 Guest-speaker/resource person method
• Situations where this method can be used.
• Advantages and disadvantages of this method.

18.0 Schemes of work and lesson plans
• Format and components for these documents
• Rationale for the teacher to have a lesson plan

Teaching Methodologies
Lecture, group presentations

Assessment Methods
Tests, Observation, Oral questioning, Term paper writing and presentation

Assessment scheme
Written Test- 20%
Term/Seminar paper- 20%
Final Examination- 60%

Text Books for the Course

Text Books for Further Reading

EDU 103: Philosophy of Education

Goal
To introduce Philosophy of Education to students as a basis for the historical development of education in Africa and Tanzania in particular.

Learning Outcomes
At the end of the Course the student will be able to:
1. Define Philosophical concepts correctly.
2. Explain the importance of Philosophy to the education system
3. Explain the way in which the education system in Africa and in Tanzania in particular has been influenced and shaped by the ideas of prominent philosophers.
4. Critically evaluate major philosophies influencing the development of the education systems of African countries particularly Tanzania.

Course Contents
1. Philosophy: meaning, origin and development, divisions and functions.
2. Major philosophical approaches to education
3. Education in the perspective of philosophers.
5. Philosophical basis of education in an era of liberalization, market economy and globalization.

Teaching methodologies
Lectures, critical group discussions, seminars.

Instructional materials
Chalkboard, OHP, video films, charts.

Assessment methods
Observation, oral/written questions during the lesson, worksheets, quizzes and tests, take-homes assessments.

Assessment scheme
20% Written assignments
20% Written tests
60% Final examination

Texts Books for the Course

Text Books for Further Reading

EDU 104: Education Media and Technology

Goal
To equip the student with technologies which have influenced educational activities in teaching and learning.

Learning outcomes
At the end of the course the student will be able to:
1. Explain the concept of technology and its role in influencing development
2. Describe the role of communication, cite models of communication in teaching-learning situation
3. Describe with example the major theories of communications and their functions
4. Analyze different forms of media and their functions
5. Demonstrate the ability to develop/or match different forms of media with the subject or topics that would be relevant for them.
6. Explain and apply Systems Approach in relevant disciplines
7. Analyze the objectives in Bloom Taxonomy and practice how brain physiology works.
8. Demonstrate the ability to select and use relevant teaching and learning resources
9. Analyze the foreseeable developments in educational settings brought about by the developments in education media and technology

Course contents
1. Concept of technology and its role in influencing development in an educational setting.
2. Communication process and its main components
3. Theory conceptualization and communication theory
4. Education media types and impact in educational setting
5. Media in teaching-learning
   - Visual media- chalkboard, posters, displays or bulleting boars, display beams and hooks, flannel/cloth board, photographs or pictures, models, overhead projectors, transparencies, relia, paper mache, mobiles and games.
   - Visual media-motioned e.g. films, video tapes and computer
   - Audio-visual:
     - One-way electronic media e.g. videotapes, films and TV.
     - Two way electronic media e.g. telephones, video text and video conferencing
6. Systems Approach
7. Educational objectives-media involvement
   - Bloom taxonomy
   - Brain physiology (brain gym), cort thinking tools and brain laterality and Learning modality
   - Starters and plenaries
8. Teaching resources and resource centers
9. Future development trends of educational media and technology

Teaching methodologies
Lectures, classroom discussions, group work, making or producing some teaching aids.

Instructional materials and equipment
Chalkboard, chalks, overhead projector, video player, TV, newspapers, magazines, relia, sample visual aids.

Assessment methods
Observation, written exercises, homework, quiz, attitudes, questionnaire, written or oral questioning, worksheet, checklists

Assessment scheme
Practical 40%
Final examination 60%

Text books for the Course
Text Books for Further reading

EDU 201: Chemistry Teaching Methods

Goal
To equip students with teaching skills of effective delivery of their lessons in secondary schools.

Learning outcomes
At the end of this course the student will be able to:
1. Analyze the various curriculum documents produced for chemistry in secondary schools curriculum.
2. Develop school laboratory rules
3. Demonstrate how to render first aid in class and school environment.
4. Manage and organize Chemistry laboratory effectively.
5. Identify and handle hazardous chemicals/reagents.
6. Apply various teaching and learning methods for various topics in Chemistry subject.
7. Conduct Chemistry experiments required for effective learning of secondary school chemistry.
8. Design schemes of work and lesson plans for Chemistry lessons.
9. Demonstrate micro-teaching of Chemistry subject

Course Contents
1. Chemistry curriculum documents at school level.
2. Laboratory rules
3. Safety in science teaching; First aid.
5. Dealing with Hazardous chemicals
7. Conducting experiments- indicated in secondary school syllabus.
8. Lesson plan and scheme of work.
9. Micro teaching for selected topics from form 1- 6 chemistry syllabus.

Teaching methodologies
Lectures, seminars, workshops, practical classes and micro teaching

Instructional materials and equipment
Chalkboard, OHP, laboratory apparatus and chemicals

Assessment
20% practical work
20% Written assignments
60% final examination

Text Books for the course
EDU 202: Biology teaching methods
Prerequisite courses: BIO 101, BIO 102, BIO 103, BIO 104

Goal
To introduce students to a wide range of biology teaching, assessment and evaluation methods, and to provide skills for organising and managing biology laboratories and the necessary equipment and resources.

Course Objectives
At the end of this course the student will be able to:
1. Analyze the objectives of biology in secondary schools and gain acquaintance with the Tanzanian secondary school syllabus and the subject of biology is related to other subjects.
2. Describe basic health and safety issues in biology teaching and develop skills to write laboratory rules.
3. Deal with simple first aid and emergencies, and know how to manage laboratories and students’ groups in order to avoid the main dangers
4. Use the local environment to teach various biology topics, manage laboratories efficiently in terms of equipment ordering, purchasing, storage and maintenance.
5. Collect, organise, preserve and store specimens as well as making and maintaining inventories, and carry out inventory checks.
6. Prepare temporal and permanent slides, common chemicals, reagents and stains for biology practical.
7. Keep and breed animals in hygienic conditions, make and maintain biology ponds and gardens.
8. Carry out the full range of practical skills required for secondary school biology.
9. Carry out assessments of students using a wide range of methods, including assessments of practical skills.

Course Contents
2. Safety in science teaching: Laboratory rules, simple first aid and fire emergency drill. Demonstrate and justify the safe supervision of students in a range of biology activities such as care of animals in labs, dissection, use of chemicals and glassware, heating, mixing, filtering etc.
3. Laboratory management skills: Ordering, purchasing, storage of scientific equipment for biology. Collection, preservation, labelling, storage and organisation of plant and animal materials for biology practical. The significance of biology ponds, gardens and museums in teaching biology in secondary schools. How to set up and maintain biology gardens and ponds
4. Laboratory preparation skills: Preparing common chemical solutions, reagents and stains needed in biology practical. Making slides, preparing equipment for demonstrations and practical group-work in biology: Setting up animal houses for keeping and breeding in hygienic conditions. Problems of keeping live animals, and uses of live animals in teaching biology – health and safety issues. Organise and manage fieldwork in the local environment. Plan and deliver micro-teaching and/or practical demonstrations in a variety of topics from forms 1-6 biology syllabus using a range of teaching and learning methods selected for that topic.

5. Reporting and assessment: Demonstrate and justify a range of techniques for assessment, recording and reporting students’ progress. Develop the skills to produce a range of different assessment instruments to cover the full range of cognitive, affective and psychomotor skills needed in biology. Evaluate teaching practices and methods, using a range of different instruments.

Teaching and Learning Methodologies
Lectures, seminars, practical, micro-teaching, peer-teaching

Instructional Materials and Equipment
Chalkboard, OHP, computers, internet access, laboratory apparatuses and chemicals, animals, plants etc.

Assessment methods
20% Practical assignments
20% Written assignments
60% Final examination

Course Textbooks

Books and journals for further reading

EDU 203: Physics teaching methods 3 Credits
Prerequisite course: EDU 111

Goal
To equip a student teacher with knowledge, skills, and competence in planning, preparing, and teaching a physics lesson as well as assessing and recording students’ progress in Physics

Learning Outcomes
At the end of this course each student will be able to:

- Prepare and use all essential Physics teaching documents
- Select appropriate teaching and learning methods for various topics
- Plan, prepare and conduct a Physics lesson
- Demonstrate practical skills required for carrying out secondary school Physics experiments
- Manage and organise physics laboratory for safety use
- Improvise teaching aids from locally available resources and use local environment for effective teaching and learning process
- Apply science cycle with special emphasis on starter experiment approach (SEA) method
- Design and administer assessment tools for Physics
- Record and report students’ performance in Physics
- State and explain the duties of the head of Physics department in organizing and coordinating Physics activities and resources.

**Course contents**
2. Teaching methods for Physics lessons.
3. Micro teaching on a variety of topics from secondary school syllabus using a range of teaching and learning methods.
4. Designing and conducting practical work for conceptual development as per secondary school curriculum.
5. Physics laboratory structure and organization.
7. Physics teaching in absence of a laboratory.
8. Science cycle and SEA.

**Teaching methodologies**
Lectures, classroom discussions, practicals, assignments, and microteaching

**Assessment methods**
- Assignments 30%
- Written tests 20%
- Final examination 50%

**Instructional materials and equipment**
Chalkboard, OHP, beamers, handouts, internet and library searches

**Text books and journals for this Course**
University

Books and Journals for Further Reading

EDU 204: Mathematics teaching methods

Goal
To enable students to use a variety of teaching methods, and select appropriate methods for the various mathematical topics taught in Forms 1 – 6 as well as to deepen student’s personal knowledge base while enhancing their ability to design and deliver Mathematics lessons using a range of active participatory teaching and learning techniques.

Learning Outcomes
At the end of this course the student will be able to:
- Analyze and evaluate variety of methods and resources used to teach mathematical concepts and processes contained in the Forms 1 – 6 syllabi
- Guide their students (Forms I – VI) how to learn mathematics
- Offer extracurricular activities in Mathematics to the school community
- Prepare good schemes of work, lesson plans and keep records of work
- Use Mathematical packages to solve various mathematics problems

Course Contents
1. Psychology and philosophy of teaching Mathematics: History of Mathematics, goals and objectives of mathematics
2. Key topics of the methodology of teaching Mathematics: Teaching mathematical concepts and skills, modeling, individual differences in learning Mathematics (fast and slow learners, the gender issue) use of computers
3. The current Mathematics education analysis: The syllabus, lesson plan, scheme of work and records of work, language and symbols, mathematical teaching concepts, selection and sequencing of subject matter, calculating devices, textbook evaluation
4. Problem solving: direct methods, indirect methods, by contradiction, mathematical induction, experimental/practice, each with examples
5. Teaching special topics: Methods, Techniques and Strategies of teaching, For examples teaching of directed numbers, sets, logic, coordinates geometry, statistics and probability, matrices and vectors, trigonometry, functions, transformations, linear programming, complex numbers, differential equations, mechanics, numerical methods, calculus
6. Assessment and evaluation in Mathematics, recreational Mathematics, implementing Mathematics club, importance of Mathematics club
7. Mathematical packages: Autograph, Mathematica, Maple

Teaching Methodologies
Lectures, seminars, individual and small group work

Instructional materials and equipment
Chalkboard, coloured chalks, OHP, screen, video camera, computers, worksheets
Assessment methods
Assignments, tests and final examination

Assessment Scheme
Written assignments 20%
Written tests 20%
Final examination 60%

Text books and journals for the course

EDU 207: Geography teaching methods

Goal
To equip students with knowledge and skills on how to teach Geography in Secondary schools forms 1 – 6.

Learning Outcomes
At the end of this course students should be able to:
   i. Discuss the nature of Geography
   ii. Discuss the aims of teaching Geography in Tanzania
   iii. Analyze the various documents produced for Geography in secondary schools – curriculum, syllabus, textbooks, teachers’ guides, and produce lesson plans and schemes of work
   iv. Select appropriate teaching and learning methods for topics being taught
   v. Produce their own teaching and learning aids and practice using them for resource-based learning
   vi. Carry out the full range of geographical skills required for secondary school Geography
   vii. Organize and manage learning outside the classroom in terms of fieldwork, visits etc., and to be able to select these methods as appropriate
   viii. Be competent in collecting, classifying and storing samples such as rocks, fossils and soils
   ix. Know how to store maps and other resources
   x. Be competent in using maps and surveying
   xi. Make their own collection of resources from a variety of sources and by improvisation
   xii. Carry out assessments of pupils using a wide range of methods, including assessment of Geographical skills.
   xiii. Plan for continuity in learning
xiv. Critically evaluate their own teaching, and develop the skills to become reflective practitioners, able to change methods and approaches as a result of evaluation

Course Contents
1. What are our experiences of Geography, what is Geography?
2. What are the aims of teaching Geography in Tanzania and elsewhere?
3. The Geography Room and its resources – an overview of resources available for teaching Geography, how to store them, guidelines for use and care of the resources
4. Analysis of curriculum documents, syllabi for Forms I-VI in terms of content and how to plan a scheme of work which integrates geographical skills applicable for various topics.
5. Practising using geographical skills in different topics
6. Producing own material for teaching and learning – posters, models, games, worksheets, collecting pictures, articles, maps, pamphlets, soil and rock specimens.
7. Develop skills in producing classroom displays. Practice using these to develop resource-based learning opportunities in selected topics
8. Plan and deliver micro-teaching sessions on a variety of topics from Form I-VI Geography using a range of teaching and learning methods selected for that topic
9. Teaching practical skills – analyzing practical skills needed in Forms I-VI Geography. Stages and methods in teaching map work.
10. Preparing resources for teaching map work. Using aerial photos and landsite photographs in schools.
11. Teaching surveying – improvising surveying equipment. Stages and methods in teaching surveying. Managing practical classes in surveying at Form I-VI
12. Organizing and managing fieldwork in the local environment for topics in physical and human geography.
13. Organizing field trips to more distant locations using the enquiry approach in fieldwork.
14. Developing an awareness of the safety, conservation and educational issues around organizing fieldwork for secondary school pupils
15. Explain and demonstrate the use of a range of strategies for teaching Geographical knowledge and understanding skills in schools.
16. Demonstrate and justify a range of techniques for assessment, recording and reporting pupils” progress.
17. Develop skills to produce a range of different assessment instruments to cover the full range of cognitive, affective and psychomotor skills needed in Geography.
18. Evaluate teaching practices and methods, using a range of different instruments. The notion of a reflective practitioner and how to develop skills of a reflective practitioner
19. Managing Geography room and resources. Exploring range of resources available from the environment, media and local communities.

Teaching Methodologies
Lectures, seminars, workshops, practical classes, micro-teaching and peer teaching sessions

Instructional Materials and Equipment
Chalkboard, OHP, screen, video player, video camera, TV, materials for improvisation of teaching aids, CD Rom and computers

Methods of Assessment
Direct observation, Oral assessment and questioning, projects and assignments, seminar presentation, micro and peer teaching
Assessment Scheme
Practical assignments 20%
Written assignments 20%
Final examination 60%

Text Books and Journals for the Course

Text Books and Journals for Further Reading

EDU 209: Educational Research Methods

Goal
To equip students with research knowledge and skills through learning of scientific research and methodologies so as to enable them address educational issues/problems in a scientific way.

Learning outcomes
At the end of this course the student will be able to:
1. Explain how research is classified
2. Distinguish the two major paradigms in educational research
3. Describe the main stages of the research process.
4. Justify the need for the researcher to review the related literature.
5. Apply appropriate research design and methodologies for the chosen project.
6. Critically evaluate the oral presentations and written projects of peers and other researchers.
7. Use various sampling methods appropriate for assignment of subjects to the sample.
8. Design and use various research instruments for data collection.
9. Develop a research proposal for his/her project.
10. Demonstrate ethical principles in research activities.
11. Apply descriptive and inferential statistics in analysis of quantitative data and qualitative techniques in analysis of non-numeric data.
12. Write a research project report and present it appropriately.

Course Contents
1. Introduction
   - Meaning of research, Educational Research
   - Classification of research by purpose and methods
2. Major paradigms in educational research
   - Quantitative paradigm, its features
   - Qualitative paradigm, its features
3. Formulation of a research problem
   - Sources of research problem
   - Research questions, objectives and hypotheses
4. Literature Review
   - Purposes of literature review
5. Research Designs
   - Experimental,
   - Quasi-experimental,
   - Survey,
   - Case Study,
   - Naturalistic,
   - Correlation design etc.
6. Sampling procedure
   - Probability and Non-probability and sub-types.
7. Developing and using various research instruments
   - Pilot-testing of research instruments (estimation of Validity and Reliability)
   - Development of research proposal - the format
8. Data collection and analysis
   - Data coding and processing
   - Use of descriptive statistics (frequency distributions, percentages, graphs, Measures of central tendency, measures of variability)
   - Inferential statistics (Chi-Square test, T-test, F-test/ANOVA)
   - Use of statistical packages in data analysis (e.g.SPSS).
   - Ethical consideration in the field
9. Writing a research report
   - Structure, writing and presentation style depending on the audience

Teaching Methodologies
Lectures and seminars

Instructional Materials and Equipment
Chalkboard, LCD projector, Statistical tables

Assessment Methods
i. Tests
ii. Observation
iii. Oral questioning.
iv. Term paper writing and presentaiton

Assessment Scheme
Written assignments 20%
Written tests 20%
Final examination 60%

Text books for the Course

Text Books for Further Reading

EDU 210: Educational Assessment and Evaluation

Goal
To equip the students with evaluation skills through the learning of various evaluation methods and techniques

Learning outcomes
At the end of the course, the student will be able to:
1. Define the terms: Measurement, assessment and evaluation in education context.
2. Explain the various types of assessment and evaluation
3. Design and use various assessment tools in his/her subject area
4. Explain the guidelines to be followed for effective students assessment
5. Describe the procedure to be followed in the development of relevant test items.
6. Test the validity and reliability of the tests.
7. Administer and invigilate tests/examinations appropriately.
8. Score and grade learners” achievement.
9. Perform item analysis for a given test or examination.
10. Participate in test moderation and standardization process.
11. Evaluate learners” achievement and teaching effectiveness.

Course Contents
1. Definitions of terms: measurement, assessment and evaluation
2. Types assessment and evaluation
3. Procedure followed in development of test items.
5. Procedure for test/examination administration and invigilation
6. Scoring and grading learners” achievement.
7. Item analysis for a given test/examination.
8. Moderation and standardization of tests/examinations
9. Interpretation and use of examination results

Teaching Methodologies
Lecture, group discussion, seminar paper presentation.

Instructional Materials 
Handouts, LCD projector

Assessment Methods
Tests, Observation, Oral questioning, Construction of assessment tools

Assessment Scheme
Written Test 20%
Seminar paper 20%
Final Examination 60%

Text books for the course

Text Books for Further reading

EDU 211: Curriculum Development

Goal
To introduce students to curriculum development process at a national level

Learning outcomes
At the end of the course, the student will be able to:
1. Explain the term curriculum and curriculum related terms or concepts.
2. Distinguish the various curriculum dimensions
3. State the relationship existing among the curriculum elements
4. Describe the main stages of curriculum development process.
5. Illustrate and critique the various models for curriculum development.
6. Describe curriculum design
7. Explain the activities involved in curriculum implementation process.
8. Describe the role of various agents of curriculum implementation.
9. Discuss the barrier factors to effective implementation of a curriculum or educational programme.
10. Explain factors influencing curriculum reforms in various countries.
11. Discuss the role of evaluation in curriculum development process.
12. Describe the steps in curriculum evaluation process.
14. Evaluate selected curriculum support materials and educational training/workshops

**Course Contents**
1. Introduction: Meaning of curriculum and related terms/concepts
2. Curriculum elements and their relationship
3. Curriculum development process: Main stages
4. Curriculum development models-Strengths and weaknesses
5. Curriculum designs
6. Curriculum implementation process: Stages and activities involved
7. Curriculum implementation agents
8. Factors which affect effectiveness of curriculum implementation
9. Factors influencing curriculum reforms
10. Curriculum evaluation and its functions: Role of evaluation in every stage of curriculum development process
11. Curriculum evaluation instruments: Aspects evaluated and criteria in a variety of selected curriculum materials (textbooks, teacher’s guide, syllabus)

**Teaching Methodologies**
Lecture, Group presentations, guest-speaker

**Instructional materials**
Handouts, LCD projector

**Assessment Methods**
Tests, Observation, Oral questioning, Term paper writing and presentation.

**Assessment scheme**
Written Test 20%
Seminar paper presentation 20%
Final Examination 60%

**Text Books for the Course**

**Text Books for Further reading**

**EDU 301: Sociology of Education**
Goal
To introduce the student into Sociology of Education in terms of content, methods and application to education.

Learning Outcomes
At the end of the course the student will be able to:
1. Define Sociology and explain its origin, development and divisions.
2. Describe the subject matter of Sociology of Education.
3. Explain the importance of Sociology to the education system.
4. Explain the ways in which the education system in Tanzania has been shaped by the ideas of prominent sociologists.
5. Critically evaluate sociological theories influencing the educational system.
6. Analyze issues that Sociology of Education addresses the relation between education and culture.
7. Demonstrate an understanding of the role of education in social mobility and stratification.

Course Contents
1. Meaning of Sociology, its development and classifications.
4. Issues in Sociology of Education
5. Education and the socialization process – socialization function of the teacher in the classroom.
6. Agents of socialization.
7. Culture and education.
8. Education and social mobility and stratification.

Teaching Methodologies
Lectures, critical group discussions, seminars, presentations.

Instructional material
Chalkboard, OHP, video films, charts.

Assessment methods
Observation, oral/written questions during the lesson, worksheets, quizzes and tests, take-homes for presentation

Assessment scheme
20% Written assignments
20% Written tests
60% Final examination

Textbooks for the Course
Text Books for Further Reading

EDU 302: Educational Planning and Economics

Goal
To equip the learners with practical and realistic approaches to educational planning which will enable them appreciate the factors that affect demand for supply of education

Learning outcomes
At the end of the course the student will be able to:-
1. Demonstrate knowledge, skills of efficient and effective planning.
2. Critically evaluate the efficiency and effectiveness of each planning approach for the formulation, implementation and appraisal of educational plans.
3. Formulate a strategic plan for educational institutions
4. Describe the importance of the development of human capital, demand and supply of education and effect of education on distribution of income
5. Describe the role of education in socio-economic development
6. Describe the methods used in financing education, the importance of equity in distribution of resources and efficiency in education.

Course Contents
1. An overview of educational planning and economics of education
2. Functions and processes of educational planning
3. Methodologies of educational planning
4. Strategic planning process in schools
5. Development of economics of education
6. Equity issues in educational planning
7. Education and development
8. Financing education

Teaching Methodologies
Lectures and seminars, resource person, group discussion, and practicum

Instructional Materials and equipment
Chalkboard, Charts, Camera recorder, power point presentations and video

Assessment methods
Oral questions, Observation, Written question and Quizzes

Assessment scheme
1. CAT – 20%
2. Project work and/or term paper presentation – 20%
3. Examination 60%

Textbooks and Journals for the Course

**Textbooks and Journals for Further Reading**

**EDU 303: Guidance and Counselling**

**Goal**
To equip students with knowledge, understanding and skills of guidance and counselling to enable them to effectively guide and counsel secondary school students

**Learning outcomes**
At the end of this course, the student will be able to;
1. Analyse basic counselling theories
2. Explain the goals of guidance and counselling
3. Demonstrate understanding of basic guidance and counselling skills and strategies
4. Apply guidance and counselling skills and strategies to one on one, small group and whole class situations
5. Compare and contrast positive strategies for helping students function more productively
6. Critically assess guidance and counselling services and programmes in Tanzanian secondary schools
7. Develop and implement a school guidance and counselling programme to help normal and at-risk students

**Course contents**
1. Meaning of the terms guidance and counselling
2. Goals of guidance and counselling
3. Basic counselling theories
4. Counselling skills and strategies
5. Guidance and counselling services and programmes in Tanzania secondary schools
6. Development and implementation of a school guidance and counselling programme
7. Framework of Guidance and Counselling programme for students with special educational needs
8. Guidance and Counselling services:- orientation services, cognitive behaviour modification, stress and trauma management, psycho-educational counselling, self- planning, vocational guidance and counselling, behaviour modification, assertiveness training, social skill training
9. Counselling theories:- rational emotive therapy, trait-fact therapy, structural family therapy, decision-making therapy, psychoanalysis, expressive arts, client-centred therapy

**Teaching Methodologies**
Lecturing, resource people, field trips, seminars, class discussion tutorials, role-play and practicum

**Instructional Materials/Equipment**
Overhead projector, transparencies, charts, handouts, computers, Internet

**Assessment methods**
Oral questions, Observation, Written question, Quizzes

**Assessment scheme**
1. CAT – 20%
2. Project work and/or term paper presentation – 20%
3. Examination 60%

**Course books and Journals**
Journal of Counseling Psychology.

**Text books and journals for further reading**

**EDU 302: Human Behaviour and Learning**

**Goal**
To develop understanding in knowledge and skills about the changes that take place during the various stages of human development and the implications for education.

**Learning Outcomes**
At the end of the course the student will be able to:
1. Use developmental concepts in a variety of educational contexts.
2. Analyze theories of developmental psychology.
3. Assess shortcomings of applying research findings outside the cultural context in which they were developed.
4. Demonstrate a wide range of skills which enable them to apply educational psychology to the tasks of classroom management and control
5. Develop positive attitudes and values in their personal and social life.
6. Assess the effects of teacher stress and have a range of self-management strategies which allow them to manage workloads in a psychologically healthy way.

**Course Contents**
1. Basic concepts and theories in Developmental Psychology.
• Stage theories of development of cognitive, moral and social development.
• Sensitive periods of learning in development
2. Personality Theories
• Trait theories of Cattel and Eysenck.
• Psychodynamic theories of Freud, Jung and Erickson.
• Cognitive theories of Kelly and Rogers.
• Situational specificity and interactionist approaches to personality.
3. Notion of normal and abnormal development.
• Psychological health and psychopathology
• Implications for mainstream and special education
• Differences between biological determinism and interactionist and constructionist perspectives.
4. Main stages of Human Development
• Childhood
• Adolescence
• Adulthood
5. Cognitive skills and intelligence as an example of development
• Concept of intelligence and its measurement
• Sternberg and Gardner as alternative views of intelligence.
6. Limitations of findings in one cultural context being applied in another culture – how do we develop a psychology for Tanzania?
7. Whole school approach to discipline - common problems in classroom control and how to deal with them.
8. Teacher stress and self management, self concept and self esteem.

Teaching Methodologies
Lectures, practical classes, group work and seminars

Instructional material
Chalkboard, practical equipment, OHP, computers

Assessment methods
Observation, oral/written questions during the lesson, worksheets, quizzes and tests, take-homes assignments

Assessment scheme
20% Written assignments
20% Written tests
60% Final examination

Text books for the Course

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British Psychological Society website.

**EDU 305: International and Comparative Education**

**Goal**
To equip the students with the historical perspective on the Tanzanian education system and make comparisons with selected educational systems of international countries.

**Learning outcomes**
At the end of the course the student will be able to:
1. Explain the term education, aims and forms of education, and describe the structure of education in Tanzania and its evolution
2. Relate the developments in modern education in Tanzania through the different historical epochs for her existence and possible change for the future.
3. Review and critically evaluate the arguments for the different degrees of centralization and local autonomy and decision making within the context of the Tanzanian education system
4. Explain the role of different administrative agencies responsible for the provision of education in Tanzania
5. Analyze the problems facing the education system in Tanzania and suggest possible solutions
6. Define comparative education and describe its scope
7. Explain development of comparative education
8. Apply the methods used in comparative education
9. Describe different education systems of selected international countries
10. Grasp in general term the problems of cultural diversity and political unity
11. Discuss objectively the idea of equal opportunity in education and its application in various education systems
12. Describe the educational crisis and the origin of education reforms in Africa and analyze the different aspects of those reforms.

**Course contents**
1. The concept of education
   - Meaning of education, aims, forms and importance
   - Structure of education system
2. Historical perspectives in education in Tanzania
   - Education before colonialism
   - Education during colonialism
   - Education after independence
3. Centralization and decentralization of education in Tanzania
   - Historical perspectives and possible future trends
   - Critical analysis of the strengths and weaknesses of the various degrees of centralization and decentralization
4. Administrative structures for the provision and management of education in Tanzania
   - Ministry of education and vocational training (MoEVT)
   - Tanzania institute of education (TIE)
   - National examination council of Tanzania (NECTA)
   - Regional education officer (REO), District Education Officer (DEO) and Ward Educational Officer (WEO)
   - School inspectors and supervisors
5. Problems facing education in Tanzania
6. Scope, purpose and resources of comparative education
7. Development of comparative education
8. Methodology in comparative education
9. Education systems of
   • England and Wales
   • France, United States of America
   • Cuba, Korea
10. Cultural diversity and political unity
11. Equal opportunity in education
12. Education crisis in Africa
13. Educational reforms - a comparative consideration
   • Benin, Tanzania, Japan, Korea, Kenya.

Teaching methodologies
Lectures, seminars, discussions, library research and group work

Assessment methods
Observation, written exercise, homework, quiz, attitudes, questionnaire, written or oral questioning, worksheet, checklists.

Assessment scheme
Written assignments 20%
Written tests 20%
Final Examination 60%

Text Books for the course
Kuleana (1999). The state of Education in Tanzania

Text Books for Further reading
EDU 305: Management of Education and School Administration 3 Credits

Goal
To equip students with knowledge and skills that will enable them adequately examine the fundamentals of educational administration and understand the roles of middle and senior managers in school.

Learning outcomes
At the end of the course the student will be able to:-
- Assess the theoretical stances of administration and management
- Demonstrate understanding of the various forces that promote or inhibit the process of administration in various situations.
- Describe the various roles of Heads of Departments, Academic master/mistress, discipline master/mistress, Second master/mistress and Head of School, and demonstrate some of the skills needed for these roles
- Demonstrate understanding of managerial processes required for efficient school functioning, for example delegation, decision making, communication, supervision, timetabling, school calendar and forward planning, record keeping, job descriptions, management support system.
- Apply administrative skills to plan the processes and stages for managing effective change in secondary schools.
- Demonstrate the importance of personal and professional ethics in management of school

Course Contents
- An overview of administration and management
- Fundamentals of educational administration
- Theories of administration as applied to secondary school
- Leadership styles and application in school management
- Legal structures and constraints on school organization and management in Tanzanian schools – Community, Government and Private.
- Management structures and roles at different management levels in a secondary school- Head, Second master/mistress, Academic Master/mistress, Head of Department etc.
- Effective delegation, decision making, supervision and communication in schools

- School records
- Ethically based management systems and the role of professional ethics in well-managed schools
- Contemporary issues in educational administration i.e. women in management, performance contracts, discipline, and strikes

Teaching Methodologies
Lectures and seminars, visits to schools, visiting speakers, and role-plays, simulations and problem-solving and student presentations.

Instructional Materials and equipment
Chalkboard, Charts, PowerPoint presentations, Camera recorder and video

Assessment methods
Oral questions, Observation, Written question, Quizzes

Assessment scheme
1. CAT – 20%
2. Term paper presentations – 20%
3. Final Examination 60%

Course books and Journals
British Journal of Educational Studies

Books and journals for further reading

EDU 307: Research Project
Prerequisite Course: EDU 210

Goal
To provide students with the opportunity to demonstrate understanding and skills obtained in research methods in addressing educational problems scientifically

Learning outcomes
At the end of this course the student will be able to:
1. Identify and conceptualize a research problem
2. Carry out literature analysis and identify research gap
3. Use a relevant design for his/her research study
4. Design valid and reliable instruments for his/her research study
5. Describe sampling methods used in his/her research work
6. Explain procedure used for data collection
7. Use various quantitative and qualitative techniques in data analysis
8. Write a sound project report by applying knowledge and skills obtained in the course EDU 210.
9. Deliver an oral presentation of the research project report.

Course Contents
1. Background of the problem
2. Reviewing the related literature.
3. Research Designs
4. Research instruments
5. Sampling methods
6. Data collection procedure
7. Data analysis techniques
8. Research report writing

NB: Each student will conduct a research project under the guidance of a research supervisor following the guideline and format used in Education department.

Teaching Methodologies
Lectures/tutorials

Instructional Materials and Equipment Chalkboard, LCD projector, Statistical tables

Assessment Methods
i. Observation
ii. Oral questioning.
iii. Project proposal and report

Assessment Scheme
Written project report 100%

Text Books for the Course

Text books for further reading
GENERAL COMMON CORE COURSE

First Year:

GST 101: Basic Computer Applications Programs  3 Credits
Prerequisite courses: None

Goal
To equip the student with basic knowledge and skills of Information and Communication
Technology (ICT)

Learning outcomes
By the end of this course the student should be able to:
   i). Operate computer safely
   ii)...Compose letters, worksheets and handouts
   iii). Create teaching aids such as posters
   iv). Design an e-teaching sequence with a sophisticated presentation program
   v). Create, register, mark books etc. by using spreadsheet program
   vi). Present and analyze information/problem using chart and/or graphs
   vii). Demonstrate understanding on emailing to communicate and exchange documents.
   viii). Use the internet to search for genuine information and images and transfer them to
          a document
   ix). Demonstrate a moral and ethical approach to the use of ICT technology.

Course content
  1. Introduction to computer:
     • Opening/shutting down computer safely, create folder, renaming, cut, paste,
       delete, move, save the document accordingly.

  2. Microsoft Word:
     • Formatting text and use variety of tools in toolbar i.e. font and paragraph,
       Insert and formatting various items like tables, pictures, chart, text box,
       word Art etc. Change page layout like orientation, color, border etc.

  3. Microsoft PowerPoint:
     • Design slides with different background style, color, theme, Editing slide
       appropriately, Insert charts, graph, clip art, text box, word art and drawing
       different shapes, Use different animation and run the presentation

  4. Microsoft Excel:
     • Basic spreadsheet i.e. sort, text wrapping, merge cells, Insert& deleting
       rows/columns etc, Format cell accordingly i.e. border, fill color etc. Design
       simple formula/ function to solve a particular problem., Use chart/ graph to
       analyze the problem

  5. Internet and Searching:
     • Creating email address and use them to communicate, Emailing including
       attaching files, Searching for information/image safely, Use MARUCO
       website and other educational platforms to access learning materials, Impact
       of internet technology( viruses, untrusted information, pornography etc)
Teaching and learning methodologies Lectures,
e-teaching, e-learning, group coaching

Instruction materials and Equipment
Desktop or laptop computer, digital projector, memory sticks, software tools, internet access, educational platform BSCW and MARUCO eCampus. Manuals and work sheets

Assessment schemes
40% Course work
60% Final Examination

Text Books and Journals for the Course

Text Books and Journals for Further Reading

**Ms Word**

**Ms PowerPoint**

**Ms Excel**

**Internet and Searching**
Computer Training Ltd.

**GST 102: Communication and Academic Skills  3 Credits**

*Prerequisite courses: None*

**Goal**
To develop the students oral and written English language communication skills required for university study and instruction in secondary school

**Learning outcomes**
By the end of this course the student should be able to:
i). Effectively manage his/her time, stress, study and examinations  
ii). Organize and use the best environment for study  
iii). Practice the basic elements of good communication  
iv). Efficiently use the library and assess text books and dictionaries  
v). Take meaningful notes from lectures, books and use the APA system for citation  
vi). Identify plagiarism and how to avoid it  
vii). Adapt the reading, listening and speed strategies  
viii) Follow the writing process for assignment writing  
ix). Construct a good sentence and a good paragraph  
x). Use grammar properly  
xi). Practice and develop public speaking and listening skills  
xii). Compose and write well-organized business letters

**Course content**

1. **Management of stress and time**
   - Stress: how to relax, how diet and exercise affect stress, how to avoid procrastination
   - Time: tips for effective management

2. **Examinations**
   - Reducing examination stress and maintaining mental health
   - Guidelines before and during examinations-choosing questions, planning, timing,
   - Interpreting and answering examination questions more efficiently and key words.
   - Organizing answers according to types of questions

3. **How to study**
   - The best environment and equipment for studying. How to use worry pad. Strategies to encourage concentration. Pacing study time and taking breaks.
   - Metacognition. Skills of metacognition and applying them to learning

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4. Introduction to communication skills
   - Meaning of communication skills
   - Features of communication in English
   - Effective use of communication skills in English
   - Non-verbal and visual communication techniques—sign language and body language.

5. Using books
   - Strategies for effective reading: skimming, scanning and SQ3R
   - Surveying text for their usefulness and relevance to purpose: title, blurb, publication details, preface, contents, index, references, bibliography

6. Note taking
   - Strategies for effective note taking—lists, diagrams, layout of page (Cornell system), use of abbreviation, summarizing synthesis, key words.
   - Note taking techniques
   - Note taking in lecture and speeches
   - Note taking from books
   - Characteristics of good notes
   - Documentation of sources using APA
   - Plagiarism and why it must be avoided at all costs

7. Reading skills
   - Further reading and understanding of different genres and diverse texts, particularly subject specific text
   - Individual reading practice
   - Understanding technical vocabulary

8. Listening skills
   - Listening comprehension
   - Listening for gist
   - Accuracy in listening and giving feedback
   - Understanding formal and informal speech
   - Intensive listening

9. Writing and oral assignment
   - The writing process
   - Identification of main types of essays
   - How to write term paper, presentation papers, seminar papers
   - Platform and oral skills for seminar presentations—presentation, discussion, voice, body language, controlling nervousness

10. Sentence and paragraphs
    - Features of a good sentence/good paragraph
    - How to construct a good sentence/good paragraph
11. Grammar
- Parts of speech
- Punctuation marks
- Verb tenses and subject verb agreement
- Articles

12. Oral skills
- Presentation: confidence building, public speaking, formal presentation
- Pronunciation: pitch, intonation, tone and stress patterns
- Conversation: tag question and echo tags
- Discussion: undergraduate level discussion
- Academic discourse. Subject specific vocabulary

13. Business letter writing
- Need for a business letter
- Kinds, format, features and functions of a business letter.

Teaching methodologies
Lectures, practical activities

Instructional materials and equipment
Chalkboard, OHP, computer with LCD projector for power point demonstrations, exercises

Assessment methods
Observation, written exercises, homework, quiz, attitudes, questionnaire, written or oral questioning, worksheet, checklists.

Assessment scheme
Practical assignment 40%
Final examination 60%

Text Books and Journals for the Course

Text Books and Journals for Further Reading
Second Year

GST 201: Social and Professional Ethics  3 Credits
Prerequisite courses: None

Goal
To equip the student with ethical concepts and principles for dealing with the rapid social changes, the ingredients of professional ethics of the society provide a forum to discuss the ethical basis of a code of conduct for professionals as well as the importance of being models of behaviour for other people in the society.

Learning outcomes
By the end of the course the student should be able to:
  i. Define ethics and explain basic ethical terms such as ethos, goodness, and happiness
  ii. Explain the characteristics of a good society and State
  iii. Examine the main implications of ethical theories and demonstrate an understanding of the importance of the good life both for the individual and society
  iv. Relate between a code of ethics and professional conduct
  v. Explain why certain acts are unacceptable within the context of a code of professional conduct
  vi. Explain situations that need to be analysed in terms of professional ethical issues in the society
  vii. Analyse the role of professionals in defending the rights of individuals within the society
  viii. Define the concept of professionalism in education and analyse some of the factors that can lead to corruption within educational systems and institutions
  ix. Develop moral and professional values: honesty, tolerance, respect, fear of God and other social values.

Course Content
2. Basic Ethical concepts – ethos, conscience, happiness, hedonism, virtue, value.
3. The meaning of a good act; discussion of hedonism, utilitarianism, happiness, a good society, a good State, ingredients of a civil society, the person and society and various ethical theories
4. Sexuality and family life; authority and obedience in social context; some principles of social order
6. Work and the meaning of work ethic, Duties of workers
7. Case study: Professionalism: rise and fall of professionalism in Tanzania
8. Code of ethics and conduct for public service in Tanzania
9. Confidentiality and honesty in personal and professional life

Teaching Methodologies
Lectures, group discussions and class presentation, visiting educationalists

Instructional Materials
Chalkboard, OHP, video player and TV
Methods of Assessment

Observation, oral/written questions during the lesson, worksheets, quizzes and tests, take-home for presentation.

Scheme of Assessment
20% Written assignments
20% Written tests
60% Final examination

Text Books and Journals for the Course

Text Books and Journals for Further Reading

GST 202: Development Studies 3 Credits
Prerequisite courses: None

Goal
The goal is to equip the student with basic knowledge of the development process in Tanzania and make him/her realise how education has been a tool to save it.

Learning outcomes
By the end of this course the student should be able to:
1. Discuss development issues and be able to teach a topic on development in General Studies in Secondary Schools
2. Account for the impact of science and technology in improving human resources and needs
3. Analyze the factors socio-economic development influencing a developing country-Tanzania.
4. Evaluate political and economic decisions made in Tanzania and other countries with respect to development
v). Critically appraise the effectiveness of multinational corporations and NGOs working in Tanzania and international organizations.

vi). Discuss and evaluate gender issues.

vii). Discuss and analyze the impacts globalization in terms of socialist/market economies.

viii). Explain economic production and appreciate the importance of work in development.

ix). Define investment and explain challenges faces by both public and private investments.

x). Explain how international cartels operate.

xi). Classify different forms of government and analyse the constitution of United Republic of Tanzania.

xiii). Describe how a local governments functions and its challenges.

xiiii). Elaborate the duties and rights of a citizen.

xiv). Tolerate and respect others.

xv). Analyse and compare parliamentary systems of Tanzania, USA, UK.

xvi). Explain the composition and structure of the executive and how it functions.

xvii). Demonstrate the basic legal proceedings in criminal justice process.

xviii). Define democracy and assess its applicability in democratic activities.

xix). Discuss the steps in carrying out elections and challenges involved in this process.

xx). Explain the role of mass media in developing Tanzania.

xxi). Apply the basics of management and conservation of our environment.

**Course Contents**

1. The nature of development.
2. Human needs, resources for development, science and technology appropriate for development, economic surplus.
3. Socio-economic development in Tanzania
   - Health and Disease control;
   - Reproductive Health and Related services, STD, HIV/AIDS.
   - Population dynamics.
5. Role of local and international organisations
   - U.N.
   - NGOs, local and international
   - CBOs
   - GATT World Bank, IMF.
6. Gender Issues and women empowerment.
8. Economic production.
10. International trade.
    - Regional integration- SADC/OAU
    - International co-operations- foreign policy, international peace and understanding, UNO.
11. Government
    - Forms and branches of government
    - The constitution of Tanzania
    - Political pluralism.
12. Local government.
13. Citizenship and civil rights.
14. Family and parenthood.
15. Parliament - role of parliament, opposition parties in parliament
16. The executive
17. The Judiciary
18. Democracy
19. Elections in Tanzania
20. Mass media
21. Environmental education

**Teaching Methodologies**
Lectures, Class discussions, Guest Speakers, tour visits, presentations, group work.

**Instructional Materials and Equipment**
Chalkboard, chalks, CD ROM, OHP, video player and TV. Newspapers, magazines and journals

**Methods of Assessment**
Observation, written exercises, homework, quiz, attitudes, questionnaire, written or oral questioning, worksheet, checklists.

**Scheme of Assessment**
Written essay 20%
Seminar paper 20% Final examination 60%

**Text Books and Journals for the Course**
2. General Studies Module-TIE DSM

**Text Books and Journals for Further Reading**
3. The Guardian Weekly: *Feature Essays on Related Topics*