UNIVERSITY OF PERADENIYA

FACULTY OF SCIENCE

COURSE UNIT SYSTEM

- Rules and Regulations
- Syllabi of Courses

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COURSE UNIT SYSTEM AT THE FACULTY OF SCIENCE

The Faculty of Science conducts courses under a semester based course unit system and the details are given below.

1. THE MEANING OF SOME OF THE FREQUENTLY USED TERMS

   **Semester:** An academic year is divided into two semesters, identified as the first semester and the second semester of a particular year such that each semester is of 15 weeks duration.

   **Course Unit:** This is a complete course taught within a semester with one or more contact hours per week. A contact hour is defined as an hour of lectures, practical, tutorials etc.

   **Levels:** Undergraduate courses will be conducted at 4 levels, namely 100 level, 200 level, 300 level and 400 level. The subject matter in courses gets progressively advanced as the levels go higher. However a student in any academic year may register for any course unit at any level, subject to the availability of space and conditions spelt out later in this document. The course units at 500 level or higher, although designed for postgraduate students, may be offered by undergraduate students with the approval of the Head of the relevant Department.

   **Credit:** The abstract value assigned to a course unit on the basis of contact hours per week is called a credit. Usually, one credit is equivalent to 15 hours of lectures and/or tutorials or 30 - 45 hours of laboratory work, field classes etc. conducted in a single semester. Course units of one credit, two credits and three credits will be available. The contents of a three credit course unit for example will be approximately three times that of a course unit of one credit.

   **Grade Point:** The range of marks is partitioned into a sequence of suitable sub-ranges (as decided by the Faculty) and the sub-ranges are designated by the symbols $A^+, A, A-, B^+, B, B-, C^+, C, C-, D^+, D$ and $F$. These are called grades and grade points are assigned according to the following table:

<table>
<thead>
<tr>
<th>Grade Point</th>
<th>Grade</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A^+$</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>$A^-$</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>$A$</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>$B^+$</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>$B$</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>$B^-$</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>$C^+$</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>$D^+$</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>$D$</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>$F$</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

   (Note: $A^+$ and $A$ have the same grade point)

   **Grade Point Average (GPA):** This is the credit weighted mean of grade points obtained by a student for the course units he/she has offered. It is calculated to the second decimal place and is an indicator of the academic performance of the student.

   **Independent Study:** A study done by a student by means of research or by reading independently on a specific topic on the recommendation and guidance of a senior academic is termed an independent study. Provision for such courses will be available only at 400 and higher levels.

   **Non Credit Courses:** A student may offer courses in addition to his normal course unit requirements with the consent of the instructor. The Faculty may also offer non-credit courses as part of its programme. These will not be considered in fulfillment of the requirements for the degree programme. Non-credit courses provide an opportunity to students to offer courses that arouse their interests and enhance their knowledge. No grade is given for such courses and these courses will not appear in the transcript.

   **Prerequisites:** The subject matter in a course unit at a lower level is sometimes essential to follow a course unit at a higher level. The course unit at the lower level so needed is called a prerequisite of the course unit at higher level. A student is required to obtain at least a $D$ grade for each of the prescribed prerequisite course units (if any) before offering the higher-level course unless this requirement is waived by the department offering the higher level course. Each department will announce at the beginning of the academic year the courses it will offer and their prerequisites.

2. ORGANIZATIONAL DETAILS

   I. The Faculty conducts courses on a semester basis. The medium of instruction shall be English. Students can seek the assistance of academic advisors who will help him/her to select appropriate subject combinations. Students are responsible for planning their programmes, but they will be guided by advisors to select course units required for the degree programme.

   II. Each department will use a two-letter prefix together with a three-digit number to identify the course units offered by that department. The first two letters will indicate the department/subject while the three digit number will indicate the level.

   For example, a 100 level course unit offered by the Department of Geology may be named as GL101.
III. The Head of a Department will advise the students on the mode of selection of the appropriate course combinations for a Special Degree programme.

IV. There will be a minimum and a maximum number of students that could be accommodated in a given course. The department having taken into consideration the nature of the course unit, the departmental needs and facilities shall decide on these numbers.

V. Grades for course units should be given within eight weeks of holding final examinations. Each department is responsible for conducting the relevant assessments and the final examination.

3. TYPES OF COURSE UNITS AND SUBJECTS

Course Units are derived from the following categories:

I. Foundation Courses
II. Principal Subject Area
III. Supplementary Subject Area
IV. Applied Sciences Subject Area
V. Statistics and Operations Research Subject Area
VI. Computation and Management Subject Area
VII. Inter-Faculty Courses

I. Foundation Courses (available only at 100 level)

Foundation courses are compulsory for all students. They comprise of courses on English Language and Computer Applications each carrying 2 credits, a course on basic Biology or Mathematics also carrying 2 credits and a non-credit course on Introduction to Science and Society (SE 100). Those who have entered in the Science stream and have not offered Combined Mathematics or Mathematics at the G.C.E. (Advanced Level) Examination shall offer Mathematics for Biological Sciences (MT 100), while those who have not offered Biology at the G.C.E. (Advanced Level) Examination shall offer Basic Life Sciences (BL 100). Students admitted to the Computation and Management Course from the G.C.E. (A/L) Arts, Commerce or Biological Sciences streams shall offer Foundation Course in Mathematics (MT 120) while those from the Physical Science stream shall offer Culture and Environment 1 (FND 104) as Foundation Courses, they are not required to follow SE 100. The grades earned in foundation course units will not be counted in the computation of GPA.

Eventually, each department may conduct a basic course unit in the relevant subject for the benefit of those who have wider interests and for those who have not offered that subject at the G.C.E. (Advanced level) Examination.

II. Principal Subject Area

100 level courses

Course units in the following subjects will be available at the 100 level

<table>
<thead>
<tr>
<th>Subject</th>
<th>Biology I</th>
<th>Computer Science</th>
<th>Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biology II</td>
<td>Geology</td>
<td>Statistics</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Mathematics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

200/300/400 level courses

Course units in the following subjects will be available from the 200 level onwards.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Botany</th>
<th>Physics</th>
<th>Zoology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>Mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Science</td>
<td>Molecular Biology &amp; Biotechnology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geology</td>
<td>Mathematics</td>
<td></td>
<td>Statistics</td>
</tr>
</tbody>
</table>

III. Supplementary Subject Area

The course units in the following subjects will be offered depending on the availability of resources.

200/300 level courses

<table>
<thead>
<tr>
<th>Subject</th>
<th>Biology</th>
<th>Computer Science</th>
<th>Economics</th>
<th>Electronics</th>
<th>Environmental Science</th>
<th>Food Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomy</td>
<td></td>
<td>Gemmology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Computing</td>
<td></td>
<td>Geographical Information Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economics</td>
<td></td>
<td>Management Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronics</td>
<td></td>
<td>Materials Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Science</td>
<td></td>
<td>Science Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IV. Applied Sciences Subject Area (available only at 400 level)

Industry related course units, which are generally available only to students extending their General degree Course by a fourth year and offering the Applied Science Degree Programme.

V. Statistics and Operations Research Subject Area

Course units which are available to students admitted for the Statistics and Operations Research course from a separate window by the University Grants Commission (UGC).

VI. Computation and Management Subject Area

Course units which are being offered jointly by the Faculty of Science and the Faculty of Arts and are available at either Faculty to students admitted for the Computation and Management course from a separate window by the UGC.

VII. Inter-Faculty Courses

Course units offered by another faculty of this university may also be selected by the students provided these courses are approved by the Faculty Board of the Faculty of Science as suitable for the course offered by the student.

4. TYPES OF UNDERGRADUATE DEGREES AWARDED

The Faculty conducts Bachelor of Science (B.Sc.) General Degree programmes and B.Sc. Special Degree Programmes in most of the Principal Subjects. Initially, a student registers for a general degree programme, and at the end of the second year, he/she may continue to follow the general degree programme or register for a special degree programme in a principal subject. The second option is possible only if he/she fulfills certain criteria as stipulated in the section "Criteria for Selection to a Special Degree Programme". The duration of a general degree programme is normally three years, while that of a special degree programme is four years. General degree students may at the end of 3rd year be selected based on performance and given the option of following courses for an additional year with special emphasis on industry-related courses leading to a B.Sc. degree in Applied Sciences in place of a General Degree. The Faculty also conducts four year B.Sc. degree programmes in Computation and Managements (jointly with the Faculty of Arts) and in Statistics and Operations Research for students admitted from a separate window.

5. SELECTION OF COURSE UNITS

The course units offered by each department will be available at the beginning of each semester, and the students are required to register using the appropriate form on or before a date specified by the Faculty. Late registrations may be accepted under exceptional circumstances at the discretion of the Faculty on payment of the prescribed fine. In each academic year, a student must register for not less than 27 and not more than 33 credits, excluding course units which are being repeated. Academic advisors will help students to select course units judiciously. Once the course units are selected, the students shall register for each course unit thus selected at the beginning of the semester and he/she can offer only these course units to earn credit.

During the first year, students other than those who have been admitted from a separate window shall select three subjects from the principal subject area and select the course units coming under these subjects. Students should follow all the components of the selected subjects, i.e. theory, practicals, field work etc. During the second year of the degree programme, students shall select at least two subjects from the principal subject area at 200 level (refer to the “Requirements to Pass the General Degree”). The remaining credits require, if any, shall be selected from the other subjects in the principal subject area/supplementary subject area. During the third year of the general degree programme, the students shall select the respective course units at 300 level as in the second year. In case a student selects only two principal subjects, he/she should select at least 6 credits each at 200 and 300 levels from principal subject area/supplementary subject area other than course units from the two principal subjects.

General degree students who at the end of 300 level are selected to the fourth year of the programme leading to the B.Sc. degree in Applied Sciences shall select 30 credits at the 400 level from the Applied Sciences subject area. The 30 credits shall include a four month 8 credit industrial training course in industry.

During the third and fourth years of the special degree programme, the students shall select course units from the subject of specialisation at 300 and 400 levels, so that their credits will add up to at least 12 per semester. The relevant department may specify the remaining course units that should be offered. Further, the special degree students will do a research project, in addition to following course units, which will carry a maximum of 6 credits.

Students following the Statistics and Operations Research or the Computation and Management degree programmes shall select course units specified for these programmes.
6. ASSIGNMENT OF GRADES, GRADE POINTS AND GPA

The grades submitted by the instructor will be reviewed by a three member committee comprising of the Head of the Department, instructor and another faculty member. The Head of the Department will submit the grades obtained by the students for all the course units under his purview to the Dean's Office. The GPA of each student is calculated using the formula \( \text{GPA} = \frac{\Sigma c_i g_i}{\Sigma c_i} \), where \( c_i \) and \( g_i \) are the number of credits and the grade point for the \( i^{th} \) course unit respectively.

Other Types of Grades

I. Grade W: Withdrawal from a course unit within the first two weeks of registration is allowed provided that the minimum credit requirement is not violated. Withdrawals after this period cannot be effected, except on medical grounds or other valid reasons. These courses will be assigned a grade W. Failure to complete a course unit, which has not been recorded as a withdrawal, will be graded as F.

II. Grade I: A grade I may be given, if the student was unable to complete the course due to acceptable reasons, and the work in the course unit is sufficiently completed and of good quality. Records should be kept in the respective department regarding the reasons for this grade and a scheme for its removal. A student should remove the grade I within one year of its recording. If the student fails to upgrade the grade I at least to a grade D, within the stipulated time, the Dean will declare that it is changed to a grade F. If the grade I was given because the student was unable to sit the final examination, he/she may be allowed to upgrade it by sitting the examination at a later stage with the approval of the relevant instructor in consultation with the department.

7. EVALUATION PROCEDURE

The assignment of the grades for a course unit is the responsibility of the Instructor who in consultation with the Head of the Department shall announce, at the commencement of the course unit, how the course unit will be evaluated. A course unit may be evaluated by means of assignments, quizzes, mid-semester and end-semester examinations, etc. There will be no second marking or rescrutiny of answer scripts at any level.

To earn credit for a course unit, the student should obtain at least a D grade for that course unit.

8. ATTENDANCE AND REPETITION OF A COURSE UNIT

University regulations require 80% attendance for all components of a course. Absence on medical grounds or any other valid reason must be approved by the Faculty Board. The instructor should report to the Head of the Department, the names of students, who are excessively absent. The Department will decide whether the missed work/examination could be made up. Where absence from classes of a course is not approved, such courses will be graded F.

A student who obtains grades of \( D^+ \), D or F for a course unit may (i) follow that course unit again or (ii) may take part in the mid-semester and final examinations of that course unit again (i.e. mid-semester and final examinations), in order to improve his/her grade. For this purpose only three more attempts will be given and the maximum grade given shall be a grade C. However, repeat candidates will not be allowed to attend practical classes. They may be allowed to sit a repeat practical examination.

9. CRITERIA FOR SELECTION TO THE APPLIED SCIENCES DEGREE PROGRAMME

The Applied Sciences Degree programme will be offered to a restricted number of students as decided by the Faculty. Selection of students for this four year degree programme shall be made at the end of the third academic year from students admitted to the General Degree programme. The minimum requirements necessary to apply for selection to the Applied Sciences degree programme are:

I. Satisfy requirements 1, 2 and 3 given under the section titled “Requirements to Pass the General Degree”

II. At least a GPA of 2.75.

Students selected for the Applied Science Degree programme must be prepared to undertake four months industrial training in any part of the island at the discretion by the Faculty. They will not be eligible for financial assistance or University Hall accommodation during the fourth year.

10. REMOVAL/WITHDRAWAL FROM THE APPLIED SCIENCE DEGREE PROGRAMME

In the event a student wants to opt out from the applied sciences degree programme he/she may inform the Coordinator of his/her decision before the beginning of the second semester of the 4th year. Performance of such students will be considered for the award of a General degree under the section titled “Requirement to Pass the General Degree” at the next meeting of the Board of Examiners.
11. CRITERIA FOR SELECTION TO A SPECIAL DEGREE PROGRAMME

Selection of students to opt for a special degree programme shall be made at the end of the second academic year. The students may apply to follow a special degree programme in any one of the following principal subjects: Botany, Chemistry, Computer Science, Geology, Mathematics, Molecular Biology and Biotechnology, Physics, and Zoology.

The minimum requirements necessary to be apply for selection to the special degree programme are:

I. At least a GPA of 2.5 from the 100 and 200 levels in the selected subject of specialization.
II. At least 16 credits for course units (32 credits for Mathematics) from the subject of specialization of which at least 8 credits (16 credits for Mathematics) should be at the 200 level.
III. At least grade C for each of the foundation courses offered.

Course units from Biology I can be counted as 100 level course units under Botany. Course units from either Biology I or Biology II can similarly be considered for Zoology.

12. REMOVAL/WITHDRAWAL FROM THE SPECIAL DEGREE PROGRAMME

In the event a student wants to opt out from a special degree programme he/she may inform the relevant Head of Department before the beginning of the second semester of the third academic year and revert to a general degree programme. On the other hand, if the department of study finds in the first semester of the third academic year that a student is unable to reach the expected standards stipulated by the Department to follow the special degree programme he/she will be required to revert to a general degree programme. In such cases the course units followed under the subject of specialization will be considered as those from a principal subject.

13. REQUIREMENT TO PASS THE GENERAL DEGREE.

The Board of Examiners will meet to consider the performance of the candidates. To pass the General Degree, candidates have to fulfill the following four requirements:

I. Obtain at least grade C for the three foundation courses
II. At least 84 credits (excluding those for foundation courses) with the following minimum credit requirements:

   24 credits from each principal subject should be earned by selecting courses subject to a minimum of eight credits at 100 level, eight credits at 200 level and eight credits at 300 level. The remaining requirements can be met by following courses in another subject or by taking a number of courses in different subjects. Students who offer only two principal subjects should offer a minimum of 6 credits each at 200 and 300 levels from principal subject area/supplementary subject area other than course units from the two principal subjects. Not more than 12 credits are allowed from the supplementary subject area.

   In the case of Botany, course units from Biology I can be counted as 100 level course units under Botany. Similarly for Zoology, course units from either Biology I or Biology II can be considered for Zoology.

III. Obtain at least grade C for course units whose credits will add up to 72 (excluding those for foundation courses), and at least grade D for the remaining course units.
IV. Obtain at least grade D in the compulsory course units specified for the General Degree in the Principal subjects offered.
V. Obtain a GPA of at least 2.0

Note: (i) Grades obtained by a student for all the course units offered by a student except foundation courses subject to the requirements stipulated in II above shall be considered in the computation of the final GPA.
(ii) Students who fulfill all the above requirements may apply for the award of the Bachelor of Science Degree (General Degree).
(iii) A student who has not fulfilled any of the above requirements may repeat the course units in order to fulfill the requirements.
14. AWARD OF HONOURS FOR THE GENERAL DEGREE PROGRAMME

A student who has fulfilled all the conditions stipulated in “The requirements to pass the General degree” shall be awarded honours, if he/she fulfills the following additional requirements:

First Class
(i) GPA of 3.75 and over
(ii) At least grade C for all the course units whose credits will add up to at least 80
(iii) Completion of the degree programme within three years

Second Class
(i) GPA of 3.30 – 3.74
(ii) At least grade C for all the course units whose credits will add up to at least 72
(iii) Completion of the degree programme within three years

15. REQUIREMENT TO PASS THE APPLIED SCIENCES DEGREE

The Board of Examiners will meet to consider the performance of the candidates to pass the Applied Sciences Degree, candidates have to fulfill the following requirements:

I. Obtain at least grade C for the three foundation courses.

II. At least 84 credits (excluding those for foundation courses) from the 100, 200 and 300 levels together with the compulsory courses as specified in Section 13 (Requirements to Pass the General Degree Examination)

III. An additional 30 credits at 400 level from the course units in the Applied Sciences subject area including the compulsory courses and the industrial training component.

IV. Obtain at least grade C for course units whose credits will add up to 102 (excluding those for foundation courses), and at least grade D for the remaining course units.

V. Obtain at least grade C for the industrial training component.

VI. Obtain a GPA of at least 2.0.

Note:
(a) Grades obtained by a student for all the course units offered by a student except foundation courses and the industrial training component subject to the requirements stipulated in II and III above shall be considered in the computation of the final GPA.

(b) Students who fulfill all the above requirements may apply for the award of the Bachelor of Science Degree in Applied Sciences.

(c) A student who has not fulfilled the requirements at 400 level will be considered for the Bachelor of Science Degree (General Degree) using the criteria in Section titled Requirement to Pass the General Degree.

16. AWARD OF HONOURS FOR THE APPLIED SCIENCES DEGREE PROGRAMME

A student who has fulfilled all the conditions stipulated in “The requirements to pass the Applied Sciences degree” shall be awarded honours, if he/she fulfills the following additional requirements:

First Class
(i) GPA of 3.75 and over
(ii) At least grade C for all the course units whose credits will add up to at least 110
(iii) Completion of the degree programme within four years

Second Class
(i) GPA of 3.30 – 3.74
(ii) At least grade C for all the course units whose credits will add up to at least 102
(iii) Completion of the degree programme within four years

Award of honours will be decided by the Board of Examiners using the above criteria as guidelines.
17. REQUIREMENTS TO PASS THE SPECIAL DEGREE

The Board of Examiners will meet to consider the performance of the candidates. To pass the Special Degree, the candidates have to fulfill the following requirements:

I. Obtain at least grade C for the three foundation courses.

II. At least 114 credits (excluding those for foundation courses) with the following minimum credit requirements:

   105 credits from the Principal Subject Area with at least 72 credits from the subject of specialisation including courses in other subject areas specified by the department of study, such that a minimum of 48 credits are from course units at 300 and 400 levels. Not more than 12 credits are allowed from supplementary subject area.

   Course units from Biology I can be counted as 100 level course units under Botany, while course units from either Biology I or Biology II can be considered as 100 level course units for Zoology. Course units from Chemistry and from Basic Biology course unit, BL 101 from Biology I can be considered for Molecular Biology and Biotechnology

III. Obtain at least grade C for course units whose credits will add up to 108 (excluding those for foundation courses), and at least grade D for the remaining course units.

IV. Obtain at least grade D in the compulsory course units specified for the General Degree for the Principal subjects offered at 100 and 200 levels and the compulsory course units specified for the Special degree in the subject of specialization.

V. Obtain at least grade C for the research project.

VI. Obtain a GPA of at least 2.0.

Note: (a) Grades obtained by a student for all the course units offered by a student except foundation courses subject to the requirements stipulated in II above shall be considered in the computation of the final GPA.

(b) Students who fulfill all the above requirements may apply for the award of the Bachelor of Science (Special Degree).

(c) A student who has not fulfilled any of the above requirements may repeat the course units in order to fulfill the requirements.

18. AWARD OF HONOURS ON COMPLETION OF THE SPECIAL DEGREE PROGRAMME

A student who has fulfilled all the conditions stipulated in "The requirements to pass the Special Degree” shall be awarded honours, if he/she fulfills the following additional requirements:

First Class
(i) GPA of 3.75 and over
(ii) At least grade A for at least half the 300 and 400 level course units and at least grade C for the remaining 300 and 400 level course units
(iii) Completion of the degree programme within four years

Second Class (Upper Division)
(i) GPA of 3.30 - 3.74
(ii) At least grade B for at least half the 300 and 400 level course units and at least grade D for the remaining 300 and 400 level course units subject to a maximum of 3 credits with grade D/D+
(iii) Completion of the degree programme within four years

Second Class (Lower Division)
(i) GPA of 2.75 - 3.29
(ii) At least grade B for at least half the 300 and 400 level course units, and at least grade D for the remaining 300 and 400 level course units subject to a maximum of 6 credits with grade D/D+ obtained from a maximum of 3 courses
(iii) Completion of the degree programme within four years

Award of honours will be decided by the Board of Examiners using the above criteria as guidelines.
19. REQUIREMENTS TO PASS THE B.Sc. IN STATISTICS AND OPERATIONS RESEARCH AND THE B.Sc. IN COMPUTATION AND MANAGEMENT

The Board of Examiners will meet to consider the performance of the candidates. To pass the Degree, the candidates have to fulfill the following requirements:

I. Obtain at least grade C for the three foundation courses.

II. At least 114 credits (excluding those for foundation courses) among those course units specified for the relevant degree programme.

III. Obtain at least grade C for course units whose credits will add up to 102 (excluding those for foundation courses), and at least grade D for the remaining course units.

IV. Obtain at least grade D in the compulsory course units specified for the course.

V. Obtain at least grade C for the project, if any.

VI. Obtain a GPA of at least 2.0.

Note:
(a) Grades obtained by a student for all the courses offered by a student except foundation courses subject to the requirements stipulated in II above shall be considered in the computation of the final GPA.
(b) Students who fulfill all the above requirements may apply for the award of the relevant Bachelor of Science degree.
(c) A student who has not fulfilled any of the above requirements may repeat the course units in order to fulfill the requirements.

20. AWARD OF HONOURS ON COMPLETION OF B.Sc. IN STATISTICS AND OPERATIONS RESEARCH AND B.Sc. IN COMPUTATION AND MANAGEMENT PROGRAMMES

A student who has fulfilled all the conditions stipulated in "Requirements to pass the B.Sc. in Statistics and Operations Research and the B.Sc. in Computation and Management" shall be awarded honours, if he/she fulfills the following additional requirements:

First Class
(i) GPA of 3.75 and over
(ii) At least grade C for all the course units whose credits will add up to at least 110
(iii) Completion of the degree programme within four years

Second Class
( Upper Division )
(i) GPA of 3.30 - 3.74
(ii) At least grade C for all the course units whose credits will add up to at least 102
(iii) Completion of the degree programme within four years

Second Class
( Lower Division )
(i) GPA of 2.75 - 3.29
(ii) At least grade C for all the course units whose credits will add up to at least 102
(iii) Completion of the degree programme within four years

Award of honours will be decided by the Board of Examiners using the above criteria as guidelines.

21. COMPLETION OF DEGREE

Students should complete all three year degree programmes within five academic years from the date of admission to the Faculty. In the case of students offering a four year degree, this period will be six academic years.

22. ENTRIES IN THE TRANSCRIPT

Course units with the corresponding grades and grade points obtained will appear in the transcript. F grades which have been upgraded will not appear but the credit earned of the repeated course unit will appear under the particular semester when the unit was completed with a label (R) to indicate that the course was repeated. The final GPA and the Class (if any) will also appear in the transcript. The transcript will be issued upon application and the payment of a prescribed fee.

Note: Changes to these rules and regulations may be made by the Faculty Board with the approval of the Senate of the University of Peradeniya
SUMMARY OF COURSES OFFERED

- FOUNDATION COURSES

Foundation courses which are conducted only at the 100 level are compulsory for all students. The grades of the foundation courses credits will not be counted when the final GPA is calculated.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>No. of credits</th>
<th>Prerequisites</th>
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<tr>
<td></td>
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<td>General Degree</td>
</tr>
<tr>
<td>EN 100</td>
<td>Basic English</td>
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<td>CS 100</td>
<td>Computer Applications</td>
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<tr>
<td>BL 100*</td>
<td>Basic Life Sciences</td>
<td>2</td>
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<td>✓</td>
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<tr>
<td>MT 100†</td>
<td>Mathematics for Biological Sciences</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>SE 100</td>
<td>Introduction to Science and Society</td>
<td>0</td>
<td>✓</td>
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</tbody>
</table>

* For those who have not offered Biology at the G.C.E. (A/L) Examination
† For those who have not offered Combined Mathematics or Mathematics at the G.C.E. (A/L) Examination

- PRINCIPAL SUBJECT AREA

BOTANY

At the 100 Level two principal subject areas, Biology I and Biology II, each having 8 credits are offered jointly by the Departments of Botany and Zoology. Both Biological and Physical Science students can offer these subjects.

From the 200 Level onwards Botany is offered as a principal subject area. The students who have followed Biology I as a principal subject area at the 100 level are permitted to take Botany as a principal subject at 200 and 300 Levels. Other students who wish to follow selected course units in Botany would also be accommodated subject to availability of places. Those students who have completed Botany as a principal subject at the 200 Level shall be eligible for selection to a Special Degree in Botany at the end of the second year. The Special Degree students spend an extra two (02) years learning courses in a range of areas in Botany and carrying out a research project. The Department also conducts three course units for the fourth year students in the Applied Science Degree Programme. The General Degree students after successful completion of three years with required GPA are permitted to register for the Applied Science Degree. The Department of Botany also offers Food Science as a supplementary subject at 200 and 300 Level.

The laboratory work of all course units offered by the Department of Botany shall be evaluated on a continuous assessment basis.

<table>
<thead>
<tr>
<th>Course Number</th>
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<th>No. of credits</th>
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<tr>
<td></td>
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<td>General Degree</td>
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<tr>
<td>BL 101</td>
<td>Basic Biology</td>
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<tr>
<td>BL 102</td>
<td>Plant &amp; Animal Form &amp; Function</td>
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<tr>
<td>BL 103</td>
<td>Basic Ecology</td>
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<tr>
<td>BL 104</td>
<td>Microbiology &amp; Biochemistry</td>
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<td>BL 111</td>
<td>Tropical Terrestrial Ecosystems</td>
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<td>BL 112</td>
<td>Sub-tropical, Temperate and Polar Terrestrial Ecosystems</td>
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<td>BL 113</td>
<td>Marine Ecosystems</td>
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<td>BL 114</td>
<td>Wetland Ecosystems</td>
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### 200 LEVEL – BOTANY

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<td>BT 202</td>
<td>Plant Diversity II</td>
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<tr>
<td>BT 203</td>
<td>Vegetation Dynamics &amp; Measurements</td>
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<td>BT 204 *</td>
<td>Enzymology</td>
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<td>BT 205</td>
<td>Angiosperm Morphology &amp; Anatomy</td>
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<td>BT 206</td>
<td>Plant Physiology</td>
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<td>BT 207</td>
<td>Plant Biochemistry I</td>
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<tr>
<td>BT 209**</td>
<td>Biostatistics</td>
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* Equivalent to MB 221 offered by the Department of Molecular Biology & Biotechnology.

** Equivalent to ST 202 offered by the Department of Statistics & Computer Science.

### 300 LEVEL – BOTANY

(Students intending to select Botany as a principal subject area at 300 level must have offered Botany as a principal subject at the 200 level).

<table>
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<td>BT 302</td>
<td>Advanced Microbiology</td>
<td>02</td>
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<tr>
<td>BT 303</td>
<td>Soil Fertility &amp; Management</td>
<td>02</td>
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<td>BT 304</td>
<td>Plant Pathology</td>
<td>02</td>
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<td>BT 305</td>
<td>Developmental Physiology &amp; Postharvest Technology</td>
<td>02</td>
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<td>BT 307</td>
<td>General &amp; Molecular Genetics</td>
<td>02</td>
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<td>BT 308</td>
<td>Plant Systematics</td>
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<td>BT 309</td>
<td>Biodiversity Conservation &amp; Management</td>
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<td>BT 310</td>
<td>Ecosystems of Sri Lanka: Their Ecology &amp; Conservation</td>
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<td>BT 311</td>
<td>Plant Reproductive Biology &amp; Plant Breeding</td>
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<td>BT 312</td>
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### 400 LEVEL – BOTANY

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<td>BT 402</td>
<td>Rhizobiology</td>
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<td>BT 403</td>
<td>Plant Toxicology</td>
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<td>BT 404</td>
<td>Advanced Plant Pathology</td>
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<td>BT 405</td>
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<td>Plant Molecular Genetics &amp; Biotechnology</td>
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<td>BT 307</td>
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<td>Advanced Plant Physiology</td>
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<td>BT 409</td>
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<td>BT 309, BT310</td>
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<td>BT 414</td>
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## FOOD SCIENCE

**200/300 LEVEL – BOTANY**

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<td>FS 202</td>
<td>Food Science I</td>
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<td>FS 302</td>
<td>Food Science II</td>
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## CHEMISTRY

**100 LEVEL - CHEMISTRY**

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<td>CH 101</td>
<td>Principles of Chemistry I</td>
<td>3</td>
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<tr>
<td>CH 102</td>
<td>Principles of Chemistry II</td>
<td>3</td>
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<td>✓</td>
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<td>CH 108</td>
<td>Elementary Chemistry Laboratory</td>
<td>1</td>
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<tr>
<td>CH 109</td>
<td>Inorganic Chemistry Laboratory</td>
<td>1</td>
<td>CH 108</td>
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**200 LEVEL - CHEMISTRY**

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<td>CH 212</td>
<td>Inorganic Chemistry II</td>
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<td>CH 211</td>
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<tr>
<td>CH 221</td>
<td>Organic Chemistry I</td>
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<td>CH 101, CH 102</td>
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<tr>
<td>CH 222</td>
<td>Introductory Organic Synthesis</td>
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<td>CH 228</td>
<td>Organic Chemistry Laboratory I</td>
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<td>CH 108, CH 221</td>
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<tr>
<td>CH 231</td>
<td>Physical Chemistry I</td>
<td>2</td>
<td>CH 101, CH 102</td>
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</tr>
<tr>
<td>CH 232</td>
<td>Molecular Properties, Molecular spectroscopy and Spectroscopic Instrumentation</td>
<td>1</td>
<td>CH 231</td>
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<td>CH 238</td>
<td>Physical Chemistry Laboratory I</td>
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<td>CH 231</td>
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**300 LEVEL - CHEMISTRY**

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<td>CH 317</td>
<td>Advanced Inorganic Chemistry</td>
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<td>CH 319</td>
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<td>CH 324</td>
<td>Organic Chemistry II</td>
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<td>CH 221, CH 222</td>
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<td>CH 325</td>
<td>Aromatic and Heterocyclic Compounds and Biomolecules</td>
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<td>Computer Applications and Instrumentation</td>
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400 LEVEL - CHEMISTRY

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<td>Topics in Solid State Chemistry</td>
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COMPUTER SCIENCE

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Note: Students opting to follow the Special Degree course in Computer Science are required to select courses from the following course units in addition to fulfill their credit requirements.

- ST102 (3 credits) Introduction to Probability Theory
- ST201 (3 credits) Probability Theory
- ST203 (3 credits) Theory of Statistics
- MT308 (2 credits) Combinatorics
- MT209 (2 credits) Graph Theory
## GEOLOGY

### 100 LEVEL - GEOLOGY

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**Total** 52

* Only one of these is compulsory

### MATHEMATICS

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** Mathematics as two subjects

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| MB 471        | Proposal Writing                                         | 1              |                                    |                |         |         |
| MB 490        | Independent Study                                        | 1              |                                    |                |         |         |
| MB 495        | Seminar                                                  | 1              |                                    |                |         |         |
| MB 499        | Research Project                                         | 6              |                                    |                |         |         |
†Available to students who have not offered biology in GCE (A/L).

**PHYSICS**

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<td>Experimental Techniques and Material Characterization</td>
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* Only one of these course unit is compulsory
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## STATISTICS

## 100 LEVEL - STATISTICS

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## 300 LEVEL - STATISTICS

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ZOOLOGY

The Department of Zoology offers Biology I and Biology II jointly with the Department of Botany at the 100 level. The Department offers Zoology as a principal subject area from 200 level onwards.

From the 200 Level onwards Zoology is offered as a principal subject area. The students who have followed Biology I or Biology II as a principal subject area at the 100 level are permitted to take Zoology as a principal subject at 200 and 300 Levels. Those students who have completed Zoology as a principal subject at the 200 Level shall be eligible for selection to a Special Degree in Zoology at the end of the second year. The Special Degree students spend an extra two (02) years learning courses in a range of areas in Zoology and carrying out a research project.

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<td>Sub-tropical, Temperate and Polar Terrestrial Ecosystems</td>
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* Equivalent to ST 202 offered by the Department of Statistics & Computer Science.

Students selecting Zoology as a principal subject at 300 level should have offered Zoology as a principal subject at 200 level.

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### 400 LEVEL - ZOOLOGY

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<td>Ecotourism and Nature Conservation</td>
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<td>Limnology &amp; Wetland Ecology</td>
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### APPLIED SCIENCES SUBJECT AREA

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<td>Research Methodology and Scientific Writing</td>
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**Total:** 115

**BS - BioScience**  **PS - Physical Science**  **Optional for Physical Science and**
**AR - Arts**  **CO - Commerce**  **Commerce stream only**

**Note:** Students opting to follow the Computation and Management Degree are required to select courses from the following course units at 400 level in addition to fulfill their credit requirements.

**Semester I:** 3 credits from CS 400 level courses and 2 credits from MGT 400 level courses

**Semester II:** 9 credits from CS 400 level or MGT 400 level of which at least 3 must be from CS 400 and 3 from MGT 400 level
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SYLLABI OF COURSES OFFERED

FOUNDATION COURSES

**BL 100 Basic Life Sciences (2 credits)**
**Biology of Plants and Animals:** Cell structure (molecular and organelle) and function. Cell cycle, mitosis and meiosis. Anatomical and histological organization of organ systems of plants and animals cells. Function of organsystems.
**Interactive learning exercises in biology.**

**CS 100 Computer Applications (2 credits)**
Introduction to Computer and operating Systems,
Micro Computer Applications : Use of Software Packages- Spread Sheet applications, DBMS applications, Utility programs and Word processing.
Data Protection Techniques : Data security techniques, Computer Viruses and prevention. Data Communication : Email, Internet and Networking of Computers.
Introduction to a Programming Language: Procedures, Functions, File handling, Application of a DB management.
(This course includes both theory and practicals)

Recommended Texts:
1. Computer Science, C.S.French
3. Computer viruses, Robert Slade

**EN 100 Basic English (2 credit)**
(This course will be conducted over two semesters of the same academic year)
**Grammar:** Parts of speech, Active & passive voice structures and Modals. Sentence Structure
Paragraph Writing: a simple description (object/element), a comparison, a process.
Conditionals - Relating to discussion part of report, Conjunctions, Prepositions of time/place. It/There Structure, Reported Speech, Perfect tense.
**Listening:** Listening Skills: Identification, Labelling, Drawing, Taking down specific information in the form of diagrams, tables, graphs, tree-diagrams and filling in blanks. Prediction and Taking down important points using above strategies. Language through Popular Songs, Dictation & Punctuation Listening Comprehension, Listening and Note-taking.
**Reading:** Surveying a textbook, skimming and scanning, main idea and the details; Description, definition, cause and effect, steps, comparison, characteristics, reasons, examples etc., Language through Poetry, Speech : Communicative activities
Consolidation of reading skills, Skimming and scanning, Cohesive devices - Arrangement of a Paragraph, Reading and Note-taking skills, Reading Comprehension (General Reading, Subject Reading).
**Writing:** Report Writing, Content vocabulary and structure vocabulary, Paragraph Writing: Main idea, Supporting details, Organisation of Written discourse, Making Inferences (Logical Inferences)

**MT 100 Mathematics for Biological Sciences (2 credits)**
Sets and inequalities, Linear equations, Quadratic equations, Functions and graphs, Trigonometric Functions, Limits, Derivatives, Curve sketching, Maximum-minimum problems, Exponential and logarithmic functions
Techniques of integration, Areas and volumes, partial derivatives, Introduction to vectors, Matrices and determinants.

Recommended text:
1. *Mathematics for Biological Sciences*, J.C. Arya and R.W. Lardner

**SE 100 Introduction to Science and Society (0 credits)**
Scientific Method; Milestones in Science; Science in Development; Science and the Law; Science and Ethics
PRINCIPAL SUBJECT AREA

BOTANY

100 LEVEL COURSES

BIOLOGY I

BL 100 Basic Life Sciences (2 credits)
Interactive learning exercises in biology.
Recommended texts:

BL 101 Basic Biology (2 credits)
Cell Biology - Chemical nature of life, origin of life, scientific method, prokaryotic and eukaryotic cells, cell types, structure and function of cell membranes and organelles, cell division, structure and function of genetic material.
Classification of organisms - Early and current systems of classification.
Genetics and evolution - Chromosome theory of inheritance, Mendelian genetics and deviation, linkage and recombination, mutations, Hardy-Weinburg principle, sources of variation, natural selection, origin of species. Laboratory exercises based on above topics.
Recommended Texts:

BL 102 Plant and Animal Form and Function (2 credits)
Tissue types, internal structure of plants and organs, photosynthesis, transport systems, plant nutrition. Animal structure and function, nutrition and digestion, respiration and gas exchange, circulatory systems and blood, homeostasis, reproduction and hormones, nervous system and coordination.
Laboratory exercises based on the above topics.
Recommended Texts:

BL 103 Basic Ecology (2 credits)
Ecological Levels (individuals, populations, communities, ecosystems, biomes, biosphere), components of the physical environment (energy, water, atmospheric gases and wind, fire, gravity, topography, geologic substratum and soil), energy flow in ecosystems (tropical levels, food webs, productivity), cycles of materials (hydrological cycle, carbon cycle, biogeochemical cycles).
Laboratory exercises based on above topics.
Recommended Texts:

**BL 104 – Microbiology and Biochemistry (2 credits)**

History and development of microbiology, introduction to microorganisms (viruses, viroids, bacteria, mollicutes, prions etc.), morphology of microorganisms, microbiological techniques (observation of microorganisms, handling, isolation and cultivation of microorganisms, culture media, sterile conditions). Microbiological equipment and safety procedures, microorganisms in biotechnology. Cellular respiration, enzymes in biological systems.

Laboratory exercises based on the above.

Recommended Texts:

**BIOLOGY II**

**BL 111 Tropical Terrestrial Ecosystems (2 credits)**

World climate and vegetation distribution; structural characteristics, adaptations and floral and faunal diversity of tropical forests, savannas and grasslands; human impacts.

Practicals and field classes based on above.

Recommended Texts:

**BL 112 Sub-tropical, Temperate and Polar Terrestrial Ecosystems (2 credits)**

Regional distribution, structural characteristics, adaptations and floral and faunal diversity of deserts and arid regions, temperate grasslands, temperate forests, coniferous forests, chaparrals and polar and high mountain tundras; human impacts.

Practicals based on above.

Recommended Texts:

**BL 113 Marine Ecosystems (2 credits)**

Plants and animals in rocky and sandy seashores, and coral and sandstone reef; plankton and floating organisms; squids and octopuses: fish, sea snakes and turtles; whales and sea cows and seals in open sea, sea birds; deep sea animals.

Practicals and field classes based on above.

Recommended Texts:

**BL 114 Wetland Ecosystems (2 credits)**

Plants and animals in lagoons, basin estuaries and river estuaries, mangroves and salt marshes, rivers, streams and canals, lakes, reservoirs (man – made lakes) and ponds, marshes, swamps, peat – bogs and paddy fields. Practical on field classes based on above.
Recommended Texts:

200 LEVEL COURSES

BT 201 Plant Diversity I (2 credits)
Basic concepts of biodiversity, levels (species, genetic, ecosystem); range of diversity in relation to size, life span, form, nutrition, reproduction, habitats, life cycles etc. Nomenclature and classification, importance of biodiversity, its conservation and sustainable utilization. Diversity among lower organisms: Monera (Prokaryota), Protista, algae, Chromista, Fungi. Basic characters, modern classification systems, range of form, reproduction and life cycles with reference to type examples. Importance of fungi in nature, biodeterioration, medicine, agriculture & industry. Laboratory exercises based on above topics.

Recommended Texts:

BT 202 Plant Diversity II (2 credits)

Recommended Texts:

BT 203 Vegetation Dynamics and Measurement (2 credits)
Plant communities, vegetation measurements, physiognomic or structural data, floristic data, vegetation dynamics, disturbances, primary and secondary succession, pioneer and climax species. Field and laboratory exercises based on the above.

Recommended Texts:

BT 204 Enzymology (2 credits)
(Same as MB 221)
Recommended Texts:

**BT 205 Angiosperm Morphology and Anatomy (2 Credits)**

Recommended Texts:
1. Bell, A.D. *Plant Form. An illustrated guide to flowering plant morphology*.

**BT 206 Plant Physiology (2 credits)**

Recommended Texts:

**BT 207 Plant Biochemistry I (2 Credits)**
Photosynthesis as energy conversion, photosynthetic electron transport, mechanism of photophosphorylation. Fixation of carbon dioxide, C3 PCR cycle, C2 photorespiratory carbon oxidation cycle, CO₂ concentration mechanisms, C4 photosynthetic carbon assimilation cycle, Crassulacean Acid Metabolism. Synthesis of sucrose and starch, phloem translocation, loading and unloading. Plant respiration, glycolytic pathway, tricarboxylic acid cycle, electron transport and ATP synthesis. Laboratory exercises based on above topics.

Recommended Texts:

**BT 209 Biostatistics (2 credits)**
(Same as ST 202)
Variables, summarization & presentation of data, variance, standard deviation, standard error, probability of simple events, probability distribution (binomial, Poisson & Normal probability distribution), Z score, t-distribution, hypothesis testing ($\chi^2$ test, paired & unpaired t-test), analysis of variance (ANOVA), CRD, RCBD and LSD, correlation and regression, use of statistical package e.g. Minitab.

Recommended Texts:
300 LEVEL COURSES

BT 301 Analytical Methods (2 credits)
Application of high precision mass spectrophotometer in stable isotopic research. Soil and foliar analytical techniques, Kjeldahl technique (theory, the equipment, sample preparation, measurements and calculations). Interferences and measures to improve the sensitivity and efficiency of the system and applications in research. Spectrophotometric methods: UV-VIS spectrophotometer (colorimeter), Atomic Absorption Spectrophotometer (AAS), Flame Emission Spectrophotometer (FES) and Mass Spectrophotometer. Use of radioactive isotopes in analytical Techniques: Geiger-Muller counters, Scintillation counters, Cerenkov counters and autoradiography. Molecular biological techniques, PCR, AFLP, RAPD’s, RFLP and DNA sequencing. Chromatographic techniques, TLC, Column chromatography, HPLC, GC. Laboratory exercises based on above topics.

Recommended Texts:

BT 302 Advanced Microbiology (2 Credits)
Population counts, growth cycle of microorganisms. Applied microbiology. Microorganisms in their natural habitats and major activities, microbiology of air (types, diseases transmitted), soil (types, estimation, distribution, role in nutrient cycling), water (types, water pollution, coliform bacteria, sanitary water analysis, water borne diseases, water purification) and food (food microflora, food spoilage, food preservation and food borne diseases). Laboratory exercises based on above topics.

Recommended Texts:

BT 303 Soil Fertility and Management (2 credits)

Recommended Texts:

BT 304 Plant Pathology (2 credits)
Introduction, history of Plant Pathology, terminology & definitions, cause of plant disease, infection process, mechanism of symptom development, fungal pathogenesis, plant defense responses – constitutive and inducible defenses, Systemic Acquired Resistance (SAR), principles of plant disease control, diagnosis of plant disease. Practical exercises: Laboratory examination of diseased specimens covering major field and post-harvest diseases of food, ornamental and plantation crops, plant pathology techniques, study of plant-pathogen interactions.
Recommended Texts:

**BT 305 Developmental Physiology and Postharvest Technology (2 credits)**

Terminology of growth, development and differentiation, phytohormones and plant growth regulators, growth promoters, inhibitors and modifiers, their physiological effects, commercial applications, biosynthesis, interactions, theories on mechanism of photoperiodism and vernalization. Signal transduction. Basic techniques of detection of phytohormones: chromatography, immunoassays and bioassays.

Postharvest technology of fruits and vegetables, causes of fruit and vegetable deterioration, maturity indices, harvesting systems, packing house operations, transportation storage: temperature management, modified atmosphere, ethylene, cold chain maintenance, technology at village and industrial level, agrochemical usage and alternatives, quality parameters and methods of determination, minimal processing.

Laboratory exercises based on the above.

Recommended Texts:

**BT 307 General and Molecular Genetics (2 credits)**

Genetic mapping in eukaryotes and prokaryotes, variation in chromosome number and structure, replication of DNA and chromosomes, translation, transcription and genetic code, mutation and DNA repair, genetics of viruses & bacteria, organelles and transposable elements, regulation of gene expression, recombinant DNA technology, genomics, population and evolutionary genetics, speciation, conservation genetics.

Laboratory exercises based on the above.

Recommended Texts:

**BT 308 Plant Systematics (2 credits)**

General definitions, nomenclature, identification and classification. Taxonomic hierarchy, different classify-cation systems. Different schools of thought as to the origin of the angiosperms. Phenetics, cladistics, different types of data. Plant collection and herbarium techniques.

Practical exercises on floral characteristics of representative species from useful plant families.

Recommended Texts:

**BT 309 Biodiversity Conservation & Management (2 credits)**


Field visits.

Recommended Texts:
**BT 310 Ecosystems of Sri Lanka: Their Ecology and Conservation (2 credits)**

Geography, climate, geology, soils and floristic zones of Sri Lanka. Natural vegetation types of the island in relation to their distribution, extent, climate, vegetation structure, floristic richness, family and species dominance, population size distributions, endemic species, underutilized species. Factors responsible for degradation of natural ecosystems. Conservation and restoration of natural ecosystems. The ecosystems considered are i) marine, ii) maritime (mangroves, sea shore, and salt marshes) and inland aquatic ecosystems, forest types (rain forests -lowland & montane, dry zone forests and scrub vegetation), grasslands (wet and dry pathanas, thalawas, savannahs and dambans).

**Recommended Texts:**

**BT 311 Plant Reproductive Biology and Plant Breeding (2 credits)**

(Prerequisite: BT 307 General and Molecular Genetics)

Genetic variation and its estimation, incompatibility and its inheritance. Pollination biology. Plant breeding perspectives, plant reproductive systems, principles of plant breeding, genetic basis of plant breeding, polygenic inheritance, methods of breeding and experimental designs, quantitative inheritance, polyploidy, methods of breeding of self- and cross pollinated crops. Application of molecular marker technologies for genome analysis. Germplasm resources preservation and utilization, hybrid crops, seed production and maintenance. Field visits to Plant Genetic Resource Centre (PGRC) and Rice Research and Development Institute, Batalagoda.

**Recommended Texts:**

**BT 312 Economic Botany (2 credits)**

Crop plants and their wild relatives, centres of origin and diversification of crop plants. A brief botanical description of economically important plants selected from cereals, millets, pulses, oil seeds, essential oils, sugar crops, tuber crops, fibre crops, spices and condiments, medicinal plants, beverages, fruits and nuts, vegetables, gums and resins, dyes and tannins, forage crops, cover crops and shade trees, avenue trees, insecticidal plants, plant toxins, invasive plants and weeds. Food plants, plants and plant products of industrial value, medicinal plants and drugs, food adjuncts. Structure and properties of wood, factors affecting the strength of timber, timber processing technology, agencies of destruction of wood, wood preservation; manufactured products of wood and their applications.

Laboratory exercises based on the above.

**Recommended Texts:**

**400 LEVEL COURSES**

**BT 401 Nitrogen Fixation (3 credits)**

Nitrogen fixation (abiological and biological), the global cycle, importance and relevance to national development. Organisms and systems that fix nitrogen, free–living, symbiotic, associative and endophytic. Methods of measuring nitrogen fixation based on, Kjeldahl analysis, acetylene reduction assay, isotopes (radioactive and heavy 15N), direct labelling and substrate labelling techniques. Gas chromatography, Mass Spectrometry and Emission Spectrometry. Enzymology of nitrogen fixation, the enzyme system, factors affecting the enzyme, oxygen sensitivity and mechanisms to protect the enzyme from oxygen inhibition. Requirements for nitrogen fixation and how these are met in nature. Biochemistry of nitrogen fixation including the mechanism. Genetics of nitrogen fixation, Nif genes and their regulation. Application of nitrogen fixation in agriculture and forestry.

Practical exercises based on above topics.

**Recommended Texts:**

**BT 402 Rhizobiology (3 credits)**
(Prerequisite: BT 302)
Practical exercises based on above topics.

Recommended Texts:

**BT 403 Plant Toxicology (2 credits)**
(Prerequisite: BT 207)
Introduction to terminology used in toxicology – LD 50, bioaccumulation, biodegradability, dose – response relationships, microbial toxins – of bacteria, cyanobacteria and fungi (mushroom toxins and mycotoxins), their nature and effects, factors contributing to their formation in food and methods of prevention of contamination and decontamination; case studies, toxins of higher plants, their nature and effects, analytical techniques, legislature in different countries, uses of toxins.
Practical exercises based on above topics.

Recommended Texts:

**BT 404 Advanced Plant Pathology (2 credits)**
(Prerequisite: BT 304)

Recommended Texts:

**BT 405 Plant Biochemistry II (3 Credits)**
(Prerequisite: BT 207)
Carbohydrates in plants, chemical classification, classification according to function, nutritional classification of starch, role of carbohydrates in the food industry, food starch modifications; physical and chemical modifications, non-food uses of starch. Proteins and amino acids in plants, types of amino acids and their classification, functional properties of proteins, role of plant proteins in human nutrition, sources of plant proteins and their importance in developing countries, anti-nutritional factors associated with cereal and legume proteins, improving the quality of proteins and the uses of plant proteins in other industries.
Lipids: classification and chemistry of lipids, catabolism of lipids in plants, biological functions, role in human nutrition, oxidation and rancidity reactions in food, plant pigments and related secondary metabolites, classification, functions other than pigmentation, related biosynthetic pathways. Practical exercises based on above topics.
Recommended Texts:

**BT 406 Plant Molecular Genetics and Biotechnology (3 credits)**
(Prerequisite: BT 307)
Practical exercises based on above topics.

Recommended Texts:

www.tigr.org
www.ebi.ac.uk

**BT 407 Advanced Plant Systematics (2 credits)**
(Prerequisite: BT 308)
Different types of data: morphological, anatomical, phytochemical, palynological and molecular data. Phylogenetic systematics, constructing classification systems. Angiosperm classification based on molecular data. Role of plant systematics in biodiversity conservation and management. Role of Molecular data in biodiversity conservation management. Selected plant orders and families.
Practical exercises based on above topics.

Recommended Texts

**BT 408 Advanced Plant Physiology (2 credits)**
(Prerequisites: BT 206, BT 207)
Practical exercises based on above topics.

Recommended Texts:

**BT 409 Dynamic Plant Ecology (3 credits)**
(Prerequisites: BT 309, BT 310)

Recommended Texts:

**BT 410 Forestry (2 credits)**
Natural forests, plantation forests and agro-forestry systems, local and global demands for forest products, forest measurements, nursery practice, seed and forest genetics, factors of the forest site. Silvicultural characteristics and species choice, establishing plantations and special tree crops. After-care of plantations, silvicultural systems. Thinning, harvesting, marketing; sustainable forest management. Forests and forest policy in Sri Lanka.

Recommended Texts:

**BT 411 Herbarium (1 credit)**
Students will collect a recommended number of specimens representing lower and higher plants, identify and submit as herbarium specimens.

**BT 412 Applied Microbiology (2 credits)**
(Prerequisite: BT 302)
Microorganisms with industrial and environmental use and their products. Growth and product formation in industrial processes, large scale fermentations: food, alcoholic beverages, animal feed, single cell proteins, antibiotics, organic acids, amino acids, enzymes, vitamins. Fuel and energy. Waste water treatment and utilization. Setting up a microbiological laboratory. Selected titles from the above course content will be offered each year.

Recommended Texts

**BT 413 Advanced Plant Developmental Physiology (2 credits)**
(Prerequisite: BT 305)
Classification of natural and synthetic plant growth regulators (PGRs), biosynthetic pathways, transport and catabolism of natural PGRs, molecular basis of action, cell signaling pathways, regulation of hormone levels in plants, role of PGRs in crop production and postharvest technology, effect of PGRs on human health, production of PGRs by microorganisms.

Recommended Texts:

**BT 414 Independent study (1 credit)**
A structured programme to encourage active student learning and develop their communication and presentation skills. The students obtain an in-depth understanding of given topics of botanical interest by literature survey and reading recommended research/scientific articles and deliver seminar/s.

**BT 415 Research Project (6 credits)**
(Prerequisite: BT 209)
Each student will carry out a research project during the final year under the supervision of a staff member. The student is required to deliver two seminars, (a) pre-project seminar, based on preparatory work and research plan and (b) end of the project seminar, based on the outcome of research and prepare a comprehensive report containing Title page, Abstract, Introduction and Literature Review, Objectives, Materials & Methods, Results, Discussion and References.

**FOOD SCIENCE**

**FS 202 - Food Science I (2 credits)**

Chemistry of Food: Introduction to Food Science and the food Industry, basic food chemistry: definitions for food components, carbohydrates proteins, lipids, vitamins and minerals, additional food constituents; colours, flavours, emulsifiers, oxidants and antioxidants etc; Natural and synthetic constituents. Properties and significance of each component of food. Tests for identification. Food Analysis: sampling techniques and proximate analysis of food.

Food Technology: Fruit and vegetable technology: physical, chemical and biological methods used in preservation, common unit operations. Post harvest handling of fruits and vegetables. Grain technology: Cereals and pulses-composition, structure, effect of processing, functional properties, post harvest technology. Food of animal origin: problems associated with keeping quality of meat, fish, eggs and milk, Methods of processing. Laboratory work based on above topics.

Recommended Texts:

**FS 302 - Food Science II (2 credits)**
(Prerequisite: FS 201 - Food Science I)

Concepts in Food Engineering: Physical concepts in food engineering: properties of liquids and solids, measuring sensory characteristics, physical and chemical properties of food products. Heat transfer systems for heating and cooling food products, evaporation and drying, grinding and size reduction, psychrometrics and dehydration.


Laboratory work based on above topics.

Recommended Texts:
CHEMISTRY

Compulsory courses for the General degree: CH 101, CH 102, CH 108, CH 109, CH 211, CH 221, CH 228, CH 231, CH 238, CH 328, CH 331, CH 338, CH 348

Compulsory courses for the Special Degree: CH 101, CH 102, CH 108, CH 109, CH 211, CH 212, CH 221, CH 222, CH 228, CH 231, CH 232, CH 238, CH 317, CH 319, CH 324, CH 329, CH 330, CH 331, CH 332, CH 339, CH 341, CH 342, CH 351, CH 369, CH 416, CH 417, CH 425, CH 426, CH 436, CH 443, CH 448, CH 455, CH 458, CH 491, CH 499, MB421.

100 LEVEL COURSES

CH 101 Principles of Chemistry I (3 credits)
General Chemistry I (15L): Modern view of the atomic structure and the development of the atomic theory of matter; Quantum mechanics and atomic theory: Electromagnetic radiation, atomic spectrum of hydrogen, Bohr model, the quantum mechanical description of the atom, electrons as waves, wave-particle duality, de Bröglie relationship, wave function and its physical meaning, Heisenberg’s uncertainty principle; Electron spin and the Pauli exclusion principle, Aufbau principle and the periodic table, electron configurations of elements, periodic trends in atomic properties; Bonding, types of chemical bonds, electronegativity, polarity and dipole moment, ionic bond, ionic lattices, packing of spheres, partial ionic character of covalent bond; Covalent bond: covalent bond energies and chemical reactions, non-valence cohesive forces.
Structure and Reactivity (15 L): Types of intermolecular interactions; Factors affecting electron availability in bonds and at individual atoms; Acidity and basicity; Functional groups responsible for reactivity of different classes of organic compounds; Relationships between the main classes of organic molecules; Introduction to reaction mechanisms - bond cleavage processes, types of reagents and reaction intermediates; Energy diagrams; Mechanisms of substitution, addition and elimination reactions; Aromaticity and Hückel’s Rule; Reactions in functional group analysis and their mechanisms.
IUPAC Nomenclature
Reactivity and Energetics (15L): The scientific method, microscopic and macroscopic theories, Kinetic Molecular Theory (KMT): KMT as a model for microscopic theories, experimental evidence, properties of gases, the perfect gas, state of gases, individual gas laws, combined gas laws, kinetic model for gases, imperfect gases; Thermodynamics: Systems, surroundings, universe, processes, zeroth law of thermodynamics, temperature, first law of thermodynamics, work, heat, internal energy, extent of reaction, enthalpy, thermochemistry, second law of thermodynamics, entropy, Gibbs energy, Helmholtz energy, Gibbs energy versus extent of reaction, reaction quotient, exothermic and endothermic reactions, reactions at equilibrium, thermodynamic equilibrium constant, activity, temperature dependence of equilibrium constant, effect of concentration, pressure, volume, temperature, etc, on the position of equilibrium.

Recommended Texts

CH 102 Principles of Chemistry II (3 credits)
(Prerequisite: CH101)
General Chemistry II (15 L): Molecular structure: Lewis structures, explanations to octet rule; Three-center bond, resonance, the VSEPR model, hybridization of atomic orbitals, molecular orbital theory, bonding in homonuclear and heteronuclear diatomic models, Periodic table and periodicity, periodic properties, applications of size and energy factors in chemistry, magnetic properties; Basic concepts in chemical analysis: titrations, buffers, indicators, solubility equilibria and applications.
Chemical Kinetics (10L): Molecular collisions; The importance of chemical kinetics: Rates, mechanisms, relationship between rate of reaction and rate of change of concentration of components; Rate law, rate constant and order, overall order of a reaction, initial rate method, integrated rate laws, isolation method, half-life of a reaction and a relationship to rate constant, molecularity of a reaction, the Arrhenius relationship between temperature and rate of a reaction, activation energy and pre-exponential factor.
Electrochemistry (5L): Introduction to Electrochemistry, Conductometry and Potentiometry
Stereochemistry and Spectroscopy (15 L): Configurational isomers, E/Z-nomenclature, symmetry, chirality; R,S-nomenclature, meso compounds, diastereomers, conformations in acyclic and cyclic compounds, cis-trans and optical isomerism in cyclic compounds; Biphenyls, allenes, introduction to spectroscopy (UV, IR) and 1H-NMR spectra.

Recommended Texts
CH 108 Elementary Chemistry Laboratory (1 credit)
Apparatus and measurements; Error analysis; Introduction to inorganic analytical method; Organic functional group analysis.

CH 109 Inorganic Chemistry Laboratory (1 credit)
(Prerequisite: CH108)
Qualitative analysis; Analysis of Inorganic anions, cations and their mixtures. Quantitative Inorganic analysis including titrimetry and gravimetry.

200 LEVEL COURSES

CH 211 Inorganic Chemistry I (2 credits)
(Prerequisites: CH 101, CH 102)
Trends in the chemistry of groups in the periodic table; Co-ordination chemistry: Co-ordination complexes, structures, stability constants, nomenclature, co-ordination numbers, reaction mechanism, crystal field theory, magnetochemistry, spectra of co-ordination complexes; Solid state chemistry, crystalline state, crystal systems; Powder diffraction methods.

Recommended Texts

CH 212 Inorganic Chemistry II (1 credit)
(Prerequisite: CH 211)
Organometallic chemistry; Nuclear and radiochemistry; Non-aqueous solvents.

Recommended Text

CH 221 Organic Chemistry I (2 credits)
(Prerequisites: CH 101, CH 102)
Organic Reaction Mechanisms I (15 L): Energetics – thermodynamics and kinetics of organic reactions; Concerted reactions, multi-step reactions; $S_{N}1$ and $S_{N}2$ reactions, effect of solvents, protic, polar aprotic solvents etc, neighbouring group participation, Internal $S_{N}2$; Elimination reactions E1, E2; Electrophilic and nucleophilic addition to double bonds; Electrophilic aromatic substitution; Nucleophilic aromatic substitution

Spectroscopy I (15 L): 1H-NMR and 13C-NMR spectroscopy; one dimensional and two dimensional NMR

Mass spectrometry EI-MS, CI-MS

Recommended Texts

CH 222 Introductory Organic Synthesis (1 credit)
(Prerequisite: CH 221)
Oxidations - alcohols, alkenes, Sharpless asymmetric epoxidation; Reductions-carbonyl compounds using hydride reducing agents, catalytic hydrogenation; Reactions of carbonyl compounds-methods of generating enolates, C-alkylation, O-alkylation, nitrogen analogues of enols and enolates, organocuprates; Carbonyl condensation reactions-aldol reactions; Robinson annulation, Caisen ester condensation, Dieckmann condensation, Thorpe nitrile condensation, Knoevenagel condensation; C=C formation - Wittig reaction and its modifications; Diels Alder reaction; Cope rearrangement; Caisen rearrangement

Recommended Texts

CH 228 Organic Chemistry Laboratory I (1 credit)
(Prerequisites: CH 108, CH 221)
Techniques in organic chemistry; Separation of mixtures; Synthesis of simple derivatives of organic compounds; Use of spectroscopic methods in identification of organic compounds.

Recommended Texts
CH 231 Physical Chemistry I (2 credits)
(Prerequisites: CH 101, CH 102)
**Quantum Mechanics** (10 L): Evidence for quantization, dynamics of microscopic systems, the Schrödinger equation, quantum mechanical principles, postulates in quantum mechanics, operators and observables, superposition and expectation values, the uncertainty principle, probability functions, solutions of Schrödinger equation for 1-, 2-, and 3-dimensional systems, including the hydrogen atom.


**Electrochemistry** (10 L): Conductometry, electronic and ionic conductors, conductivity and molar conductivity, strong and weak electrolyte solutions, determination of limiting molar conductivity, Kohlrausch’s law of independent migration of ions, determination of ionic concentrations, equilibrium constants and rate constants. Conductometric titrations, electrodes, electrochemical cells, applications of potentiometry, factors effecting cell e.m.f., Thermodynamic functions from emf measurements, potentiometric titrations.

Recommended Texts

CH 232 Molecular Properties, Molecular Spectroscopy and Spectroscopic Instrumentation (1 credit)
(Prerequisite: CH 231)
Electrical properties, dipole moment, intermolecular forces, magnetic properties, magnetic susceptibility, permanent and induced magnetic moments; Introduction to molecular spectroscopy; Rotational Spectra, vibrational spectra, electronic spectra, basic components of spectroscopic instrumentation.

Recommended Texts

CH 238 Physical Chemistry Laboratory I (1 credit)
(Prerequisite: CH 231)
Introduction to physical chemistry laboratory, apparatus and measurements; Error analysis; Equilibria; Thermochemistry; Problems in quantum mechanics and spectroscopy.

Recommended Texts

300 LEVEL COURSES

CH 316 Special Topics in Inorganic Chemistry (2 credits)
(Prerequisite: CH 211)
Silicates; Boranes; Metal clusters; Intercalates and their applications (15 L). Chemistry of the transition elements; Lanthanides; Actinides; Transuranium compounds; Rare Earths: Chemistry and extraction (15 L).

Recommended Texts

CH 317 Advanced Inorganic Chemistry (3 credits)
(Prerequisite: CH 211)
**Symmetry**: Symmetry elements, symmetry operations, classification of molecules/ions according to their symmetry; point groups; determination of point groups of molecules/ions, deduction of polarity and optical activity of molecules from their point group, group multiplication, basis, representative and matrix representation, character of an operation, character tables, reducible and irreducible representations.

**Spectroscopic Methods**: Selection rules, symmetry species, spectral transitions, NMR, NQR, ESR, Mossbauer, and inorganic applications.

**Diffraction Methods**: General aspects of diffraction mechanism, generation of X-rays, Bravais lattices, reciprocal lattices, translational symmetry operations, space groups, systematic absences and space group determination, atomic scattering factors, structure factors, Fourier and Patterson maps, structure determination and refinement using single crystal XRD data, and applications; Neutron diffraction; Electron diffraction.

**Advanced Co-ordination Chemistry**: Ligand field theory, electronic spectra of complexes, magnetochemistry
Recommended Texts


CH 319 Advanced Inorganic Chemistry Laboratory (2 credits)
Analysis of rare earths, insoluble mixtures, magnetic measurements, X-ray diffraction, UV-visible spectra of transition metal complexes, synthesis of special inorganic compounds (only for Chemistry special students).

CH 324 Organic Chemistry II (2 credits)
(Prerequisites: CH 221, CH 222)
*Organic Reaction Mechanisms II* (15 L): Reactions of carboxylic acids and derivatives; Reactive intermediates – reactions of free radicals, carbones and nitrenes; Reactions of carbonyl compounds – carbanions, enols, enolates; Rearrangements reactions; Symmetry controlled reactions; Electrocylic reactions, cycloadditions and sigmatropic rearrangements.
*Organic Synthesis II* (15 L); Reterosynthetic analysis - disconnection, functional group interchange, transform, synthons, synthetic reagents; Chemoselectivity, regioselectivity, stereoselectivity and stereospecificity; Types of disconnections- one group and two group disconnections; Amine synthesis; Strategies and control in carbonyl condensation- 1,3-dicabonyl compounds, -hydroxy carbonyl compounds, -unsaturated carbonyl compounds, specific enolates, intramolecular aldol reaction, 1,5 - dicarbonyl compounds; Strategies in ring synthesis ; Free radicals in organic synthesis

Recommended Texts

CH 325 Aromatic and Heterocyclic Compounds and Biomolecules (2 credits)
(Prerequisite: CH 221)
*Aromatic and Heterocyclic Compounds* (15 L): Aromatic properties, Heterocyclic compounds, Polycyclic hydrocarbons, Benzenoid and non-benzenoid hydrocarbons.
*Biomolecules* (15 L): Reactions and properties of monosaccharides, structures of disaccharides and polysaccharides; Properties and reactions of amino acids, structure and synthesis of peptides (10 L). Introduction to the chemistry and biosynthesis of flavonoids, terpenoids, steroids and alkaloids (5 L)

Recommended Texts

CH 326 Advanced Organic Chemistry I (2 credits)
(Prerequisite: CH 221)
*Conformational Analysis* (15 L); Conformations of simple acyclic molecules, alkenes, carbocyclic ring systems (6-membered rings, 3,4 and 5-membered rings, large rings), Conformational analysis. Conformation and reactivity, Rules for ring closure, Stereo-electronic effects in organic compounds (15 L); Advanced stereochemistry (10 L); Pericyclic reactions (5 L)
*Spectroscopy II* (15L) – 2D NMR, MS and GC-MS, ORD-CD (15 L)

CH 328 Organic Chemistry Laboratory II (1 credit)
(Prerequisite: CH 228)

Recommended Texts
1. FO Mann and BC Saunders (1960) *Practical Organic Chemistry*, Longman scientific
4. RJ Fessenden and JS Fessenden *Organic Laboratory Techniques* Cole Publishing Co.

**CH 329 Advanced Organic Chemistry Laboratory (2 credits)**

(Prerequisite: CH 228)

Microscale preparation of organic compounds, multistep syntheses; Application of spectroscopic methods for structure determination of organic compounds. (only for Chemistry special students)

Recommended Texts


**CH 330 Advanced Physical Chemistry I (3 credits)**

(Prerequisites: CH 232, CH 331)

**Quantum Mechanics** (15 L): Quantum mechanical models: Simple harmonic oscillator, rigid rotator; H atom and diatomic molecules; Approximate methods, variation and perturbation methods; Multi-electron atoms, Hartree-Fock Self-consistent Field method; Molecules, Born-Oppenheimer Approximation, Slater determinant, Huckel Molecular Orbital theory, Conjugated $\pi$-electron systems, Secular determinant, Ab-initio method.

**Advanced Molecular Spectroscopy** (15 L): Spectral line widths and intensities, Microwave spectroscopy; Rigid and non-rigid rotor systems; Symmetric-top molecules; Spectra of isotopes; Vibrational spectroscopy; Harmonic and Anharmonic Oscillators, Fundamentals, Overtones, Combination bands, hot bands; Vibrational-Rotational Spectroscopy: diatomic and polyatomic molecules; Raman Spectroscopy; Determination of molecular structure; Electronic Spectroscopy; Vibrational and Rotational fine structure, Franck – Condon principle.

**Statistical Thermodynamics** (15 L): Boltzmann distribution, molecular partition functions, canonical ensemble, canonical partition function, translational, rotational, vibrational and electronic partition functions. Statistical entropy, Sackoor-Tetrode equation, calculation of thermodynamic functions from partition function data, equipartition principle and mean energy, calculation of heat capacity, residual entropy and equilibrium constants, equilibrium composition.

Recommended Texts

2. WJ Moore, *Introduction to Molecular Spectroscopy*
3. DA MacQuarrie, *Quantum Chemistry*

**CH 331 Physical Chemistry II (2 credits)**

(Prerequisite: CH 231)

**Advanced Thermodynamics** (10 L): Specific applications of the first law and second law of thermodynamics, free energy functions, criteria for spontaneity, fundamental equations of thermodynamics, open systems; temperature dependence of internal energy and enthalpy, Joule-Thompson coefficients, inversion temperature, general relationships between $C_p$ and $C_v$. third law, third law entropies, reaction entropies; Temperature dependence of Gibb’s function, Gibbs-Helmhlotz equation; Pressure dependence of Gibb’s function, chemical potential of gases, real gases and fugacity, standard state of gas; Real solutions, activities, solvent and solute activities; Equilibrium constants for rear gases, response of equilibrium constants to catalysts.

**Surface and Colloid Chemistry** (10 L): Interfaces and surfaces; Kelvin equation and its applications; Adsorption and absorption, Surface excess; Physisorption and Chemisorption, Adsorption at liquid/gas, solid/gas interfaces, Measurement of amount of adsorption, Adsorption isotherms, isobars and isospherics: Gibbs, Langmuir, BET, Freundlich adsorption isotherms; Enthalpy of adsorption; Heterogeneous catalysts; Dispersion systems; Surfactants and their uses.

**Phase Equilibria** (10 L): The phase rule, meaning of phase, component, one component systems and their phase diagrams; Two-component systems, liquid-liquid phase diagrams, distillation of partially miscible liquids, liquid-solid phase diagrams; Phase diagrams for reactive systems; Ultra purity and controlled purity; Three component systems, triangular phase diagrams.

Recommended Texts

2. M Campbell, *Catalysis at Surfaces*.

**CH 332 Physical Chemistry III (1 credit)**

(Prerequisite: CH 231)

**Kinetics**: Steady-state approximation, pre-equilibrium, enzyme catalyzed reactions, the kinetics of complex reactions, catalysis.

**Polymer Chemistry**: Introduction to polymers, polymerization process, Carother’s equation for linear and non-linear step-growth polymerization, kinetics of addition and step-growth polymerization; Melting point and glass transition.
temperature; Relationship between chemical structure and properties of polymers; Statistical thermodynamics of polymer solutions; Characterization of polymers.

Recommended Texts
1. PW Atkins (1994), Physical Chemistry, Oxford University Press
2. RJ Young, PA Lovell, Introduction to polymers.

CH 336 Theories of Liquids and Solids (2 credits)
(Prerequisite: CH 231)
Theories of liquids, solutions, liquid crystals; Theories of Solids: Electronic, mechanical, thermal and structural properties of solids; Technologically important materials: Clays, zeolites, polymers, ceramics, superconductors,

Recommended Text

CH 338 Physical Chemistry Laboratory II (1 credit)
(Prerequisite: CH 238)
Experiments in physical chemistry: Electrochemistry, chemical kinetics, spectroscopy.

Recommended Text
2. A Findlay, Findlay’s Practical Physical Chemistry
3. P Mathews, Experimental Physical Chemistry.

CH 339 Advanced Physical Chemistry Laboratory II (2 credits)
(Prerequisite: CH 238)
Experiments in advanced physical chemistry: Electrochemistry, kinetics, spectroscopy.

Recommended Text
2. A Findlay, Findlay’s Practical Physical Chemistry
3. P Mathews, Experimental Physical Chemistry.

CH 341 Analytical Chemistry (3 credits)
(Prerequisite: CH 231)
Advanced Calculations (12 L): Review of statistics in chemical analysis: test of significance, paired t-test, F-test, etc.; Statistics of linear chemical relationships; Performance characteristics of analytical methods; Interlaboratory testing; Sensor characteristics; Advanced calculations as applied to chemical analysis: derivation and error calculations associated with acid-base, redox and complexometric titrations; Iteration methods; metal-complex equilibria; Solubility equilibria and Gran plots.
Analytical Aspects of Spectrophotometry (9 L): Atomic absorption and emission methods, molecular uv and visible absorption spectroscopy.
Electroanalytical Chemistry (12 L): Potentiometric applications; voltammetry including polarographic methods, pulsed techniques, steady-state and flow injection amperometric methods, bulk electrolysis methods, microelectrodes in chemical analysis, electrochemical sensors,
Separation Methods (12 L): Solvent extraction, partition coefficient, distribution ratio, multiple extractions, extraction of metals, introduction to chromatographic techniques and classifications, gas chromatography, van-Deemter equation, ion-exchange chromatography, thin layer and paper chromatography, introduction to liquid-liquid chromatography.

Recommended Texts
1. DA Skoog, West and Holler, Analytical Chemistry

CH 342 Computer Applications and Instrumentation (2 credits)
Introduction to computers: Number systems (decimal, binary, octal and hexadecimal) Logic gates: Sequential logic, de Morgan’s theorems, Flip flops, counters, Computer memory organisation, Analog to digital conversion (ADL), Data acquisition and Instrument control, Programming exercises, Plotting of radial wave functions, atomic and molecular orbitals, hybridisation.

Recommended Text
CH 348 Analytical and Inorganic Chemistry Laboratory (1 credit)
(Prerequisite: CH 109)
Inorganic preparations, colorimetry, applications of physical methods to study inorganic reactions, quantitative analytical methods.

Recommended Text
1. WL Jolly, Inorganic preparations.

CH 351 Biological Chemistry I (2 credits)
(Prerequisite: CH 325; Not allowed for those who have completed MB 201, MB 221 or BT 204.)
**Metabolism** (15 L) Metabolism of amino acids, carbohydrates, lipids and nucleic acids

**Enzymology** (15 L): Enzymes as catalysts in biological systems, structure, classification and nomenclature of enzymes; Mode of enzyme action; Enzyme kinetics; Regulatory enzymes; Applications of enzyme technology in industry; Enzyme systems and human health

Recommended Text

CH 361 Environmental Chemistry (3 credits)
(Prerequisites: CH 211, CH 221 and CH 231)
**Theory Component** (20 L): Chemical cycles, aquatic chemistry, water pollution, water treatment, water quality standards. Atmospheric chemistry, particles in the atmosphere Air pollution- inorganic and organic air pollutants, particles in the atmosphere, photochemical smog, global warming, acid rain, depletion of the ozone layer. Municipal and solid waste and their management, hazardous waste, waste as a resource; Pollution prevention and control, clean production mechanism; Environmental biochemistry; Toxicology; Environmental monitoring and analysis, sampling, classical methods and instrumentation; Analysis of data.

**Laboratory Component** (20 hr): Analysis of water and wastewater, analysis of air pollutants and particles; detection of pesticides.

Recommended Texts
2. C Baird (2000), Environmental Chemistry

CH 369 Industrial Training (1 credit)
Each student following the chemistry special degree is required to undergo a six week training programme at an industry/institution identified by the Department.

CH 371 Industrial Chemistry (3 credits)
Metallurgy, minerals of Sri Lanka, industrial inorganic chemistry, coal, petroleum, essential oils, polymers, dyes, pharmaceuticals, intellectual property rights, elementary chemical engineering, mass transfer, heat transfer, reactors.

Recommended Text
1. PG Cooray (1964) Geology of Sri Lanka, Ceylon Museum

400 LEVEL COURSES

CH 415 Advanced Topics in Inorganic Chemistry (2 credits)
(Prerequisites: CH 211, CH 212)
Radiation detectors, particle accelerators (linear accelerators, cyclotron, synchrocyclotron, betatron); Nuclear models (shell model and liquid drop model), stability of isobars; Radioanalytical techniques (isotope dilution analysis, neutron activation analysis)

Role of metals in biological systems, electron transfer catalysts, cytochromes, iron sulphur proteins, molybdoenzymes, zinc and copper containing enzymes, oxygen carriers, nitrogen fixation, iron metabolism

Recommended Texts
CH 416 Advanced Inorganic Chemistry II (2 credits)
(Prerequisite: CH 317)
Organometallic Chemistry: Complexes of olefines, carboxyls, nitrosyls, arenes, and other organic ligands, organometallic complexes as catalysts.
Reaction Mechanisms in Inorganic Chemistry: Substitution reactions of octahedral and square planar complexes, trans effect, electron transfer reactions, Frank-Condon principle, Marcus theory, photochemical reactions

Recommended Texts
2. F.Basolo and RG Pearson, Inorganic Reaction Mechanism.

CH 417 Topics in Solid State Chemistry (2 credits)
(Prerequisite: CH 211)
Advanced ceramics, inorganic polymers, solid state batteries, nanostructures, sol-gel technology, semiconductor catalysts, photoelectrochemical solar cells, photovoltaics.
Crystal Lattices, metallic elements, alloys, ionic solids, defects, ceramics, glasses, layered MS₂ structures, Chevural phases, solid state electrolytes, batteries, solid state synthesis, thermal techniques.

Recommended Text

CH 424 Special Topics in Organic Chemistry (1 credit)
Supramolecular chemistry, stereoelectronic effects, reactive intermediates, insect related chemistry, biomolecules of interest. (Topics may vary each year)

CH 425 Advanced Organic Chemistry II (3 credits)
(Prerequisites: CH 324, CH 326)
Physical Organic Chemistry (15 L): Analysis of factors that influence the rates and mechanisms of organic reactions
Advanced Stereochemistry (15 L):
Problem Solving (15 L): Application of principles of stereochemistry, reaction mechanisms, organic synthesis and spectroscopy in solving problems in organic chemistry

Recommended Text

CH 426 Natural Product Chemistry (3 credits)
(Prerequisite: CH 325)
Carbohydrates (10 L): Conformations of carbohydrates and conformational effects. Reactions of carbohydrates. Synthesis of modified carbohydrate molecules and other natural products
Steroids and Terpenoids (5 L): Studies of steroids, structure and reactions; Terpenoids, classes of terpenoids, structural elucidation, saponins
Alkaloids (7 L): Classification, chemical and spectroscopic methods in structure elucidation, reactions and synthesis
Oxygen heterocycles (8 L): Characterization, synthesis and reactions of pyrylium salts, anthocyanins, α-pyrones, γ-Biosynthesis (15 L): Basic structural units, precursors and common reactions in biosynthesis; Acetate, shikimate and mevalonate pathways; Biosynthesis of alkaloids; Investigation of biosynthetic pathways.

Recommended Texts

CH 435 Advanced Physical Chemistry II (2 credits)
(Prerequisite: CH 331)
Advanced Electrochemistry (15 L): Solvents, electrolyte solutions, non-ideal nature of electrolyte solutions, ion-solvent interactions, ion-ion interactions; The Debye-Huckel theory, ideal polarized electrodes, electrocapillary curves, determination of surface charge density, surface excess concentrations of ionic and neutral species at electrode surfaces, AC methods, theories of electrode/solution interfaces, electrode kinetics, mass transfer, charge transfer and other processes, Tafel plots, mass transfer-controlled electrode kinetics.
Advanced Topics in Kinetics and Reaction Dynamics (15 L): Review of fundamental laws of kinetics, fast chemical reactions and experimental methods for studying rates of such reactions, relaxation methods, collision theory, activated
complex theory, Eyring equation, thermodynamic parameters, potential energy surfaces, applications in surface science and catalysts.

Recommended Texts

**CH 436 Advanced Physical Chemistry III (2 credits)**
(Prerequisite: CH 331)

**Surface and Colloid Chemistry (15 L):** Introduction to surface processes, adsorption at liquid/fluid interfaces, Gibbs adsorption isotherm and its application, surfactants and their uses, adsorption at solid/gas interfaces, enthalpies of adsorption, measurement of enthalpy of adsorption, physical adsorption, chemisorption and its significance, theories of adsorption; heterogeneous catalysis, dispersion systems, properties of dispersions

**Polymer Chemistry (15 L):** Introduction to polymers, Polymerization processes; Carother’s equation for linear and non linear step-growth polymerization; Kinetics of addition polymerization; Kinetics of step-growth polymerization; Melting point and glass-transition temperature, the relationship between the chemical structure and properties of polymers; Statistical thermodynamics of polymer solutions; Characterization of polymers

Recommended Texts
2. M.Camphell, *Catalysis at surfaces*

**CH 443 Advanced Analytical Chemistry (3 credits)**
(Prerequisites: CH 232, CH 341)

**Spectroscopic Instrumentation and Spectrochemical Analysis** (20 L): Optical components of spectrophotometers: sources, transducers, measurement systems, signal-to-noise ratio; Spectrochemical measurements: methodology and errors in spectrochemical analysis, sensitivity and detection limits, automated spectrochemical measurements; Advanced atomic spectral methods: Plasma, Arc and Spark methods; Atomic fluorescence spectrometry; Infrared and luminescence molecular spectroscopic methods.

**Surface Analytical Techniques** (10 L): X-ray and uv photoelectron spectroscopies, Auger spectroscopy, Low energy electron diffraction, X-ray microscopy, etc.

**Advanced Electroanalytical Techniques** (5 L): Preparation and applications of chemically modified electrodes; Spectroelectrochemical methods.

**Advanced Separation Techniques** (10 L): Capacity factor and selectivity ratio as applied to gas chromatography and liquid chromatography, high performance liquid chromatography, size exclusion chromatography, supercritical fluid chromatography, affinity chromatography.

Recommended Text

**CH 448 Analytical/Instrumental Chemistry Laboratory (1 credit)**
(Prerequisite: CH 443)

Experiments in advanced analytical chemistry and water analysis.

**CH 455 Biological Chemistry II (2 credits)**
(Prerequisite: CH 351)

**Bioanalytical Chemistry & Biophysical Chemistry** (10L): Biochemical techniques, centrifugation and chromatography; Topics in physical chemistry pertinent to biology - conformations of macromolecules, spectroscopy, thermodynamics, dynamics and transport processes, Donan equilibrium; Biological spectroscopy

**Food Chemistry** (10L): Methods in food processing

**Toxicology and Reactive species in biology** (10L): Natural toxins, environmental pollutants, drug abuse, fats and toxic effects of xenobiotics in biological systems; Reactive oxygen species, lipid peroxidation, free radicals and toxicology, free radical reactions in living systems, diseases associated with free radical damage.

Recommended Texts

**MB 416 Environmental Biotechnology (2 credits)**
Living organisms as pollution indicators; biodegradation; waste management; pollution treatment; biomining; biogas production; microbes in environment management
Recommended Texts

MB 421 Fermentation Technology (2 credits)
Microorganisms used in industrial fermentation; isolation and preservation of pure cultures; mutants, factors influencing rate of mutation; bioreactors design and operation; culture media; sterilization; control of different parameters; process monitoring; isolation of products; current applications

Recommended Texts
2. BR Glick, JJ Pasternak (1998) Molecular Biotechnology, American Society for Microbiology

CH 458 Biological Chemistry Laboratory (1 credit)
(Prerequisite CH 351)
Detection, isolation and analysis of amino acids, proteins, carbohydrates and nucleic acids

CH 491 Seminar (1 credit)
(Compulsory for all special degree students)
Each student is required to present a seminar on a topic assigned by the Department.

CH 492 General Aspects and Recent Developments in Chemistry (1 credit)
(Compulsory for all special degree students)
The students will be evaluated on their knowledge and understanding of the principles of chemistry covered in the compulsory courses, and on general chemistry introduced through seminar- and industrial-presentations.
The three-hour question paper will also include an essay on a topic of general chemical interest.

CH 499 Research Project (6 credits)
(Compulsory for all special degree students)
Each student will carry out a research project during the final year under the supervision of a staff member. The student is required to give a seminar, based on the research project, and submit a report.
COMPUTER SCIENCE

100 LEVEL COURSES

CS 100  Computer Applications (2 credits)
Introduction to Computer and operating Systems,
Micro Computer Applications : Use of Software Packages- Spread Sheet applications, DBMS applications, Utility
programs and Word processing.
Data Protection Techniques : Data security techniques, Computer Viruses and prevention. Data Communication : Email,
Internet and Networking of Computers.
Introduction to a Programming Language: Procedures, Functions, File handling, Application of a DB management.
(This course includes both theory and practicals)

Recommended Texts:
1. Computer Science, C.S.French
3. Computer viruses, Robert Slade

CS 101  Introduction to Computer Science (3 credits)
Introduction and overview : Intelligent machines and systems applications, Business, Communications, Educational,
Engineering, Environmental, Medical and Scientific applications.
Introduction to computing concepts : Basics of computer programming : data types, declarations, assignments, basic
input and output ASCII files, built-in functions.
Structured programming ideas : selection statements: sequence, iteration (counting loops, while loops, file pointers),
conditional (if-then-else statements ,case statements) ,matrix manipulations (addition, subtraction, multiplication,
transposition ).
Modular programming : functions, procedures with actual and formal parameters, simple sort algorithms, dynamic
memory allocation and addressing.
Numerical methods: Linear interpolation, linear regression, pseudo random , roots of functions, solutions of
simultaneous linear equations by Gaussian elimination, numerical integration.

Recommended Texts
1. The Thinking Ape: Evolutionary Origins of Intelligence, R. Byrne.
3. Artificial Intelligence, E.Rich and K. Knight

CS 102  Programming Techniques (3 credits)
Basic concepts, basic components of programming languages, binding, simple algorithms operating on non-structured
data, modularity in program construction.
Basics of constructing larger programs : abstraction and instantiation of program components, structured data (lists,
stacks, queues, ordered binary trees ), storing and accessing data structures, operations on mutable data, working with
mutable data, object-based programming, data encapsulation

Recommended Texts:
2. Structured programming concepts,K. Labudde

CS 103  Programming Laboratory 1 (2 credits)
(Prerequisites: CS 101, CS 102, which shall be taken concurrently (1 cr. per semester))
Language constructs : data declarations, loops, decision structures ,input/output, files, subprograms / procedures,
numeric and non-numeric data. Design and construction of software: top-down and bottom-up design, decomposition,
structuring, design for reuse, documentation, study of examples, writing software as a team, using software from others.
Programming assignments: A variety of progressively more complex assignments.
(Sections are offered in C,C++ and Java )

Recommended text:
1. Turbo C++, I. Bryan Byron S. G. (1990),
3. JAVA: How to Program, H.M. Deitel and P.J. Ditel
200 LEVEL COURSES

CS 201  Data Structures (2 credits)
(Prerequisites: CS 101, CS 102)
Introduction: 1. Arrays, records, pointers, indices, 2. Recursion 3. Objectives: (I) Timing comparisons, (ii) Memory comparisons, Implementation: array/linked; ordered/unordered. Searching: introduction to set abstract data type, Stacks and queues, Trees; Pointer implementation, traversal, Binary search; Definition, Searching, Creation and insertion, Good and bad trees, Deletion, B-trees, Hashing: initial hash, collisions, separate chaining, Graphs; Implementation of depth first search, breadth first search, topological numbering, connected, Sorting; Insertion sort, Quick sort, Heap as priority queue; Heap sort
Recommended Text:
  1. Standish T. A.; *Data Structures in Java*; Addison-Wesley; 1998
  2. Deitel, H. M.; Deitel, P. J.; *Java how to Program*; Prentice Hall; 1999

CS 202  Data Structures Practicals (1 credits)
(Prerequisites: CS 103, CS 201)
Implementation of data structures studied in CS 201 using C, C++ and Java.
Recommended Text:
  1. Standish T. A.; *Data Structures in Java*; Addison-Wesley; 1998
  2. Deitel, H. M.; Deitel, P. J.; *Java how to Program*; Prentice Hall; 1999

CS 203  Database Management Systems (2 credits)
(Prerequisites: CS 101, CS 102)
Introduction, The entity-relationship model, Logical organization of databases; The relational model, Relational algebra, SQL, Physical organization of databases; Characteristics of disks and disk blocks, Storage of relations, Query processing and optimization, Concurrency control; Transactions, Serializability, Locking, Recovery, Distributed databases, Functional dependencies and normal forms.
Recommended Text:
  1. Date, C. J.; *An Introduction to Database Systems*; Addison-Wesley; 2000

CS 204  Programming using Database Management Systems (1 credits)
(Prerequisites: CS 103, CS 202, CS 203)
Computer programming using database management packages such as Informix, Sybase, Oracle and FoxPro on PCs and workstations. Programming assignments: A variety of progressively more complex assignments.
Recommended Text:

CS 205  Computer Architecture (2 credits)
(Prerequisites: CS 101, CS 102)
Combinational logic networks, Computer arithmetic; arithmetic/logic unit, Sequential logic networks, Memory hierarchy, CPU design, I/O architecture, Instruction sets, addressing modes, linking and loading, Subroutines, ALU design, Basic processor design, Basic pipelining, Memory hierarchy design, Input/output, Parallel processing.
Recommended Text:

CS 206  Computer Device Interfacing (2 credits)
(Prerequisite: CS 205)
Review of basic features of computer hardware and software; Lab: Introduction to equipment, demo, simple experiment. Input/Output (I/O) concepts and examples; Lab: Experiment involving parallel I/O; More concepts and examples; Lab: Experiment involving serial I/O. Interfacing to the analog world; Lab: Experiment using digital-to-analog (D/A) conversion; Lab: Experiment using analog-to-digital (A/D) conversion. Techniques for analysis of acquired data; Lab: Experiment requiring digital signal processing. Interfacing to local area network (LAN; Lab: Experiment using LAN.
Recommended Text:
  1. Horowitz P. & Hill W.; *The art of Electronics*; Cambridge Univ. Press; 1989
300 LEVEL COURSES

CS 301 Software Design and Development (3 credits)
(Prerequisite: CS 201)
The software life cycle; Overview of software engineering; classic life cycle model, Project planning; Fundamentals of project and system planning, Requirements analysis Software design fundamentals; Stepwise refinement, bottom-up approach, modularity, Design techniques; Use of data flow vs. data structure vs. object oriented techniques; modularity, Testing: Testing objectives, test case design, white box vs. black box testing, overview of testing strategies, Maintenance; Overview of maintenance issues and software configuration management.

Recommended Text:

CS 302 Design and Analysis of Algorithms (1 credits)
(Prerequisites: CS 201, CS 202)

Recommended Text:

CS 303 Operating Systems Concepts (3 credits)
(Prerequisite: CS 203)
Introduction, Distributed OS Techniques; Naming, Inter-process communications and remote procedure calls Data and process migration, transactions, file systems, Parallel OS Techniques; Process management, scheduling, synchronization, Data management, caching, coherency, consistency, file systems, Load balancing, Advanced OS Concerns; Memory management, virtual memory, garbage collection, Fault-tolerance, reliability, replication, Protection, authentication, security, cryptography, I/O models, Performance, benchmarking, and monitoring, Client - Server Model.

Recommended Text:
1. Tanenbaum, A.S.; Modern Operating Systems ; Prentice Hall; 1992

CS 304 Project in Computer Science I (3 credits)
(Prerequisites: CS 301, CS 302, CS 303 which shall be taken concurrently (1 cr per semester )).
Students of the batch are organized into teams of four to six students with a department advisor to analyze a problem proposed, to select a suitable solution, and to implement that solution. Students work in teams to solve typical commercial or industrial problems. Work involves planning, design, and implementation (The use of Computer programming in Java or/and Database Management package is essential). Oral and written work is required.

Recommended Text:
1. Texts will be assigned by the instructor

CS 305 Communication Networks (2 credits)
(Prerequisite: CS 303)
Overview; Examples and concepts of layered architecture; overview of higher layer protocols. LAN - Network Topologies, Medium Access Control Methods, LAN Standards, WAN - Introduction to ISO/OSI Model, Introduction to Internet & TCP/IP Protocols, Transport layer; Internet addressing and Internet protocols; socket interface, Network layer, Taxonomies; relevant parameters of network and traffic, Multiple-access methods for broadcast networks, Taxonomies of multiple access methods; contention, methods; polling methods; reservation methods, Switched networks Architectures of switches; scheduling and admission control; routing, flow control, and congestion control, Interconnections of networks Logical data link protocols.

Recommended Text:
1. Tanenbaum, A.S.; Computer Networks; Prentice Hall; 1996

CS 306 Compiler Construction (3 credits)
(Prerequisites: CS 302, CS 303)
Context-free languages and grammars, Bottom-up parsing, Syntax-directed translation, Storage allocation, Review of symbol tables, type checking, semantic analysis, Project logistics, Code generation, Basic blocks/dags, Expressions, Instruction selection, optimization, integrated, techniques, Control and data flow, Flow graphs, dominators, Iterative and interval analysis, Def-use, use-def, live variable analysis, Dead code, redundant computation elimination, Constant propagation, strength reduction, Program representations (SSA, PDG), Loop optimization, Register allocation, Garbage
collection, Dynamic data structures, pointer analysis, aliasing, Code scheduling, pipelining, Dependence testing, Loop level optimization, Superscalar optimization, Profile-driven optimization, Debugging support, Incremental parsing, Type inference, Advanced parsing algorithms (Tomita/Early), Practical attribute evaluation, Function in-lining and partial evaluation.

Recommended Text:
1. Aho et al; Compiler Construction Principles, Techniques and Tools; Addison Wesley; 1986

**CS 307  Computer Graphics (3 credits)**
Students who registered for this course should also follow CS 308. (Prerequisite: CS 302)
Introduction; Overview of graphics systems, Components of graphics systems, Display devices, processors, software standards; introduction to GKS, PHIGS and OpenGL, Basic raster algorithms; Generation of output primitives, attributes (color, area filling, etc.), geometric transformations, Structure of graphics packages; 2-D viewing, structures /segments, hierarchical model, graphical user interfaces, interactive input methods, 3-D object representations and manipulations; Polygon mesh, spline surfaces, superquadrics, fractal geometry, octrees, visualization of 3-D, data sets, geometric transformations, 3-D viewing; Parallel and perspective projections, Visible surface identification methods, Illumination models and surface rendering; Constant intensity, Gouraud shading, Phong shading, ray tracing, radiosity, Color models; Basic concepts; RGB.

Recommended Text:

**CS 308 Computer Graphics Programming (2 credits)**
(Prerequisite: CS 307)
Software, hardware, and mathematical tools for the representation, manipulation, and display of topological and two- and three-dimensional objects; applications of these tools to specific problems. Computer programming on PCs and Workstations.

Recommended Text:

**CS 309 Object Oriented Analysis and Design (3 credits)**
(Prerequisites: CS 102, CS 201)
Fundamental of Object-oriented design: Encapsulation, classes and objects, information hiding, operator overloading, inheritance, overriding, delegation; Analyze problems, determine objects that are necessary to model the system, determine what attributes the objects need to have, determine what behaviors the objects need to exhibit, develop conceptual models, generate designs from the models, and implement the models.

Recommended text:

**CS310 Server Side Web Programming (3 credits)**
(Prerequisites: CS103, CS203, CS204)
Introduction to HTML, Introduction to Client Side Scripting *Java Script*; JavaScript syntax, JavaScript object model, JavaScript objects, Static objects, Forms object (Submit () and Reset () methods), Event handling - Mouse related events, Keyboard events, Document events, Output in JavaScript, Introduction to VB Script, *ASP.net*; Implement ASP.net with VBScript, Use SQL & ADO to Interact with ASP.net Databases, Write Cookies on the Client Using ASP.net *J2EE* - *Java Enterprise Edition*; JDBC, JSP, Servlet, *Hypertext Preprocessor* ;Program structure, Use php to process html forms, Regular expressions for form validation and other applications, Read and write files, Database applications. *XML*; Understand the role of XML, Write XSL Documents to Describe how XML Documents are to HTML, Create Simple DTD & Schema Files to Describe the Grammar of XML, Differences between DTD’s & Schema, Differences between Cascading Style Sheets & XSL, Other new trends in Web development; Eg. SOAP, WSDL

Recommended text:
2. Java 2 with Swing: Deitel and Deitel
400 LEVEL COURSES

CS 401  Artificial Intelligence and Expert Systems: (3 credits)
(Prerequisite: CS 301)

Recommended Text:

CS 402  Intelligent Systems in CIM(3 credits)
(Prerequisite: CS 401)
Intelligent system, Autonomous systems, Skilled base system, modeling industrial manipulators, Kinematics, Dynamics, control, Motion and Grasp planning, Computer aided Design (CAD), Geometrical modeling of objects, Robots and tools, computer aided process planning, Task specification and technological route planning, Sensor systems, Virtual and Virtual sensors, Intelligent control systems: Simulation.

Recommended Text:

CS 403  Artificial Neural Networks: (3 credits)
(Prerequisite: CS 401)

Recommended Text:
1. Haykin, S.; Neural Networks: A comprehensive foundation; Prentice-Hall; 1999

CS 404  Parallel Processing: (3 credits)
(Prerequisites: CS 206, CS 303, CS 306)

Recommended Text:

CS 405  Fuzzy Logic and Modeling: (3 credits)
(Prerequisite: CS 401)
Fuzzy system models, Fuzziness and certainty, fuzzy sets, basic properties and characteristics, Domains, Alpha- level sets and support sets, Linear representation, Fuzzy set operators, Conventional (crisp) set operations, basic Zadeh type operations, intersection, union and complement of fuzzy sets, General algebraic operations, Fuzzy set hedges, Fuzzy reasoning, linguistic variables, Fuzzy models, Fuzzy systems and modeling, Design methodologies, modeling and utility software.

Recommended Text:
1. Nguyan H.T.; Walkey E.A; A first course in Fuzzy Logic; Chapman and Hall; 1996.
2. Ross T.J.; Fuzzy Logic with Engineering Applications; McGraw Hill ;1995

CS 406  Foundations of Distributed Computing (3 credits)
(Prerequisites: CS 102, CS 305)
Networking: network types, network protocols, packet switching, networking technology, internetworking; Interprocessor communication: communication mechanisms, communication models, client-server communication, group communication, remote procedure calling; Distributed operating systems: issues, building blocks, architecture; Distributed file services: file system, file and directory services, sharing, remote access methods; Name and time services: names and attributes, name services, internet domain name system, time and coordination; Replication: architectural models, consistency and request ordering, ordering implementation, process groups; Transaction processing: transaction properties, concurrency control, fault tolerance and recovery, distributed and nested transactions, concurrency control methods.
Recommended Text:


CS407  **Object-Oriented Software Design with Patterns (3 credits)**
(Prerequisites: CS 301, CS 309)
Overview of the software life cycle, Reuse of design patterns and software architectures, Developing, documenting, testing and applying reusable class libraries and object-oriented frameworks, Decentralized software architecture, Design patterns, Component reuse, Class interface definition, Module decomposition.

Recommended text:


CS 421  **Project in Computer Science II – Individual Project Work (6 credits)**
(Prerequisite: CS 301)
The project topic could be selected from any area in the in the Computer Science Special Degree which specified above. The selection of the project is done at the beginning of the year and involves at least 8 hours work per week. The project will be done throughout the year and consist of three progress reports (one for term), a dissertation and oral presentation.

CS 423  **Seminar (1 credit)**
Compulsory for all special degree students in Computer Science. Each student will be assigned a topic on which he/she is expected to make a presentation.

**Note:** Students opting to follow the special degree course in computer science are required to select courses from the following course units in addition to fulfill their credit requirements.

- MT 207 Combinatrics
- MT 209 Graph Theory
- ST 102 Introduction to Probability Theory
- ST 201 Probability Theory
- ST 203 Theory of Statistics
GEOLOGY

100 LEVEL COURSES

GL 101 Earth Processes (3 credits)

Recommended texts:
1. Press, Frank and Siever, Edmund (1994) *Earth*
2. Summierfield, M.A. *Global Geomorphology*
3. Moore, R.B., Lalicker, C.G. and Fishers, A.G. *Invertebrate fossils*
4. Nileds and Tucker, V.C.T. *Palaeontology-An Introduction*
5. Ross, Kenneth P. *Geochronology.*

GL 102 Earth Processes Practical (1 credit)
(Prerequisite: GL 101)
Study and interpretation of topographic, orographic, geological, agricultural and land-use maps and cross-sections. Introduction to geological mapping and 10-15 days of geological mapping exercise.

GL 103 Earth Materials (3 credits)

Recommended texts :

GL 104 Earth Materials Practical (1 credit)
(Prerequisite: GL 103)
Identification of common crystal forms, habits and twinning. Their Point group symmetry and classification into classes and systems. Identification of common rock-forming minerals, economic minerals on the basis of physico-chemical properties. Study of mineralogy and texture of igneous, sedimentary and metamorphic rocks. Identification of common fossil forms.

200 LEVEL COURSES

GL 201 Mineralogy (3 credits)
Structure, classification and crystal chemistry of rock-forming minerals and their occurrence and parageneses. Principles of optical mineralogy. Study of optical properties of rock-forming minerals
Identification of rock forming minerals in hand-specimen and under the polarizing microscope

Recommended Texts :

GL 202 Economic Minerals and Resource Geology (2 credits)
Introduction to ore-forming processes; overview of nature and geological setting of metallic deposits, coal, graphite, diamond, phosphates, bauxites and placer deposits. Introduction to gemmology; Economic geology of Sri Lanka. Rocks,
minerals, and soils as industrial and raw materials. Ore microscopy, identification and study of economic minerals, gems and resource materials.

Recommended Texts:

**GL 203 Soil and Rock Mechanics (2 credits)**

Soil properties; soil water, soil stresses, compressibility, consolidation and settlement, shear strength. Lateral pressure and retaining structures. Slope stability analysis. Bearing capacity and foundations, improving soil condition and properties; Introduction to physical and mechanical properties of rocks; rock testing, strength and failure of rocks; defects in rock masses. Improvement of properties of rock masses.

Recommended Texts:

**GL 204 Water Resources (1 credit)**

Surface and groundwater resources. Water for domestic purposes. Industry and Agriculture; Quantity and quality requirements. Depletion of water resource due to pollution and exploitation. Conservation water resources

Recommended Texts:

**GL 205 Introductory Petrology (3 credits)**


Recommended Texts:

**GL 206 Paleontology and Stratigraphy (2 credits)**

Methods in paleontology. Fossils and fossilization., trace fossils, plant fossils, microfossils and their uses.

Recommended Texts:
3. Moltzer, J.G., *Paleontology practical course manuel*

**GL 207 Geochemistry (2 credits)**

Introduction to geochemistry. Primary differentiation of the earth and solar system. Classification and distribution of elements and isotopes. Geochemistry of rocks and minerals. Energy, entropy and fundamental thermodynamic concepts and its application to natural systems. Aqueous solutions in geology; Cosmogeochmistry; Geochemistry of solid earth; Reactions at the earth surfaces-weathering, soils and stream chemistry, Oxidation-reduction; Soil geochemistry and organic geochemistry.
Recommended Texts:
2. Krauskopf, Konrad B. *Introduction to geochemistry*.

**GL 208 Field Techniques in Geology (1 credit)**
Methods of field geology. Introduction to basic geological structures; faults, folds, foliations and geomorphology in geological mapping. Geological cross-sections. Mapping of rock sequences, interpretation of geological field data, preparation of geological maps and cross sections. Production of geological reports

Recommended Texts:

**300 LEVEL COURSES**

**GL 301 Introduction to Structural Geology and Tectonics (2 credits)**
Concepts of force, stress, strain and deformation. Brittle and ductile deformations. Fractures and faults and their origins. Concept of stereonet and graphical analysis of structural data. Importance of structures in economic geology, ground water exploration and engineering geology. Study of structural features in hand-specimens and in the field. Interpretation of geological and structural maps. Mesoscopic, macroscopic and megascopic structures should be studied in the field.

Recommended Texts:

**GL 302 Photogeology (2 credits)**
Basis of photogrammetry, practical uses of aerial photographs in structural geology, economic geology, geomorphology, hydrology, hydrogeology, geography, agriculture and land-use. Guided geo-mapping in a selected area and its geological and structural analysis. Submission of geological report by individual students. Visual interpretation of aerial photographs, resource exploration, land-use, land pattern analysis.

Recommended texts:
2. Miller and Miller. *Photogeology*

**GL 303 Geomorphology (1 credit)**

Recommended texts:
2. Reinic and Singh. *Tropical geomorphology*

**GL 304 Geophysics (2 credits)**
Introduction to geophysics, structure of the Earth. Earth’s gravity field, seismicity and earthquakes, geomagnetism, paleomagnetism, radioactivity and radioactive dating, Earth’s internal heat, geo thermal energy.

Recommended texts:
GL 306 Environmental Geology (2 credits)
Introduction to environment; environmental issues, resources and the environment; Pollution of the Earth’s environments (atmosphere, water and soil). Environmental effects of geological resource extraction, conserving mineral resources, geological hazards; urbanization and sustainable cities; Environmental Impact Assessment (EIA) and EIA processes.

Recommended texts:
2. Stumm and Morgen. *Aquatic chemistry*.

GL 307 Engineering Geology (2 credits)
Engineering properties and classification of soils and rocks, stability of slopes and mass movements, site investigations for building, dams, reservoirs, tunnels and highways. Rocks and soils as construction materials. Laboratory studies of engineering properties of soils and rocks, use of maps as a tool in engineering geological studies.

Recommended texts:
2. Bell, F.G. Engineering geology and geotechniques.
3. Goodman, R.E. Engineering Geology

GL 308 Introductory Hydrogeology (2 credits)
Surface and sub-surface distribution of water. Unsaturated and saturated zones, aquifers and their properties. Darcy’s law and groundwater flows. Draw-down discharge relationships. aquifer types and groundwater environments. Chemical characteristics of groundwater. Field and Laboratory studies hydrogeological properties of soils and rocks. Maps, airphoto and satellite imagery interpretations in groundwater studies. Laboratory and field exercises in hydrogeology.

Recommended texts:

GL 309 Hydrology (2 credits)
Introduction to basic principals of hydrology including mathematical, physical and chemical concepts. Discussion on practical applicability of common-used analytical techniques in understanding the different components of the hydrological cycle – climate, precipitation, evapo-transpiration, runoff and infiltration. Hydrological Cycle - sources of stream flow, uniform and steady state flow. Hydrographs and hydrologic routing; basin study and water balance, probability and statistical techniques, Computer applications in hydrology.

Recommended texts:

GL 310 Geology of Sri Lanka (2 credits)

Recommended texts:

GL 311 Geological Data Analysis (2 credits)
Familiarizing with software tools in quantitative data analysis, describing and comparing data populations, simple data manipulations, creating and working with databases, surface contouring and modeling, graphic data representation, and simple computer modelling of geological processes. Basic statistics (curve fitting, error analysis, hypothesis testing, univariant data analysis, bivariant data analysis, multivariate data analysis). Multivariate model developments in geology; using principal component analysis, discriminant analysis, cluster analysis. Students will be exposed to a suite of relevant software.
Recommended texts:

**GL 312 Metamorphic Petrology (3 credits)**
(Prerequisites: GL 201, GL 205)

Recommended Texts:

**GL 313 Applied Analytical Techniques in Geology (2 credits)**
Sampling methods (geological and environmental); Principles of X-Ray Diffractometry (XRD), X-ray Fluorescence (XRF) spectroscopy, Electron Probe Micro Analysis (EPMA), Atomic Absorption Spectrophotometry (AAS), and Inductively Coupled Plasma (ICP) with applications to earth sciences; Quality control in sampling and analysis. Lectures on theory are followed by hands-on laboratory exercises. Interpretation of analytical results; identification of minerals, calculation of chemical formula of minerals, mineral recalculation, graphical representation and substitution.

Recommended Texts:

**GL 314 Igneous Petrology (3 credits)**
(Prerequisites: GL 201, GL 205)

Recommended Texts:

**GL 315 Advanced Economic Geology (1 credit)**
(Prerequisite: GL 202)
Physico-chemical characteristics of mineral deposits, volcanogenic ore deposits Cu-Zn, Pb-Zn, Cu-Mo… etc.) Mineral deposits in sedimentary and metamorphic environments, non metallic deposits, precious metals and minerals, examples of world’s typical mineral deposits, uses of minerals, overview of ore genesis related to plate tectonics.

Recommended Texts:

**GL 316 Remote Sensing and GIS (2 credits)**
Introduction to GIS, Overview, History and Concepts of GIS, Scope and Application Areas, Purpose and Benefits of GIS, Functional Elements of GIS, Mapping Concept – Map elements, Map scales and representation Map Projection, Geometric Rectification, Data Structure – Raster and Vector Data Structure, Data Acquisition, digitization. Laboratory works with the GIS programs (e.g. Arcview and Arc-Info)
Recommended Texts:

GL 317 Sedimentology (3 credits)
(Prerequisites: GL 201, GL 205)

Recommended texts:
3. The Geology of Fluvial Deposits by A.D.Miall Springer 1996

GL 318 Advanced Field Geology (2 credits)
Advanced geological and structural mapping at regional scale. Two weeks field excursions. Field mapping of Highland Complex of Sri Lanka, involving intensive field component, and utilizing aerial photographs and GIS techniques.

Recommended texts:

400 LEVEL COURSES

GL 401 Applied Hydrogeology (2 credits)

Recommended texts:

GL 402 Soils and Quaternary Geology (2 credits)
Soils as a product of the natural environment with focus on formative processes and classification. Soil conservation; The soils of Sri Lanka; Major events and the significance of the Quaternary period with special reference to Quaternary Geology of Sri Lanka.

Recommended Texts:

GL 403 Precambrian Geology (2 credits)
Recommended Texts:

GL 404 Isotope Geology (2 credits)
Isotopes - stable and radioactive, stable isotope fractionation, stable isotopes in the lithosphere, hydrosphere and biosphere and the mantle and their applications in geology. Radioactive isotopes, their decay schemes and use in isotopic dating of minerals and rocks and inference of geological history of earth materials.

Recommended Texts:

GL 405 Applied Geophysics (2 credits)
Principles of applied geophysics. Investigations of earth resources and geologic structures by Geophysical methods, Seismic Surveying, Gravity Surveying, Magnetic Surveying, Electrical Surveying, Electromagnetic surveying, Bore hole geophysics.

Recommended Texts:

GL 406 Oceanography and Coastal Geomorphology (3 credits)

Recommended Texts:

GL 407 Surveying and Levelling (2 credits)

Recommended Texts:

GL 408 Energy Resources (1 credit)

GL 409 Advanced Metamorphic Petrology (3 credits)
(Prerequisite: GL 312)
Principles and application of thermodynamics to mineral equilibrium in metamorphic rocks. Quantitative approaches in metamorphic petrology. Geothermometry and Geobarometry. Principles and application of the P-T-t path concept. P-T-t path case studies, P-T-t path determination using compositional zoning in minerals. Laboratory study of P-T-t history of metamorphic terrain using mineral reactions and reaction textures in thin sections. Introduction to experimental petrology

Recommended Texts:

**GL 411 Structural Geology and Tectonics (2 credits)**

Crystal defects and deformation mechanisms. Concept of strain ellipse and ellipsoid. Ductile structures such as foliations, lineations, folds, boudins and shear zones. Mechanism(s) of their formation. Folding, elements of fold style and fold mechanism. Introduction to structural geology and tectonics of Sri Lanka. Geodynamic evolution of Sri Lanka. Plate tectonics in detail. Concept of formation and break-up of supercontinents. Tectonics in the Indian Ocean region. Study of microscopic to megascopic structures and related fabrics in the field for practical classes. Lectures have to be supplemented by preparations of essays and seminar presentations by students.

**Recommended Texts:**

**GL 412 Mineral Exploration and Mining Geology (2 credits)**

Methods of exploration and mining geology, including mapping, geophysics, remote sensing, exploration geochemistry, inclusion studies and diamond drilling. Technical and economic aspects of exploration programme design and reserves evaluation procedures. Open cast mining, underground mining, mining in the soft ground, underwater and deep sea.

**Recommended Texts**

**GL 413 Advanced Igneous Petrology (3 Credits)**

(Prerequisite: GL 314)

Application of phase diagrams, experimental petrology, and field and petrographic relationships to the origin of magmas. Layered intrusions, Ophiolite complex, Igneous processes and global tectonics field trips. Petrographic studies on layered rocks, associations and ophiolite complexes.

**Recommended Texts:**

**GL 414 Advanced Environmental Geology (2 credits)**

(Prerequisite: GL 306)

Natural environment, particularly geologic factors that may impact upon human life or way of life, Environmental problems and possible alternative solutions to such problems The biogeochemical cycles of water, carbon, nitrogen, and sulfur; the interactions among major biogeochemical cycles and resultant global change. Health and disease, waste disposal, water, mineral and energy resources and conservation, land reclamation, land-use planning.

**Recommended texts:**

**GL 415 Environmental Geochemistry (2 credits)**

(Prerequisite: GL 207)

Geochemistry of ecosystems; Heavy metal pollution; sources and origins of heavy metals in the environment; mobility and immobility of heavy metals in environmental media; bioaccumulation; Dose-response relationships, toxic elements and elemental forms; Medical geochemistry; Geochemical health problems pertaining to Sri Lanka.

**Recommended texts:**

**GL 417 Geologic and Hydrologic Hazards (Prevention and Mitigation) (2 credits)**

**Landslides**—causes, types and processes of slope movement, slope stabilization and mitigation, landslide hazard zonation maps. **Earthquake**—ground shaking, surface faulting, ground failure, subsidence, Tsunamis, Tsunami Warning System, Reduction of losses from earthquakes and tsunamis. **Floods**—causes of flooding, Flash flooding, Riverine floods, Tidal floods, Reduction of losses from floods. **Volcanic eruptions**—different kinds, hazards from volcanoes, forecasting of volcanism, Reduction of losses from volcanism.

Recommended texts:

**GL 418 Advanced Engineering Geology (2 credits)**
(Prerequisites: GL 203, GL 307)


Recommended texts:

**GL 419 Petroleum Geology and Exploration (1 Credit)**


Recommended texts:

**GL 420 Advanced GIS (2 credits)**
(Prerequisite: GL 316)


Recommended texts:

**GL 421 Project Proposal and Report Writing (1 credit)**

Research Project, EIA, Budget estimation, Writing scientific papers and reports

Recommended texts:

**GL 422 Seminar on Special Topics in Geology (1 credit)**

A structured program of reading and seminars leading to an in-depth understanding of a chosen topic in geology. Students may repeat course once for an additional two or three credits
GL 423  Research Project (6 credits)
Field/Laboratory studies on a problem of current geological interest. A detailed report has to be submitted incorporating objectives, methodology, results, interpretation, conclusions and bibliography. An oral examination based on the project will be held as part of this course. The candidate will have to make a summary presentation of the project at this oral examination conducted by a panel of Senior teachers/researchers.

GL 424  Field Geology Assessment   (2 credits)
Each student is required to individually prepare a detailed geological/structural map of a given area and submit a report, and may be required to make an oral presentation, on the basis of his/her study. The report (and the presentation) shall consist of laboratory studies pertaining to the area in addition to the field observations. The map and the report will be assessed and graded. A student is required to spend at least a minimum of 90 hours to complete the field work component of this assessment.

GL 427  Seismology (2 credits)
Seismic waves and earth models, Seismic sources and source parameters, Seismic signals and noise, Seismic sensors and recording systems, Site selection, preparation and installation of seismic stations, Seismic networks and arrays, Seismic data formats archival and exchange, Data analysis and interpretation, Seismic hazard assessment.

Recommended texts:

GL 428  Advanced Sedimentary Petrology  (3 credits)
(Prerequisite: GL 317)
Introduction-basic concepts and methodology; siliciclastic sediments- sandstones and sandstone diagenesis, conglomerates, breccia, mud rocks; chert and siliceous sediments. Carbonate sediments and limestones- carbonate diagenesis and microfabrics; dolomitization and dedolomitization; Evaporites and sequences; sedimentary ironstones and iron formations Phanerozoic and the Precambrian); sedimentary phosphate deposits, nodular and bedded phosphorite, bioclastic and pebble bed phosphorites, Guano phosphorites; geology of fluvial deposits, coal, oil shale and petroleum, petroleum source rocks; volcaniclastic sediments; origin and mineralogy of clays

Recommended texts:
2. Carbonate microfabrics by R.Rezak and D.L. Lavoie  Springer Verlag  1990
6. Origin and Mineralogy of Clays by B.Velde Springer Verlag 1995
MATHEMATICS

100 LEVEL COURSES

MT 100 Mathematics for Biological Sciences (2 credits)
Sets and inequalities, Linear equations, Quadratic equations, Functions and graphs, Trigonometric Functions, Limits, Derivatives, Curve sketching, Maximum-minimum problems, Exponential and logarithmic functions Techniques of integration, Areas and volumes, partial derivatives, Introduction to vectors, Matrices and determinants.

Recommended text:
1. *Mathematics for Biological Sciences*, J.C. Arya and R.W. Lardner

MT 101 Vector Methods (2 credits)
**Vector Geometry:** Collinear Vectors, Coplanar vectors, Vectors equation of a line, Vector equation of a plane, Tetrahedron, Parallelepiped, pyramid and the prism, Coplanar and skew lines, Intersecting and parallel planes Cylindrical polar coordinates, Spherical polar coordinates, Simple surfaces: Sphere- Cone, Cylinder, Cosine and Sine formulae in Spherical Trigonometry.  
**Vector Functions of a Single Scalar Variable:** Differentiation, Integration, Space curves, Tangent and normals.

Recommended text:
1. *Elementary Vector Analysis*, C.E. Weatherburn  
2. *Vector Analysis*, M.D. Raisinghania

MT 102 Introduction to Probability Theory (3 credits)
(Same as ST102)

MT 103 Differential Equations (2 credits)
**First Order Ordinary Differentials Equations:** Review of first order equations, Exact equations, Clairaut's equation, Ricarti's equation.  
**Higher Order Ordinary Differential Equations:** Linear equations with constant coefficients, Wronskian, Differential operators, Undetermined coefficients. Variation of parameters.

Recommended text:
1. *A First Course in Differential Equations*, D.G. Zill  

MT 104 Abstract Algebra I (3 credits)
**Number Theory:** Euclid's Algorithm, Greatest common divisor and least common multiple, and their Relationship, Solution of Linear Diophantine equations in two variables, Linear congruences, Systems of linear Congruences having the same modulus, Chinese Remainder Theorem.  
**Relations, Functions and Binary Operations:** Equivalence relation. Partitions, Orbits and transversals functions a subset of a relations, bijective functions, inverse of a function.  
**Permutations:** Theorems on the product of disjoint cycles, Transpositions and the uses, parity and signature of a permutation.  
**Group Theory:** Group Tables, Subgroups, Elementary properties of Cyclic groups, Dihedral group of order 2n and its properties, Symmetric and Alternating group: Direct product of two groups, Identification of non-isomorphic groups of order up to 10.

Recommended texts:
1. *A First course in Abstract Algebra*, J.B. Fraleigh  

MT 105 Real Analysis I (3 credits)
Real number system as a complete ordered field, Complex number system, Topology of the real line, Neighborhoods, Sequences and limits, Limit theorems, Monotonic Sequences, Limit Concept of a Real-Valued Function, Algebra of limits, Continuity, Monotonic functions, Differentiability, Role's Theorem, Mean-Value Theorems, L'Hospital's Rule, Riemann Integral and the basic properties. Fundamental theorem of Calculus, Improper integrals.
Recommended text:
1. *Elementary Real Analysis*, H.G. Eggleston
2. *Analysis*, S.R. Lay

**MT 106 Classical Mechanics I (3 credits)**
(Prerequisite: MT 105)

**Motion of a particle in a plane:** Velocity and acceleration components in Cartesian and polar coordinates, Newton's second law: Inertial frame, Use of polar coordinates, Impulse-Momentum Integral Work-Energy Integral.

**Constrained motion:** Motion in a space curve. Use of intrinsic coordinates, Varying mass: Mass increasing or decreasing at a constant rate.

**Dynamics of a system particles:** Linear momentum and equation of the center of mass. Angular Momentum, Kinetic energy, Equations for impulsive motion, Rotation of a rigid body about a fixed axis: Kinetic Energy of rotation and energy Conservation equation, Forces exerted on the axis of revolution, Angular Momentum and impulse, conservation of angular momentum about a fixed axis.

**Plane motion of a rigid body:** Instantaneous center of a lamina, Motion of the center of mass, motion relative to the center of mass, Equations of motion and their use, Kinetic energy and energy conservation equation, Angular momentum about any axis, conservation of linear momentum/angular momentum.

Recommended text:
1. *Textbook a/Dynamics*, F.Chorlton

NOTE: MT 104 and MT 105 are compulsory for students who offer Mathematics as a principal subject.

### 200 LEVEL COURSES

Courses MT 201 and MT 202 shall be compulsory for students offering Mathematics as a single subject.

Courses MT 201, MT 202, MT 204, MT 206 and MT 207 shall be compulsory for students offering Mathematics as two subjects.

**MT 201 Groups, Rings and Fields (3 credits)**
(Prerequisite: MT 104)

**Groups:** Cosets, Normal Subgroups and Factor Groups, Direct Product and Semi-direct Products, homomorphisms, Isomorphisms, Isomorphism Theorems, Permutation Groups, Cayley’s Theorem, Isomorphism between Dihedral and Symmetric Groups, Congruity and the Class Equation.

**Rings:** Commutative rings, Rings with unity, Integral Domains and Fields, Subrings, Ring Homomorphisms, Ideals and Factor Rings, Principal Ideal Domains, Euclidean Domains and Unique Factorisation Domains, Quotient Fields.

**Polynomials:** Polynomials with Integer Coefficients, Solution of Cubic and Quartic Polynomials, General Polynomial over a field, Roots of a Polynomial, Existence of Roots, Factorisation, Irreducible polynomials, Gauss’s Lemma, Eisenstein’s Irreducibility Criterion.

**Fields:** Properties of a Field, Properties of a multiplicative group of a Field, Field Extensions, Finite Fields.

Recommended Texts:
3. I.N. Herstein (1964), *Topics in Algebra*, Blaisdell

**MT 202 Real Analysis II (3 credits)**
(Prerequisite: MT 105)

Cauchy sequences, Convergence tests, Absolute and conditional convergence, Power series, Integration and differentiation of power series, Taylor series, Uniform continuity, Upper and lower Riemann integrals, Characterization of Riemann integrable functions, Functions of several variables, Limits and continuity, Partial derivatives, Differentials, Chain rule, Extrema of functions of several variables, Lagrange Multipliers.

Recommended Texts:

**MT 203 Ordinary Differential Equations (3 credits)**
(Prerequisite: MT 103)


Recommended Texts:
**MT 204 Mathematical Methods (3 credits)**
(Prerequisite: MT 101)

**Differentiation of Vectors:** Scalar and vector point functions and their partial derivatives with respect to coordinate variables, Gradient of a scalar point function; Directional derivative, Divergence and curl of a vector point function.

**Integration of Vectors:** Line integrals and their evaluation using parametric representation, Surface integrals, Green’s theorem in the plane, Stokes theorem, Circulation and flux of a vector point function, Volume integrals, Divergence theorem, Irrotational and Solenoidal vector fields, Orthogonal Curvilinear Coordinates, Grad, Div, Curl in OCC, Cylindrical polar and spherical coordinate systems, Use of these coordinate systems in evaluation of surface and volume integrals. **Special Solution of Laplace’s Equation:** Solutions in two-dimensions, Axi-symmetric solutions. **Integral Transforms:** Laplace transforms; Elementary Properties, Inverse Laplace transform and its properties, Convolution theorem and its use in evaluation of integrals, Uses of Special functions connected with Laplace transform, Evaluation of integrals using LT, Applications in ODE and integro-differential equations, Applications in PDE, Fourier Transforms; Infinite-Fourier sine/cosine transforms and their inverse formulae, Finite-Fourier sine/cosine transforms, Derivation of inverse formulae, Use of Fourier series, Boundary value problems—Use of Fourier transforms.

Recommended Texts:

**MT 205 Classical Mechanics II (2 credits)**
(Prerequisite: MT 106)

**Statics**

- **Catenary:** Equation of catenary; Standard relations, Tension at a point, Examples on equilibrium of heavy strings, Tightly stretched catenary. **Strings on plane curves:** Heavy string on smooth space, Heavy string on rough space. **Thin rigid beams:** Shear force and SF diagram, Bending Moment and BM diagram, Relationship between SF, BM and Loading (continuous/concentrated). **Deflection of beams:** Equilibrium of slightly elastic beams, Bending of slightly elastic beams, Equation of three moments.

**Dynamics**

- **Central Orbits:** Particle motion under a central force, Use of polar and reciprocal polar coordinates, Use of pedal coordinates, Elliptic, Parabolic and Hyperbolic Orbits, Kepler's Laws of planetary motion, Distributed central orbits. **Small Oscillations:** Expressions for Kinetic/Potential Energies, Equation of motion and their solutions, Normal modes of oscillation, Normal coordinates and their determination.

Recommended Texts:
1. S.L. Green (1962), *General Degree Applied Mathematics*, University Tutorial Press Ltd
2. F. Chorlton (1985), *Dynamics*, CBS publishers

**MT 206 Mathematical Modelling (3 credits)**

Dimensions and Units, Scaling, Approximation and reasonableness of answers, Linear and quadratic models, Polynomial and rational models, Traffic flow models, Exponential models, Catastrophe theory, usage of differential equations and Bifurcation

Economic Functions: supply; Demand; TC; TR; AC; AR; MC and MR. Elasticity, Consumer’s Surplus, Producer’s Surplus, Income determination model, Cobweb model, Harrod model, Equilibrium in Economic Resources, Economies, Attainable states, Private ownership, Fixed point theory, Continuous-time systems, Controllability, Liner feed back, Discrete-time systems, Stability theory, Optimal controls.

Recommended Texts:

**MT 207 Numerical Analysis I (2 credits)**


Recommended Texts:
MT 208 Set Theory (1 credits)
Axiom schema of comprehension, Formulas, classes, ZFC-model; Algebra of sets, Principle of Duality, Indexing, Countability, Cardinal Arithmetic, Cantor's Theorem; Continuum Hypothesis, Partial ordering and Zone’s Lemma, Ordinal numbers and Transfinite Induction, Well-ordering Principle.

Recommended Texts:
1. K.J. Delvin (1993), The Joy of Sets : Fundamentals of Contemporary Set Theory (Undergraduate Texts in Mathematics), Springer-Verlag

MT 209 Graph Theory (2 credits)
Isomorphism of Graphs, Paths, Circuits, Eulerian graphs, Hamiltonian graphs, Shortest path problem, Chinese postman problem, Directed graphs, Graph Colouring, Four colour problem, Proof of five colour theorem, Planar graphs, Trees and Searching: Properties of trees, Travelling salesman problem, Tree Analysis of sorting algorithms, Hall’s Theorem, Transversal theory, Applications to game theory.

Recommended Texts:
1. F. Harary (1988), Graph Theory, Narosa Publishing House
2. R. J. Wilson (1996), Introduction to Graph Theory, Addison-Wesley Longman

300 LEVEL COURSES
Courses MT 301 and MT 302 shall be compulsory for students offering Mathematics as a single subject. Courses MT 301, MT 302, MT 310 and MT 312 shall be compulsory for students offering Mathematics as two subjects. Courses MT 301, MT 302, MT 305, MT 306, MT 307, MT 309, MT 310 and MT 312 shall be compulsory for students following Special Degree Course in Mathematics.

MT 301 Linear Algebra (3 credits)
(Prerequisite: MT 201)

Recommended Texts:
3. G. L. Bradley (1975), A Primer of Linear Algebra, Prentice-Hall

MT 302 Real Analysis III (3 credits)
(Prerequisites: MT 202)
Jacobian, Inverse and Implicit Functions Theorem, Multiple integrals, change of variables (transformations) in multiple integrals, Function of Bounded Variation, Total variations, Rectifiable curves, Uniform convergence of infinite series, Infinite products, Special Functions (Gamma, Beta, Bessel, Legendre etc), Riemann Stieltjes Integral.

Recommended Texts:
1. W. Rudin (1976), Principles of Mathematical Analysis, McGraw-Hill
2. T. M. Apostol (1974), Mathematical Analysis, Addison-Wesley Longman

MT 303 Differential Geometry (2 credits)
MT 304 Partial Differential Equations (2 credits)
(Prerequisite: MT 103)
First order partial differential equations: Linear equations, Non-linear equations, Characteristics.
Numerical methods of solving partial differential equations.

Recommended Texts:

MT 305 Group Theory (3 credits)
(Prerequisite: MT 201)
Classes of groups, Radicals and Residuals, Group Action on a set, Orbits and Stabiliser, Sylow's Theorems, Simple groups, Applications of Sylow's Theorems, Subnormal and Normal Series, Jordan-Holders Theorem, p-groups, Soluble and Nilpotent groups, Non-solubility of $S_n$ ($n>4$) and Simplicity of $A_n$ ($n>4$), Action of groups on groups.

Recommended Texts:

MT 306 Topology I (3 credits)
(Prerequisite: MT 105)
Metric spaces, open and closed sets, continuous and Bi-continuous functions, complete metric spaces and Banach’s Fixed Point Theorem, Topology on $\mathbb{R}^n$, General topological spaces, Neighborhood Axioms, Bases and Local Bases Homeomorphisms, Subspaces, Finite Products and Quotients, Separation Axioms, Convergence, Compactness, Connectedness, Homotopy of paths.

Recommended Texts:

MT 307 Complex Analysis I (2 credits)
(Prerequisite: MT 202)
The complex field, Riemann sphere, Topology of the complex plane, Analytic functions, Cauchy- Riemann equations, Elementary functions, Cauchy’s Theorem (Proof based on Green's theorem), Cauchy’s integral formulae, Taylor series, Laurent series, Classification of singularities, Residue Theorem, Evaluation of real-valued integrals by means of residues, Conformal mappings.

Recommended Texts:

MT 308 Combinatorics (2 credits)
(Prerequisite: MT 209)
Recurrence relations and generating functions: Computing solutions to recurrence relations, The principle of Inclusion and Exclusion, Latin squares, System of distinct representatives, Extremal set theory.
Steiner triple systems: Direct construction, Recurrence construction, Tournaments and Kirkman’s school girls problem, Further Graph Theory, Networks, Matroids, Designs, Hadamard matrices.
Error-Correcting codes: Linear Codes and Hadamard codes.

Recommended Texts:
MT 309  Number Theory (3 credits)
(Prerequisite: MT 201)
Continued fractions, Linear congruences in two or more variables, System of congruences, Congruences of higher order, Euler $\phi$-function and related theorems, Properties of the group $\phi(n)$, Euler’s theorem, Wilson’s theorem, Primitive roots, Quadratic residues, Gauss Quadratic Reciprocity law and its applications, Fermat numbers and Pepin’s test.

Recommended Texts:

MT 310  Fluid Mechanics I (3 credits)
(Prerequisites: MT 202, MT 204)
Kinematics of Fluid Motion: Real and Perfect Fluids, Velocity of a fluid at a point, Streamlines and their differential equations, Steady and Unsteady motions, Vorticity and Circulation; Stokes’s theorem, Irrotational flow and the velocity potential, Local, convectional and material rates of change of flow quantities, Acceleration as a material derivative, Equation of Continuity, Compressible and Incompressible fluids Conditions satisfied by a perfect fluid at a rigid boundary.

Euler’s Equation of Motion: Pressure at a point in a fluid (moving or at rest), Euler’s Equation in vector form, Motion under conservative body force; Steady Rotation about a fixed vertical axis, Bernoulli’s Equation in irrotational motion; Radial flow, Theorems on velocity potential, Kinetic Energy; Kelvin’s theorems.

Three-dimensional flow fields: Source, Sink and Doublet, Flow past a fixed sphere; Moving sphere in a fluid, Motion generated by impulses on boundaries of fluid, Concentric Spherical boundaries of fluid.

Two-dimensional flow fields: Velocity and Vorticity in terms of the Stream Function in incompressible fluid, The Complex Potential and the Complex Velocity, in irrotational motion, Source, Sink, Doublet and Vortex, Image Systems for straight and circular boundaries Circle Theorem of Milne-Thomson, Flow past a fixed circular cylinder with singularities in the field outside.

Recommended Texts:
1. F. Chorlton (1990), *Fluid Dynamics*, Oxford University Press

MT 311  Linear Programming (3 credits)

Linear Programming (LP): Mathematical formulation of the LP problem, LP in two-dimensional space, Graphical solution methods, General LP problem.

The Simplex Method: Simplex algorithm, Two-phase simplex algorithm, Revised simplex algorithm, LP problems with unrestricted variables, LP problems with bounded variables.

Duality in LP: Duality in LP problems, Duality theorems, Applications of duality, Dual simplex algorithm.

Special Types of LP Problems: Transportation problem, Assignment problem.

Recommended Texts:

MT 312  Numerical Analysis II (3 credits)
(Prerequisite: MT 207)

Direct Methods for Solving Linear Systems: Linear systems of equations, Gaussian elimination and backward substitution.

Numerical Solutions of Non-Linear Systems of Equations: Fixed points for functions of several variables, Newton’s method, Quasi-Newton methods, Steepest descent techniques.


Recommended Texts:
400 LEVEL COURSES

All of the following courses shall be compulsory for students following Special Degree Course in Mathematics.

MT 401 Galois Theory (3 credit)  
(Prerequisites: MT 301, MT 305)  
Field extensions, Ruler and Compass Constructions, Three classical Problems, Galois groups of field extensions, Automorphisms of a field, Theorem of the Primitive Element, Splitting Fields, Automorphisms of a field extension over a fixed field, Galois Groups, Separable and Inseparable Extensions, Normal Extensions and Galois Extensions, Subgroups of the Galois group and intermediate fields of the extension, Fundamental Theorem of Galois Theory, Solubility of polynomials, Galois group of a polynomial, Radical Extensions, Solubility by radicals, Proof that a polynomial is irreducible if and only if its Galois group acts transitively on its roots, Proof of the Fundamental Theorem of Algebra.

Recommended Texts:
2. I. Kaplansky (1972), Rings and Fields, University of Chicago Press  
3. I. N. Stewart (1973), Galois Theory, Chapman and Hall

MT 402 Measure Theory (3 credit)  
(Prerequisite: MT 302)  
Lebesgue Measure on the real line, \( \sigma \)-algebras, Measurable functions, Measure spaces, Lebesgue integral, Fatou's Lemma, Monotone Convergence Theorem, Dominated Convergence Theorems, \( L^p \) spaces, Modes of Convergence, Product measures, Fubini's Theorem.

Recommended Texts:
2. H. L. Royden (1988), Real Analysis, Macmillan

MT 403 Topology II (3 credits)  
(Prerequisite: MT 306)  
Box Topology and Tychonoff Topology, Inadequacy of sequences, Nets and Filters; Tychonoff spaces and Normal spaces, Uryshon’s Lemma and Tietze’s Extension theorem; Paracompactness and BNS- Metrization Theorem; \( G_\delta \) - Sets and Baire Spaces; Totally disconnected spaces, The Cantor set, Homotopy relations, Fundamental group; Triangulating spaces, Infinite Complexes, Euler Characteristics and Surgery, Knots and covering spaces

Recommended Texts:

MT 404 Complex Analysis II (3 credits)  
(Prerequisites: MT 306, MT 307)  

Recommended Texts:
1. L. V. Ahlfors (1979), Complex Analysis, McGraw-Hill  
2. J. B. Conway (1980), Functions of One Complex Variable, Narosa Publishing House

MT 405 Functional Analysis (3 credits)  
(Prerequisites: MT 301, MT 306, MT 402)  
Normed Linear Spaces, Banach Spaces, Riesz-Fischer Theorem, Linear maps and functionals or normal linear spaces, Dual Spaces; Geometry of Banach Spaces, Hanch Banach Theorems (Separation Form, Extension Form); Uniform Boundedness Principle, Open Mapping Theorem, Banach’s Isomorphism Theorem, Closed Graph Theorem; Second Dual Space, Projections and direct sums in Banach Spaces, Schauder Basis, Hilbert Spaces; Banach Algebras, Topological Vector Spaces.

Recommended Texts:
MT 406 Fluid Mechanics II (3 credits)
(Prerequisite: MT 310)
Perfect Fluid Theory
Two-dimensional flow: Complex potential, Blasius Theorem, Conformal Transformation; Joukowski and Schwartz Christoffel. Discontinuous Motion, Vortex Motion.
Three-dimensional flow: Stokes’ stream function in axi-symmetric flows, Image systems in 3-D.
Viscous Flow
Navier-Stokes equation of motion; its exact solutions, Steady slow motion past a fixed sphere, Reynold’s Number, Prandtl’s Boundary Layer.

Recommended Texts:
1. L.M. Mline-Thomson (1968), *Theoretical Hydrodynamics*, McMillan
3. F. Chorlton (1990), *Fluid Dynamics*, Oxford University Press

MT 407 Optimization Theory (3 credits)
(Prerequisite: MT 311)
Advanced Linear Programming: Dantzig-Wolf decomposition algorithm, Goal programming.
Integer Programming: Cutting plane algorithms, Branch and bound algorithms.
Non-Linear Programming: Kuhn-Tucker conditions, Quadratic programming, Separable programming.

Recommended Texts:

MT 408 Independent Study/Project Work (3 credits)
Supervised independent study on a project approved by an academic staff member of the department.
Candidates are required to present their work at a seminar and submit the work in a report/dissertation form.
100 LEVEL COURSES

BL 101 Basic Biology (2 credits)
Cell Biology - Chemical nature of life, origin of life, scientific method, prokaryotic and eukaryotic cells, cell types, structure and function of cell membranes and organelles, cell division, structure and function of genetic material.
Classification of organisms - Early and current systems of classification.
Genetics and evolution - Chromosome theory of inheritance, Mendelian genetics and deviation, linkage and recombination, mutations, Hardy-Weinburg principle, sources of variation, natural selection, origin of species.
Laboratory exercises based on above topics.

Recommended Texts

CH 101 Principles of Chemistry I (3 credits)
General Chemistry I (15L): Modern view of the atomic structure and the development of the atomic theory of matter; Quantum mechanics and atomic theory: Electromagnetic radiation, atomic spectrum of hydrogen, Bohr model, the quantum mechanical description of the atom, electrons as waves, wave-particle duality, de Brôglie relationship, wave function and its physical meaning, Heisenberg’s uncertainty principle; Electron spin and the Pauli exclusion principle, Aufbau principle and the periodic table, electron configurations of elements, periodic trends in atomic properties; Bonding, types of chemical bonds, electronegativity, polarity and dipole moment, ionic bond, ionic lattices, packing of spheres, partial ionic character of covalent bond; Covalent bond: covalent bond energies and chemical reactions, non-valence cohesive forces.
Structure and Reactivity (15 L): Types of intermolecular interactions; Factors affecting electron availability in bonds and at individual atoms; Acidity and basicity; Functional groups responsible for reactivity of different classes of organic compounds; Relationships between the main classes of organic molecules; Introduction to reaction mechanisms - bond cleavage processes, types of reagents and reaction intermediates; Energy diagrams; Mechanisms of substitution, addition and elimination reactions; Aromaticity and Hückel’s Rule; Reactions in functional group analysis and their mechanisms.
IUPAC Nomenclature
Reactivity and Energetics (15L): The scientific method, microscopic and macroscopic theories, Kinetic Molecular Theory (KMT): KMT as a model for microscopic theories, experimental evidence, properties of gases, the perfect gas, state of gases, individual gas laws, combined gas laws, kinetic model for gases, imperfect gases; Thermodynamics: Systems, surroundings, universe, processes, zeroth law of thermodynamics, temperature, first law of thermodynamics, work, heat, internal energy, extent of reaction, enthalpy, thermochemistry, second law of thermodynamics, entropy, Gibbs energy, Helmholtz energy, Gibbs energy versus extent of reaction, reaction quotient, exothermic and endothermic reactions, reactions at equilibrium, thermodynamic equilibrium constant, activity, temperature dependence of equilibrium constant, effect of concentration, pressure, volume, temperature, etc, on the position of equilibrium.

Recommended Texts

CH 102 Principles of Chemistry II (3 credits)
(Prerequisite: CH 101)
General Chemistry II (15 L): Molecular structure: Lewis structures, explanations to octet rule; Three- center bond, resonance, the VSEPR model, hybridization of atomic orbitals, molecular orbital theory, bonding in homonuclear and heteronuclear diatomic models; Periodic table and periodicity, periodic properties, applications of size and energy factors in chemistry, magnetic properties; Basic concepts in chemical analysis: titrations, buffers, indicators, solubility equilibria and applications.
Chemical Kinetics (10L): Molecular collisions; The importance of chemical kinetics: Rates, mechanisms, relationship between rate of reaction and rate of change of concentration of components; Rate law, rate constant and order, overall order of a reaction, initial rate method, integrated rate laws, isolation method, half-life of a reaction and a relationship to rate constant, molecularity of a reaction, the Arrhenius relationship between temperature and rate of a reaction, activation energy and pre-exponential factor.
Electrochemistry (5L): Introduction to Electrochemistry, Conductometry and Potentiometry

Stereochemistry and Spectroscopy (15 L): Configurational isomers, E,Z-nomenclature, symmetry, chirality; R,S-nomenclature, meso compounds, diastereomers, conformations in acyclic and cyclic compounds, cis-trans and optical isomerism in cyclic compounds; Biphenyls, allenes, introduction to spectroscopy (UV, IR) and 1H-NMR spectra.

Recommended Texts

CH 108 Elementary Chemistry Laboratory (1 credit)
Apparatus and measurements; Error analysis; Introduction to inorganic analytical method; Organic functional group analysis.

CH 109 Inorganic Chemistry Laboratory (1 credit)
(Prerequisite: CH 108)
Qualitative analysis; Analysis of Inorganic anions, cations and their mixtures .Quantitative Inorganic analysis including titrimetry and gravimetry.

200 LEVEL COURSES

MB 201 Biological Chemistry (3 credits)
(Prerequisites: BL 101, CH 101, CH102)
The cell as a basic unit of life; major intracellular organelles and their functions; structure, function and metabolism of biomolecules (carbohydrates, lipids, nucleic acids and proteins) in plant and animal cells; membrane and transport; protein trafficking and organelle biogenesis; bioenergetics; cell-cell communication; moving signals across membranes; types of signals and receptors; second messengers; G-Proteins and other membrane associated signal transmitters.

Recommended Texts:

MB 206 Principles of Genetics (3 credits)
(Prerequisite: BL 101)
Mendelian genetics; alterations of Mendal laws; linkage; sex determination; cytoplasmic inheritance; cytogenetics; macro and micro mutations; polyploidy and aneuploidy; population genetics; quantitative genetics; heterosis and hybrid vigor; principles and practical aspects of breeding.

Recommended texts:

MB 211 Cell and Tissue culture (2 credits)
(Prerequisite: BL 101)
Introduction and general techniques in cell and tissue (plants and animals) culture; preparation of culture media; isolation and culture of animal cells and tissues for assays; cell counting techniques; embryo and meristem cultures; somatic embryogenesis; protoplast isolation and culture. somatic hybridization; applications of cell and tissue culture.

Recommended texts:

MB 216 General Microbiology (1 credit)
(Prerequisite: BL 101)
Introduction to microorganisms (bacteria, viruses, fungi); classification and morphology; microbial genetics; growth and metabolism of bacteria; microbial techniques (culture media, aseptic techniques, isolation and culture of bacteria, enumeration, staining, identification).
Recommended texts:

**MB 221 Enzymology (2 credits)**
(Same as BT 204)
(Prerequisites: BL 101, CH 101, CH 102)
Enzymes as catalysts in biological systems; protein structure and folding; classification and nomenclature of enzymes; mechanism of enzyme action; kinetics of enzymatic reactions; quantitative and qualitative aspects of enzyme activity; effect of temperature, pH, substrate, enzyme concentration and inhibitors on enzyme activity; mode of enzyme regulation; qualitative tests for different types of enzymes; isozymes and isozyme analysis; enzyme assay methods; purification and characterization and characterization; application of enzyme technology in industry; protein engineering.

Recommended texts:

**MB 226 Molecular Genetics (3 credits)**
(Prerequisites: BL 101, CH 101, CH 102)
Organization of prokaryotic and eukaryotic genomes; genes and chromosomes; mitochondrial and chloroplast DNA; mobile genetic elements; genome replication; genetic recombination; DNA repair; RNA synthesis, processing and metabolism; the genetic code; protein synthesis; regulation of gene expression; DNA cloning and microarrays; genetic disorders and gene therapy.

Recommended texts:

**BT 201 Plant Diversity I (2 credits)**
(Prerequisites: BL 101, CH 101, CH 102)
Basic concepts of biodiversity, levels (species, genetic, ecosystem); range of diversity in relation to size, life span, form, nutrition, reproduction, habitats, life cycles etc. Nomenclature and classification, importance of biodiversity, its conservation and sustainable utilization. Diversity among lower organisms: Monera (Prokaryota), Protista, algae, Chromista, Fungi. Basic characters, modern classification systems, range of form, reproduction and life cycles with reference to type examples. Importance of fungi in nature, biodeterioration, medicine, agriculture & industry. Laboratory exercises based on above topics.

Recommended Texts:

**BT 206 Plant Physiology (2 credits)**

Recommended Texts:

**CH 221 Organic Chemistry I (2 credits)**
(Prerequisites: CH 101, CH 102)
**Organic Reaction Mechanisms I** (15 L): Energetics – thermodynamics and kinetics of organic reactions; Concerted reactions, multi-step reactions; $S_n1$ and $S_n2$ reactions, effect of solvents, protic, polar aprotic solvents etc, neighbouring group participation, Internal $S_n2$; Elimination reactions E1, E2; Electrophilic and nucleophilic addition to double bonds; Electrophilic aromatic substitution; Nucleophilic aromatic substitution

**Spectroscopy I** (15 L): 1H-NMR and 13C-NMR spectroscopy; one dimensional and two dimensional NMR
Mass spectrometry EI-MS, CI-MS

Recommended Texts

**CH 231 Physical Chemistry I (2 credits)**
(Prerequisites: CH 101, CH 102)

Quantum Mechanics (10 L): Evidence for quantization, dynamics of microscopic systems, the Schrödinger equation, quantum mechanical principles, postulates in quantum mechanics, operators and observables, superposition and expectation values, the uncertainty principle, probability functions, solutions of Schrödinger equation for 1-, 2-, and 3-dimensional systems, including the hydrogen atom.


Electrochemistry (10 L): Conductometry, electronic and ionic conductors, conductivity and molar conductivity, strong and weak electrolyte solutions, determination of limiting molar conductivity, Kohlrausch’s law of independent migration of ions, determination of ionic concentrations, equilibrium constants and rate constants. Conductometric titrations, electrodes, electrochemical cells, applications of potentiometry, factors effecting cell e.m.f., Thermodynamic functions from emf measurements, potentiometric titrations.

Recommended Texts

**CH 232 Molecular Properties, Molecular Spectroscopy and Spectroscopic Instrumentation (1 credit)**
(Prerequisite: CH 231)

Electrical properties, dipole moment, intermolecular forces, magnetic properties, magnetic susceptibility, permanent and induced magnetic moments; Introduction to molecular spectroscopy; Rotational Spectra, vibrational spectra, electronic spectra, basic components of spectroscopic instrumentation.

Recommended Texts

**PH 261 Medical Physics (2 credits)**

Biomechanics of the human body: forces on and in the body, metabolism and energy balance of the body, fluid dynamics of the human circulatory system; Physics of the cardiovascular system and cardiovascular instruments: mechanics of cardiac contraction, pressure volume curves, ECG, pacemakers, defibrillators; Fiber optics in medicine: physics of fiber optics, endoscopes; Laser in medicine: physics of Laser, Laser treatment, Laser safety; Physics of diagnostic techniques: ultrasound imaging (MRI); Nuclear medicine and Radiation physics: properties of nuclear radiation, radioisotopes for nuclear medicine, radiopharmaceuticals, nuclear medicine instrumentation, radiation dosimetry, radiation protection.

Recommended texts:

**ST 202 Applied Statistics (2 credits)**

This course cannot be offered by students who offered ST 101 or ST 201. Some practical assignments will be given for this course.

Types of data, Data summarization: Histogram, Frequency polygon, Ogive.
Measures of location, Measures of Dispersion, Representation of data using Stem-Leaf diagrams and Box plots. Some Statistical distribution functions and their properties.
Test of hypothesis, Estimation and tests on difference between two means and proportions, Tests on variances.
Simple linear regression and correlation, Lack of fit residual plots, Introduction to Analysis of variance, and analysis of two-way contingency tables.

Recommended texts
ZL 201 Animal Embryology (2 credits)
Gametogenesis; Fertilization; Cleavage; Gastrulation; Neurulation; Early development of amphioxus, frog, chick, and man; Early development of selected invertebrates.
Practicals based on above.
Recommended Texts:
1. Animal Biology. Grove & Newell
2. Introduction to Embryology. B.I. Balinsky.

300 LEVEL COURSES

MB 301 Biochemistry and Molecular Biology Laboratory (2 credits)
(Prerequisites: MB 201, MB 226)
UV-visible spectroscopy; chromatographic methods; electrophoresis; DNA and RNA purification and analysis; polymerase chain reaction; restriction fragment length polymorphism (RFLP) and random amplified polymorphic DNA (RAPD) techniques; DNA sequencing; southern and northern transfer techniques; immunochemical methods; radioactive and non radioactive detection methods; biosensors.
Recommended texts:

MB 306 Recombinant DNA Technology (3 credits)
(Prerequisites: MB 201, MB 226)
Introduction to Recombinant DNA technology; purification and manipulation of DNA; cloning vectors; transformation; production of gene libraries; isolation, identification & characterization of cloned genes; gene expression; restriction mapping; generation of transgenic plants and animals.
Recommended texts:

MB 311 Molecular Cell Biology (3 credits)
(Prerequisite: MB 201)
Structure of eukaryotic and prokaryotic cells; cell organelles and functions; cell membrane, function and transport cross membranes; protein trafficking; organelle biogenesis; cytoskeleton and cell motility; extracellular matrix and cell adhesion; cell-to cell signaling; signaling in the sensory system; cell cycle, regulation and apoptosis.
Recommended texts:

MB 316 Molecular Immunology (2 credits)
(Prerequisite: BL 101)
The immune system; structure and function of immunoglobulins; cells of lymphoid systems; response to antigenic stimulation; antigenic determinants; antigen processing and presentation; intercellular interactions; compliment system and its function; biology of the major histocompatibility complex; mechanisms of immunity and hypersensitivity; immunomodulatory products of parasites; diagnostic assays using antibodies; polyclonal and monoclonal antibodies; phage antibody production; immunochemical methods.
Recommended texts:
MB 321 Biotechnology I (2 credits)  
(Prerequisites: MB 226, MB 306)  
Genetic engineering of plant and animals, and their applications; biocontrol of pests; recombinant microorganisms/fermentation technology; preparation of bioactive compounds in microbes and tissue/cell cultures; biological nitrogen fixation; germplasm conservation; molecular breeding; biofertilizers; genomics and proteomics; DNA/protein based techniques in forensic science and medicine; biodiversity and biotechnology; biosafety in biotechnology; international conventions related to biotechnology and products of biotechnology; impacts of Biotechnology on the developing world.

Recommended texts:  

MB 326 Bioinformatics (3 credits)  
(Prerequisite: MB226)  
Molecular databases; bioinformatics and computational biology software; sequence alignment; phylogenetic analysis; functional genomics; DNA micro arrays; protein structure analysis, motif identification, evolutionary alignments and structure prediction; drug design

Recommended texts:  

MB 331 Radioisotope Techniques and Radiation Safety (1 credit)  
(Prerequisites: BL 101, CH 101, CH 102)  
Atoms, nuclides and radionuclides, radioactivity, units of radioactivity, rate of radioactive decay and half life, types and origin of radiation, radiation detection and monitoring, properties of radiations emitted from radionuclides commonly used in the biological sciences, radioisotope techniques used in biological sciences, biological effects of radiation, radioisotope storage, handling and waste disposal.

Recommended texts:  

BT 302 Advanced Microbiology (2 Credits)  
Population counts, growth cycle of microorganisms. Applied microbiology. Microorganisms in their natural habitats and major activities, microbiology of air (types, diseases transmitted), soil (types, estimation, distribution, role in nutrient cycling), water (types, water pollution, coliform bacteria, sanitary water analysis, water borne diseases, water purification) and food (food microflora, food spoilage, food preservation and food borne diseases). Laboratory exercises based on above topics.

Recommended Texts:  

BT 304 Plant Pathology (2 credits)  
Introduction, history of Plant Pathology, terminology & definitions, cause of plant disease, infection process, mechanism of symptom development, fungal pathogenesis, plant defense responses – constitutive and inducible defenses, Systemic Acquired Resistance (SAR), principles of plant disease control, diagnosis of plant disease.  
Practical exercises: Laboratory examination of diseased specimens covering major field and post-harvest diseases of food, ornamental and plantation crops, plant pathology techniques, study of plant-pathogen interactions.

Recommended Texts:  


**BT 309 Biodiversity Conservation & Management (2 credits)**


Field visits.

Recommended Texts:

**BT 311 Plant Reproductive Biology and Plant Breeding (2 credits)**

(Prerequisite: BT 307)

Genetic variation and its estimation, incompatibility and its inheritance. Pollination biology. Plant breeding perspectives, plant reproductive systems, principles of plant breeding, genetic basis of plant breeding, polygenic inheritance, methods of breeding and experimental designs, quantitative inheritance, polyploidy, methods of breeding of self- and cross pollinated crops. Application of molecular marker technologies for genome analysis. Germplasm resources preservation and utilization, hybrid crops, seed production and maintenance. Field visits to Plant Genetic Resource Centre (PGRC) and Rice Research and Development Institute, Batalagoda.

Recommended Texts:

**CH 341 Analytical Chemistry (3 credits)**

(Prerequisite: CH 231)

**Advanced Calculations** (12 L): Review of statistics in chemical analysis: test of significance, paired t-test, F-test, etc.; Statistics of linear chemical relationships; Performance characteristics of analytical methods; Interlaboratory testing; Sensor characteristics; Advanced calculations as applied to chemical analysis: derivation and error calculations associated with acid-base, redox and complexometric titrations; Iteration methods; metal-complex equilibria; Solubility equilibria and Gran plots.

**Analytical Aspects of Spectrophotometry** (9 L): Atomic absorption and emission methods, molecular uv and visible absorption spectroscopy.

**Electroanalytical Chemistry** (12 L): Potentiometric applications; voltammetry including polarographic methods, pulsed techniques, steady-state and flow injection amperometric methods, bulk electrolysis methods, microelectrodes in chemical analysis, electrochemical sensors,

**Separation Methods** (12 L): Solvent extraction, partition coefficient, distribution ratio, multiple extractions, extraction of metals, introduction to chromatographic techniques and classifications, gas chromatography, van-Deemter equation, ion-exchange chromatography, thin layer and paper chromatography, introduction to liquid-liquid chromatography.

Recommended Texts

**CH 361 Environmental Chemistry (3 credits)**

(Prerequisites: CH 211, CH 221 and CH 231)

**Theory Component** (20 L): Chemical cycles, aquatic chemistry, water pollution, water treatment, water quality standards. Atmospheric chemistry, particles in the atmosphere Air pollution- inorganic and organic air pollutants, particles in the atmosphere, photochemical smog, global warming, acid rain, depletion of the ozone layer. Municipal and solid waste and their management, hazardous waste, waste as a resource; Pollution prevention and control, clean production mechanism; Environmental biochemistry; Toxicology; Environmental monitoring and analysis, sampling, classical methods and instrumentation; Analysis of data.

**Laboratory Component** (20 hr): Analysis of water and wastewater, analysis of air pollutants and particles; detection of pesticides.

Recommended Texts
**ZL 302 Comparative Anatomy and Animal Physiology (2 credits)**
Anatomy and Physiology of Digestion, and Nutrition; Excretion and Homeostasis; Respiration and Gas exchange; Circulation and Blood; Reproduction and hormones; their Action and Regulation; Muscular system and Movement; Nervous system, Sense organs and Coordination
Practicals based on above.

Recommended Texts:

**ZL 303 General Entomology (2 credits)**
Insect Structure and Function; Classification and Identification of insects, Methods of Collecting, Preserving and Curating different insect orders; Insect development and Role of hormones; Insects of Agricultural, Medical and Veterinary importance; Principles and Methods of Insect Pest Control.
Practicals and Field work based on above.

Recommended Texts:

**ZL 312 Developmental Biology (2 credits)**  
(Prerequisite: ZL 201)
Introduction to Developmental Biology; Differentiation and morphogenesis in *Dictyostelium*; The cellular basis of morphogenesis; Organizing multicellular embryo; Genomic constancy; Cytoplasmic determinants; Differential gene expression during development; Maternal and zygotic control of gene expression; Maternal specification of embryonic axes; Hox genes and establishment of body plan; Cell-cell interactions; Cell signalling; Cell adhesion; Programmed cell death; Pattern formation; Establishment of segments, hierarchy of segments and segment identity of Drosophila; Sex determination and differentiation; Life cycles and development patterns; Aging and senescence; Regeneration; Teratogenesis; Cloning and transgenic animals.
Practical based on above.

Recommended Texts:

**400 LEVEL COURSES**

**MB 401 Molecular biology of plant and animal diseases (2 credits)**  
(Prerequisites: MB 201, MB 226)
Genetic disorders; abiotic stresses; infectious diseases; host-parasite interactions; infectiousness of disease causing agents; host response to disease causing agents; diagnosis of disease; treatment; molecular aspects to drug resistance; rational drug design.

Recommended texts:

**MB 406 Evolution and Molecular Systematics (2 credits)**  
(Prerequisites: MB 206, MB 226)
Molecular basis of heredity and evolution; genetic maps; general principle of systematics; phylogenetic variations in plant and animal taxa (cladistics and phenetics etc.); molecular phylogenies; speciation and hybridization; applications of molecular methods in biodiversity assessment; *in vitro* germplasm conservation

Recommended text:
MB 411 Biotechnology II (2 credits)
(Prerequisite: MB 321)
Biotechnology in food and agriculture (GM crops, cloning livestock); applications of molecular techniques in medicine (drug design, drug delivery, gene therapy); bioreactors (production of pharmaceuticals); new avenues of biotechnology; biofilm technology; biodiversity and biotechnology; embryonic stem cells and therapeutic cloning; top biotech companies and products; current prospects of biotechnology in Sri Lanka (includes a series of lectures by researchers from industry and other research institutions).

Recommended texts:

MB 416 Environmental Biotechnology (2 credits)
(Prerequisites: MB 226, MB 321)
Living organisms as pollution indicators; biodegradation; waste management; pollution treatment; bio-mining; biogas production; microbes in environmental management.

Recommended texts:

MB 421 Fermentation Technology (2 credits)
(Prerequisites: CH 101, CH 102, MB 321)
Microorganisms used in industrial fermentation; isolation and preservation of pure cultures; mutants, factors influencing rate of mutation; bioreactors design and operation; culture media; sterilization; control of different parameters; process monitoring; isolation of products; current applications.

Recommended texts:

MB 426 DNA and Forensic Medicine Laboratory (1 credit)
(Prerequisites: MB 226, MB 321)
Principals and methods of DNA profiling; recent examples; techniques in DNA analysis; forensic DNA databases; implications in law enforcement.

Recommended texts:

MB 431 Molecular Entomology (2 credits)
(Same as ZL 413)
(Prerequisites: MB 226, ZL 303)
Genome organization of insects; sex determination of insects; evolution and genetics of insect populations; developmental biology and gene manipulation in insects; molecular genetics of insect behaviour; molecular biology of vector-parasite/virus interactions, and of midgut, haemolymph and salivary gland targets for disruption of pathogen transmission; up-regulation of specific genes as a response to the development of pathogens; molecular targets of pesticides and molecular basis of resistance development; transgenic insects for agricultural pest management and disease vector control programs.

Recommended texts:
MB 436 Molecular Virology (2 credits)
(Prerequisite: MB 226)
Introduction to virology; plant and animal viruses and zoonoses, virus life cycle; molecular mechanism of virus reproduction and pathogenesis; virus-host interactions; genetic modification of viruses; diagnosis of virus infections; virus mechanisms to evade host immunity; antiviral treatment; vaccination.

Recommended texts:

BT 401 Nitrogen Fixation (3 credits)
Nitrogen fixation (abiological and biological), the global cycle, importance and relevance to national development. Organisms and systems that fix nitrogen, free-living, symbiotic, associative and endophytic. Methods of measuring nitrogen fixation based on, Kjeldahl analysis, acetylene reduction assay, isotopes (radioactive and heavy 15N), direct labelling and substrate labelling techniques. Gas chromatography, Mass Spectrometry and Emission Spectrometry. Enzymology of nitrogen fixation, the enzyme system, factors affecting the enzyme, oxygen sensitivity and mechanisms to protect the enzyme from oxygen inhibition. Requirements for nitrogen fixation and how these are met in nature. Biochemistry of nitrogen fixation including the mechanism. Genetics of nitrogen fixation, Nif genes and their regulation. Application of nitrogen fixation in agriculture and forestry. Practical exercises based on above topics.

Recommended Texts:

BT 402 Rhizobiology (3 credits)
(Prerequisite: BT 302)

Recommended Texts:

ZL 403 Applied Entomology (3 credits)
Insect taxonomy, Classification and Identification of selected taxa. Insect genitalia and their importance; Beneficial insects and Biological control; Chemical methods of pest control; Insecticide resistance and Mechanisms of resistance; Insect ecology, Insect communication; Insect population dynamics and Life tables; Insect conservation. Practicals based on above.

Recommended Texts:
1. Agricultural Insect Pests of the Tropics and Their Control. D.S. Hill.

ZL 408 Inland Fisheries and Aquaculture (3 credits)
Fisheries of Sri Lanka, its importance, potential, regulation and management, fishing gear and methods of fishing, preservation and processing of food fish, techniques of natural stock enhancements in inland fisheries. General Principles and Economics of Aquaculture: Aquaculture methods and practices, culturable fish and shellfish, construction of fish farms, management of fish farms, fish nutrition, fish diseases, induced breeding and seed fish production, Culture of prawns and shellfish. Practicals based on above.
Recommended Texts:


**MB 471 Proposal Writing** (1 credit)
Review of research area; introduction to project; types and purposes of project proposals; structure and components of proposal; covering letter and the recipients of the proposal; identifying, justifying and presenting a problem; literature review and development of proposal; time frame, resource identification and budgeting.

**MB 490 Independent Study** (1 credit)
The student will work on a selected molecular biology topic of interest under the guidance of a faculty member who agrees to supervise such work. Number of credits registered depends on degree of difficulty.

**MB 495 Seminar** (1 credit)
The student will present a seminar on a topic assigned by the advisor.

**MB 499 Research Project** (6 credits)
The student will carry out a research project under the supervision of a faculty member. The student is required to give a seminar on the project and submit a report.
PHYSICS

100 LEVEL COURSES

PH 101 General Physics I (3 credits)
Mechanics: Laws of Motion, Work and Energy, Impulse, Momentum and Center of mass, Rotational Motion, Gravitation, Fluids, Special Relativity.
Thermal Physics: Kinetic theory and Thermodynamics.
Wave mechanics: Oscillatory and wave motion. Sound waves.
Optics: Interference, Diffraction, Polarization and Scattering of light. Lasers.

Recommended texts:

PH 102 General Physics II (3 credits)
Electrical and magnetic phenomena: Electric field, Magnetic field, Sources of Magnetic Field, Magnetism in Matter, Electromagnetic Induction, Transient Circuits and Alternative Currents.
Modern physics: Introductory Quantum Physics, Atomic Physics, Nuclear Physics, Elementary particles.

Recommended texts:

PH 103: Elementary Physics Laboratory I (1 credit)
PH 104: Elementary Physics Laboratory II (1 credit)

200 LEVEL COURSES

PH 200 Mechanics and Fluid Dynamics (2 credits)
Coordinate systems, Inertial Frames, Newton’s Laws of Motion, Central Forces, System of Particles, Rotating Coordinate Frames, Motion of Rigid Bodies, Flow characteristics, Newtonian and Non-Newtonian fluids and Measurement of viscosity.

Recommended texts:
2. Smith, P. and Smith, R.C., Mechanics (1990), John Wiley & Sons, 2nd ed
3. Massey, B.S., Mechanics of Fluid, ELBS

PH 205 Thermal and Statistical Physics (2 credits)
First and Second laws of Thermodynamics, Entropy, Thermodynamics potentials, Maxwell relations, First and second order phase transitions, Nernst postulates and its applications to solids, magnetic and electric systems, thermodynamics of dilute solutions, Gaussian reactions, adsorption.

Recommended texts:
3. Alonso and Finn, Fundamental University Physics (VolIII) (1967), Addision-Wersley

PH 211 Vibrations and AC Theory (2 credits)
Free and Force Vibrations, Normal Modes, Progressive waves. AC generation, Series and Parallel LCR circuits, Mutual inductance and Transformers, Filters.

Recommended texts:
3. Yarwood, J., *Electricity and Magnetism*

**PH 230 Quantum Mechanics and Atomic Physics (2 credits)**

Recommended texts:
3. Thomas, Albert and Fromhold Jr, *Quantum Mechanics for Applied Physics and Engineering*

**PH 240 Introductory Solid State Physics (2 credits)**
Crystal Structure, Experimental Determination of Structures, Crystal Defects, Lattice vibrations, heat capacity of solids; Electron in solids.

Recommended texts:

**PH 245 Electronics Theory I (2 credits)**
Circuit analysis, Diodes and Transistors, Operational amplifier. Digital Electronics, Combinational & Sequential logic: ROM; PROM; EPROM; EEPROM; PALs and PLAs, registers, RAMs; digital communication basics; sequential ICs, Counters.

Recommended texts:

**PH 261 Medical Physics (2 credits)**
Biomechanics of the human body: forces on and in the body, metabolism and energy balance of the body, fluid dynamics of the human circulatory system; Physics of the cardiovascular system and cardiovascular instruments: mechanics of cardiac contraction, pressure volume curves, ECG, pacemakers, defibrillators; Fiber optics in medicine: physics of fiber optics, endoscopes; Laser in medicine: physics of Laser, Laser treatment, Laser safety; Physics of diagnostic techniques: ultrasound imaging (MRI); Nuclear medicine and Radiation physics: properties of nuclear radiation, radioisotopes for nuclear medicine, radiopharmaceuticals, nuclear medicine instrumentation, radiation dosimetry, radiation protection.

Recommended texts:

**PH 262 Energy, Weather and Environment (2 credits)**

Recommended texts:

**PH 263 Introductory Astronomy (2 credits)**
Astronomy before and after Copernicus; gravity; light and telescopes; solar system; properties, formation and evolution of stars; star systems; Milky Way and galaxies; galaxy clusters; cosmology.
Recommended texts:
1. Fox, John D. *Astronomy: Journey to the Cosmic Frontier* (1995), Mcgraw-Hill

**PH 280 General Physics Laboratory I** (1 credit)
(Prerequisites: PH 103, PH 104)

**PH 281 General Physics Laboratory II** (1 credit)
(Prerequisites: PH 103, PH 104)

**PH 285 Electronics Laboratory I** (1 credit)
(Prerequisite: PH 245)
Available only for maximum of 60 students who have performed well in PH245.

**300 LEVEL COURSES**

**PH 304 Relativity (2 credits)**
Background, Postulates of Special Relativity, Derivation of Lorentz Transformation equations, Consequences of LT Equations. Relativistic Dynamics, Relativity and Electromagnetism, Invariance of Maxwell’s equations, Possible limitation of special relativity; Special Topics: Geometric representation of space-time; Solutions of twin paradox; Principle of equivalence and General Relativity.

Recommended texts:

**PH 313 Physical Optics and Optical instruments (2 credits)**

Recommended texts:

**PH 323 EM Waves and Communication (2 credits)**
Summary of vector algebra. Maxwell's equations, Properties of plane e-m waves in free space, Poynting's theorem, Waves in ponderable media, Radio and TV transmission. : polarization of em waves, dipole antennas, wireless communications, transmission line theory and concepts, antennas and equivalent principles.

Recommended texts:

**PH 333 Introductory Nuclear Physics (2 credits)**
Compulsory for Special Degree
**Distribution of Nuclear matter:** α -particle scattering: Rutherford's formula, differential cross-session; other experimental evidence for the nuclear structure; nuclear density variation; nuclear radius; skin thickness; **Nuclear Binding energy:** neutron and proton separation energies; features of binding energy curve; liquid drop model; semi empirical mass formula; nuclear stability of isobars; **Nuclear Reaction:** reaction energy; threshold energy; exothermic and endothermic reactions; **Nuclear Decay:** conservation laws; α - decay: basic α-decay processes, energy release, theory of α-emission; β-decay: basic β-decay process, energy release, β-spectrum, neutrino, electron capture; γ-decay: nuclear excited states, internal conversion, isometric states; **Nuclear Fission:** spontaneous fission, activation energy, explanation using semi empirical formula, induced fission, mass distribution of fragments, energy released, neutrons emitted, chain reaction, fission reactors; **Nuclear Fusion:** basic process, characteristics of fusion thermonuclear fusion, fusion reactors.
Recommended texts:
2. Evans, *Introduction to Nuclear Physics*.

**PH 334 Introductory Particle Physics (1 credit)**

**Introduction:** standard model, leptons, quarks and gauge bosons; fundamental interactions; relativistic wave equations; Dirac’s interpretation of particles and antiparticles; introduction to Feynman diagram; **Production of charged particles:** charge particle accelerates, center of mass energies; charge particle detectors; **Leptons and Quarks:** hadrons; quantum numbers; strangeness, charm and beauty, hypercharge space-time symmetries and conservation laws; spin, parity, charge conjugation, time reversal CP invariance and the CPT theorem; **Isospin and the Quarks model:** mass splitting of hadrons; Y - I diagrams for mesons, and quarks and baryons; colour and colour confinement, introduction to quantum chromo dynamics (QCD) and gluons; weak interaction, $W^\pm$ and $Z^0$ bosons, charge current and neutral current reactions; search for the top quarks grand unification of fundamental interactions; Nuclear and particle astrophysics and the big bang.

Recommended texts:
2. Fraunfelder and Henley, *Sub-atomic Physics* (!974), Prentice Hall, New Jersey

**PH 341 Semiconductor Physics and Devices (2 credits)**

Conductors, insulators and semiconductors, thermal equilibrium, carrier life time, diffusion, mobility and its measurements; Band structure in semiconductors, Semiconductor junctions: theory of p-n junction, capacitance, work function, Schottky barriers, avalanche and Zener breakdown, homo and hetero junctions, ohmic contacts, thermonic emission; Introduction to Simple devices and Fabrication: LED, Solar cell, and LSR. Elemental semiconductors, III-IV, II-VI and ternary compounds; Growth and characterisation of semiconductor materials. Bipolar transistor, JFET, and MOSFET. Optical Devices: Photodetectors, Photodiodes, LEDs, Laser diodes, Solar cells and Quantum well devices.

Recommended texts:

**PH 345 Electronics Theory II (2 credits)**

(Prerequisites: PH245, PH285)

Advanced BJT circuits, Ebers-Moll equation. Differential amplifier; $G_{AV}$, $G_{CM}$, CMRR, dc amplifier, current mirrors and applications, power amplifiers; Miller effect; bootstrapping; Field Effect Transistor; JFET; $I_C$, $V_{DS}$ characteristics, comparison with BJT, FET current source; FET amplifiers; FET as a variable resister; FET switches; multiplexes, sample and hold, MOSFET logic switches; PMOS, NMOS, CMOS, CMOS inverter, CMOS logic gates, NAND and NOR circuits, MOSFET power switching; Op Amp; logarithmic amplifier, Schmitt trigger, op amp departure from ideal; instrumentation amplifier; power supplies; ac-to-dc conversion, IC regulators, switching regulators, dual power supplies, dc-to-dc conversion; batteries, solar cells; oscillators; relaxation oscillator, sinusoidal, Wien bridge, LC, IC and crystal oscillators, timer chip 555; unwanted oscillations in electronic circuits, phase-locked loops, Integrating logic families.

Recommended texts:

**PH 350 Microstructure and Properties of Materials (2 credits)**

(Prerequisite: PH240)

Structure–Property relations, Elastic and plastic behaviour, microplasticity of single crystals, behaviour of polycrystalline materials; fracture and creep theories. Mechanical testing of materials, Microstructure and properties, phase diagrams, phase equilibria, nucleation and growth, non-equilibrium phase transformation, some commercial alloy and ceramic systems.

Recommended texts:

**PH 361 Biophysics (2 credits)**

Cell: introduction to cell, biopolymers, biomembranes, Biophysics of transport of matter in biosystems: diffusion, Fick’s law, diffusion through membranes, compartment systems, flow of fluids, Stokes’s law, Hagen-Poiseuille’s law, Reynolds
number; Thermodynamics of biosystems: equilibrium thermodynamics, Gibbs free energy, chemical potential; Neurobiophysics: neurons, membrane potential, transference equation, electric analog of membrane, nerve excitation, action potential, conduction of action potential; Bioenergetics: photosynthesis; Radiation biology: biological effects of radiation, ionization radiation and biomaterials, radiation safety.

Recommended texts:

**PH 363 Astronomy (1 credit)**
Physics prelude: orbits in and outside solar system, special relativity, particles, forces, stars, radiation processes, cosmology; The solar system, Stars, HR diagram. The Milky Galaxy: preview, interstellar medium, evolution and death of stars, The Universe: galaxies beyond Milky Way, large scale structure of the universe, active galaxies and quasars, cosmology.

Recommended texts:

**PH 370 Mathematical Methods in Physics (2 credits)**
Vectors, coordinate systems, determinants; matrices; infinite series; Ordinary differential equations, Method of Lagrange multipliers; Legendre transformations. Functions of complex variables; Partial differential equations; Legendre, Bessel, Hermite, Laguerre and Special functions; Fourier series ; Integral transformations: Laplace and Fourier transformations; Green's function; Calculus of variations, Tensors.

Recommended texts:

**PH 373 Computational Physics (2 credits)**
Basic mathematical operations, ordinary differential equations, boundary value and eigen value problems, special functions of Gaussian quadrature, partial differential equations, Monte Carlo methods.

Recommended texts:

**PH 374 Experimental Techniques and Material Characterization (2 credits)**
Introduction to experimentation, Topics of current interest: High vacuum techniques, cryogenics: Electron microscopy: SEM and TEM, Analytical microscopy; XRD, XRF, SIMS, AES etc. Optical Techniques: Optical reflectivity, Absorption and Modulation techniques, Monochromators and Spectrophotometers. FTIR and Raman techniques; Electrical Techniques: Electrical conductivity, Four probe method, Impedance analysis, I-V, C-V techniques. Thermal techniques.

Recommended texts:

**PH 380 General Physics Laboratory III (1 credit)**
(Prerequisites: PH 103 & PH 104)

**PH 381 General Physics Laboratory IV (1 credit)**
(Prerequisites: PH 103 & PH 104)
Compulsory only for General degree students who are not offering Electronics Laboratory-I

**PH 383 Advanced Physics Laboratory I (2 credits)**
(Prerequisites: PH 280 & PH 281)

**PH 384 Advanced Physics Laboratory II (2 credits)**
(Prerequisite: PH 383)
PH 385 Electronics Laboratory II (1 credit)
(Prerequisites: PH 245, PH 285)

PH 392 Seminar (1 credit)
A student is expected to carry out an extensive literature survey on a topic assigned to him/her by a senior faculty member. At the completion of the project the student is expected to write a report of not less than twenty pages and make a presentation.

PH 395 Industrial Training (1 credit)

400 LEVEL COURSES

PH 403 Classical Mechanics (2 credits)
(Prerequisite: PH 200)
Rotating coordinate systems, Motion of rigid bodies, Principle of least action and the derivation of Lagrangian equations of motion. Applications. Galilean transformation and Lagrangian for a (i) free particle and (ii) system of particles; Mechanical similarity and viral theorem; conservation laws and symmetries in nature; constraints and method of Lagrange’s undetermined multipliers; generalized force and generalized momentum; Hamiltonian and Hamiltonian equations of motion; simple application; Poisson bracket, Ehrenfert’s theorem and integrals of motion; canonical transformations; Hamilton-Jacobi equation; adiabatic invariance and canonical variables.

Recommended texts:
3. Desloge, Classical Mechanics (1982), John Wiley & sons, vol 1,2,3

PH 406 Statistical Physics (2 credits)
(Prerequisite: PH 205)
Introduction and Review: classical & quantum mechanics; thermodynamics; mathematics: probability distribution, binomial and multinomial distributions, Lagrange multipliers, binomial distribution at large numbers; Canonical and other Ensembles, fluctuations. Boltzmann, Fermi-Dirac and Bose-Einstein statistics, ideal monatomic and diatomic gases; Quantum statistics: weakly and strongly degenerate ideal Fermi-Dirac gas; photons; Crystals: vibrational spectrum of monoatomic crystal; Einestein and Debye theories of heat capacity; phonons; point defects; Imperfect gases: Virial equation, Special Topics: Brownian motion; correlation functions; transport phenomena.

Recommended texts:

PH 414 Lasers (1 credit)

Recommended texts:

PH 422 Magnetic Materials (2 credits)
(Prerequisite: PH 240)
Atomic theory of magnetism, Diamagnetism, Paramagnetism, Ferromagnetism and Antiferromagnetism. Ferromagnetic Domains, Application of ferromagnetic materials: magnetic bubbles and their uses; Magnetic resonance: paramagnetic resonance and the maser; magnetic relaxation; nuclear magnetic resonance (NMR); ferromagnetic resonance and spin waves.

Recommended texts:
1. Ashcroft, N.W. and Mermin, N.D., Solid State Physics (1976), Saunders college publishing
PH 423 Electromagnetic Theory (2 credits)
(Prerequisite: PH 323)

Recommended texts

PH 430 Quantum Mechanics I (3 credits)
(Prerequisite: PH 230)

Recommended texts:

PH 431 Quantum Mechanics II (2 credits)
(Prerequisite: PH 430)
Methods of Approximation: Time independent and dependent perturbation theory, radiative transitions and Einstein coefficients. Variational technique, WKB approximation. Theory of scattering and many particle systems.

Recommended texts:

PH 433 Nuclear and Reactor Physics (3 credits)
(Prerequisites: PH 230, PH 333)
Nuclear Properties; Nuclear force, Nuclear models, Nuclear reactions. Neutron Sources, Neutron Interactions, Energy loss in scattering collisions, Neutron Diffusion and Moderation, Nuclear Reactor Theory, Time-Dependent Reactor: Reactor kinetics: prompt neutron lifetime and mean diffusion time of thermal neutrons. Reactors with and without delayed neutrons; Reactor with delayed neutrons. Reactivity equation. The prompt critical state; the prompt jump (drop). Reactor control: control rods and chemical shims; Rod worth; Temperature effects on reactivity.

Recommended texts:
2. Evans, *Introduction to Nuclear Physics*.

PH 436 Radiation Detection and Measurement (2 credits)
(Prerequisite: PH 333)
Radiation Sources and Interactions, Counting Statistics, General Properties of Radiation Detectors, Radiation Detectors: ionization chambers; proportional counters; Geiger-Mueller counters; G-M survey meter; Scintillation detectors; Semiconductor detectors; Miscellaneous detectors: Cerenkov detector, Superconducting detectors, Photographic emulsions; Thermoluminescent dosimeters; Neutron detection by activation.

Recommended texts:

PH 440 Solid State Theory (3 credits)
(Prerequisite: PH 240)
Classical and quantum free electron models, Failures of free electron models, Review of crystal lattices and X-ray crystallography, Electrons in a periodic potential, Bloch’s theorem, Nearly free electron model, Band gaps, Band structures, Fermi surfaces, Tight binding model, Empty lattice model, Semiclassical model of electron dynamics, Semiclassical motion under external electric and magnetic fields, Effective band mass, Concept of holes, Cyclotron motion, Measuring the Fermi surfaces, Landau levels, de Hass-van Alphen effect, Quantum Hall effect, Lattice Dynamics, Phonon modes, Superconductivity, Type I and Type II superconductors, Cooper pairs and BCS theory.
Recommended texts:

PH 445 Electronics Theory III (2 credits)
(Prerequisite: PH 345)
Gates and flip flops combined, Logic pathology, Logic families: RTL, DTL, TTL, CMOS, etc., TTL/CMOS characteristics, TTL/CMOS interfacing. Opto electronics; LED’s CCD’s, 7-segment, 16-segment and 5x7 dot matrix displays, driving LED displays, opto couplers; Data acquisition; sample and hold, noise and signal processing; A/D and D/A conversions, Digital filters; microprocessors and micro computers; computer architecture, microprocessor support chips, processor example, programmed input/output interrupts, bus signals and interfacing, data communication concepts, Project; design and construction of a practical electronic circuit

Recommended texts:

PH 453 Polymers (1 credit)
Basic concepts of Polymers, Properties of polymer solutions, thermodynamics of polymer solutions; Flory-Higgins theory; phase separation; polymer blends; Amorphous polymers: glasses, elastomers and gels; definition and measurement of glass transition temperature; time-temperature superposition; molecular dynamics, dielectric spectroscopy and nmr techniques; Mechanical Properties: viscoelasticity; mechanical analogues of viscoelastic behaviour; dynamic mechanical analysis; deformation yield and cracking effect of microstructure on properties; Polymer crystallisation: Applications of polymers, processing, environmental issues and recycling.

Recommended texts:
2. Bower, D.I., An Introduction to Polymer Physics, Cambridge Univ. Press

PH 454 Solid State Ionics & Devices (2 credits)
Ionic conductivity and solid electrolytes, point defect notation, type of defects, ionic mobility in solids, theoretical explanation of ionic conductivity, Arrhenius relationship, requirements for high ionic conductivity, types of solid electrolytes, some representative examples, composite electrolytes, polymer electrolytes, glassy electrolytes, ionic conductivity measurement, complex impedance technique, transference number and d.c. polarisation, intercalation compounds, solid state batteries, fuel cells, sensors, electrochromic devices

Recommended texts:
2. Chandra, S., Superionic Conductors (1981), North-Holland Publishing company

PH 481 Advanced Physics Laboratory III (4 credits)
(Prerequisites: PH 381 & PH 382)

PH 486 Nuclear Physics Laboratory (2 credits)
(Prerequisite: PH 436)
An introduction to the devices and techniques most common in nuclear measurements. Topics include the principles of operation of gas-filled and scintillation detectors for charged particle, gamma ray and neutron radiations. Techniques of pulse shaping, counting, and analysis for radiation spectroscopy. Timing and coincidence measurements.

PH 487 Investigation Laboratory (1 credit)

PH 491 Research Project (6 credits)
A student is expected to carry out an independent research project on a topic assigned to him/her under the supervision of a senior faculty member. At the completion of the project the student is expected to write a report and make a presentation.

PH 493 Independent Study (1 credit)

PH 496 Laboratory Teaching course (1 credit)
This teaching course is available for a fourth year Physics Special student selected by the Department of Physics. The course involves laboratory teaching (one laboratory class per week) in an undergraduate laboratory for one semester.
STATISTICS

100 LEVEL COURSES

ST 101 Introduction to Statistics (3 credits)
Basic ideas in Statistics: Representation of data, Histogram, Frequency polygon, Ogive.
Measures of Location: Various Means (AM, GM, HM, TM), Median, Mode, Quantiles, Deciles, Percentiles. Measures of Dispersion: Range, Interquartile range, Variance, Standard deviation, Chebyshev’s rule for sample, Shepperd’s correction for variance, Coefficient of variance, Moments of higher order, Skewness, Kurtosis.
Representation of data using Stem-Leaf diagrams and Box plots.
Regression and Correlation: Scatter diagrams, Linear Regression, Method of least squares, Correlation, Coefficient of correlation, Rank correlation, Spearman’s rank correlation coefficient.
Index numbers: Introduction, Price Relatives, Quantity Relatives and Value Relatives. Link and Chain Relatives, Cost of living Index Numbers, Methods of construction of Index Numbers, Quantity Index Numbers, Tests for Index numbers.

Recommended texts
2. A Basic Course in Statistics, G.M.Clarke, and D.Cooke

ST 102 Introduction to Probability Theory (3 credits)
Counting Techniques: Combinations, Permutations, Set partitions,
Random variables: Discrete and continuous r.v.’s, Probability mass function, Probability density function,
Cumulative distribution function, Functions of a random variable, Expectation, Moments, Mean and variance, Moment Generating function.
Probability inequalities: Chebyshev’s and Markov’s etc.
Distributions: Discrete: Uniform, Bernoulli & Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric,
Multinomial, Continuous: Uniform, Normal, Gamma, Exponential, Properties and applications of distributions, Probability Generating functions.
Approximation to Binomial using Poisson, Binomial using Normal, and Poisson using Normal.

Recommended Texts
2. Basic Course in Statistics, G.M.Clarke and D. Cooke

ST 103 Statistics Applications I (1 Credit)
(Prerequisite: ST 101 or any other Basic Statistics course)

Recommended Text
1. MINITAB Reference manual

ST 104 Statistics Applications II (1 credit)
(Prerequisite: ST 101 or any other Basic Statistics course)
Introduction to the SAS Display manager system, Structure of a SAS program, Editing, rearranging, displaying and summarizing data using PROC PRINT, PROC SORT, PROC FREQ, PROC MEANS, PROC UNIVARIATE, PROC FORMAT, PROC CORR PROC TABULATE, PROC STANDARD, PROC RANK etc. Creating Graphics using PROC PLOT, PROC CHART etc.
SAS Expressions, SAS Functions, Some SAS statements (ARRAY, DELETE, DO, DROP, FORMAT, GO TO, IF, INFILE, INFORMAT, INPUT, KEEP, LABEL MERGE, OUTPUT, PUT, SET, ID, VAR, TITLE, LIBNAME ETC.) Applications.

Recommended texts:
1. SAS Reference manual
200 LEVEL COURSES

ST 201 Probability Theory (3 credits)
(Prerequisite: ST 102)
Joint distribution of two (or more) discrete or continuous random variables, Marginal distribution, Conditional distribution, Independence of random variables, Expectation, Conditional expectation, Covariance, Correlation coefficient, Transformations involving two or more random variables, Probability density functions of (a) sum and difference, (b) product and quotient of two random variables, Random samples, Empirical distributions, Order statistics, Distributions of MIN \( X_i \), MAX \( X_i \) etc., Distributions of sample mean and sample variance; \( t \), \( F \) and \( \chi^2 \) distributions and their properties, Laws of large numbers, Central limit theorem.

Recommended texts

ST 202 Applied Statistics (2 credits)
This course cannot be offered by students who offered ST 101 or ST 201. Some practical assignments will be given for this course.
Types of data, Data summarization: Histogram, Frequency polygon, Ogive.
Measures of location, Measures of Dispersion, Representation of data using Stem-Leaf diagrams and Box plots. Some Statistical distribution functions and their properties.
Test of hypothesis, Estimation and tests on difference between two means and proportions, Tests on variances.
Simple linear regression and correlation, Lack of fit residual plots, Introduction to Analysis of variance, and analysis of two-way contingency tables.

Recommended texts

ST 203 Theory of Statistics (3 credits)
(Prequisite: ST 201, Some practical assignments will be given for this course)
**Estimation:** Point estimation: Properties of estimators; Unbiasedness, Consistency, Relative efficiency, Efficiency, Sufficiency, Factorization theorem, Rao-Blackwell theorem, UMVUE, Exponential families, Cramer-Rao inequality, Methods of obtaining estimators; Method of moments, Maximum likelihood estimators etc.
Interval estimation: Constructing confidence intervals for population parameters under various assumptions, Tolerance limits.
**Testing Hypothesis:** Tests on population parameters, Tests on independent and paired samples, Neyman-Pearson lemma, Uniformly Most Powerful tests, Likelihood Ratio tests.

Recommended texts

ST 204 Sampling Techniques (2 credits)
Some practical assignments will be given for this course. (Prequisite: ST 202 or ST 203)

Recommended texts
300 LEVEL COURSES

ST 301 Regression Analysis (3 credits)
Some practical assignments will be given for this course. (Prequisite: ST 202 or ST 203)
Simple linear regression, Tests for regression coefficients, Interval estimation, Prediction, Analysis of variance approach,
Diagnostic and remedial measures, Matrix approach to simple linear regression, Multiple regression, Polynomial regression.
Introduction to logistic regression and nonlinear regression, Introduction to Time series Analysis.

Recommended texts

ST 302 Statistical Quality Control (2 credits)
Some practical assignments will be given for this course. (Prequisite: ST 202 or ST 203)
Control charts for mean, variance, range etc, Properties of control charts, Acceptance sampling procedures and consumer
risks, Operating characteristic curves, Process capability analysis, Introduction to Quality assurance and acceptance
control, Lot-by-Lot acceptance sampling by attributes, Acceptance procedure based on AQL, Other acceptance
procedures, Continuous acceptance sampling by attributes, Acceptance procedures for variable characteristics.

Recommended texts

ST 303 Design and Analysis of experiments (3 credits)
Some practical assignments will be given for this course. (Prequisite: ST 202 or ST 203)
Comparison of two samples (independent, dependent), One-way ANOVA: Assumptions, Normal theory, F-tests. Multiple
comparisons: LSD method, Tuckey's method, Bon- ferroni method, Scheffe’s method, Duncan’s multiple range method.
Two-way ANOVA: Normal theory, Randomized block design, The two factor factorial, Multifactor Factorials, Confounding, Introduction to Analysis of covariance, Latin square.

Recommended texts

ST 304 Non-parametrics and categorical data Analysis (2 credits)
Some practical assignments will be given for this course. (Prequisite: ST 202 or ST 203)
Non-Parametrics : One sample sign test, Binomial test, Two sample sign test, Wilcoxon paired samples, Signed rank test,
Wilcoxon and Mann Whitney test, Correlation tests, Tests of independence, Wald- Wolfowitz runs test, Kruskal-Wallis test,
Friedman test.
Categorical Data Analysis : Multinomial distribution, Goodness of fit tests, The Kolmogorov-Smirnov Statistics, Testing

Recommended texts

Students, who do not offer Statistics as a major subject, can take the following course units after following the
Applied Statistics (ST202) course. Note that ST 103 course can be followed concurrently with ST 202.

ST 103 Statistics Applications I  ST 104 Statistics Applications II
ST 204 Sampling Techniques  ST 301 Regression Analysis
ST 303 Design and Analysis of experiments  ST 302 Statistical Quality Control
ST 304 Non-parametrics and Categorical Data Analysis
ZOOLOGY

100 LEVEL COURSES

BIOLOGY I

BL 100 Basic Life Sciences (2 credits)


Interactive learning exercises in biology.

Recommended texts:

BL 101 Basic Biology (2 credits)

Cell Biology - Chemical nature of life, origin of life, scientific method, prokaryotic and eukaryotic cells, cell types, structure and function of cell membranes and organelles, cell division, structure and function of genetic material.

Classification of organisms - Early and current systems of classification.

Genetics and evolution - Chromosome theory of inheritance, Mendelian genetics and deviation, linkage and recombination, mutations, Hardy-Weinburg principle, sources of variation, natural selection, origin of species.

Laboratory exercises based on above topics.

Recommended Texts

BL 102 Plant and Animal Form and Function (2 credits)

Tissue types, internal structure of plants and organs, photosynthesis, transport systems, plant nutrition. Animal structure and function, nutrition and digestion, respiration and gas exchange, circulatory systems and blood, homeostasis, reproduction and hormones, nervous system and coordination.

Laboratory exercises based on the above topics.

Recommended Texts:
2. Surrey, U.K.
5. Company, Inc.

BL 103 Basic Ecology (2 credits)

Ecological Levels (individuals, populations, communities, ecosystems, biomes, biosphere), components of the physical environment (energy, water, atmospheric gases and wind, fire, gravity, topography, geologic substratum and soil), energy flow in ecosystems (tropical levels, food webs, productivity), cycles of materials (hydrological cycle, carbon cycle, biogeochemical cycles).

Laboratory exercises based on above topics.
Recommended Texts:

BL 104 Microbiology and Biochemistry (2 credits)
History and development of microbiology, introduction to microorganisms (viruses, viroids, bacteria, mollicutes, prions etc.), morphology of microorganisms, microbiological techniques (observation of microorganisms, handling, isolation and cultivation of microorganisms, culture media, sterile conditions). Microbiological equipment and safety procedures, microorganisms in biotechnology. Cellular respiration, enzymes in biological systems.
Laboratory exercises based on the above.

Recommended Texts:

BIOLOGY II

BL 111 Tropical Terrestrial Ecosystems (2 credits)
World climate and vegetation distribution; structural characteristics, adaptations and floral and faunal diversity of tropical forests, savannas and grasslands; human impacts.
Practicals and field classes based on above.

Recommended Texts:

BL 112 Sub-tropical, Temperate and Polar Terrestrial Ecosystems (2 credits)
Regional distribution, structural characteristics, adaptations and floral and faunal diversity of deserts and arid regions, temperate grasslands, temperate forests, coniferous forests, chaparrals and polar and high mountain tundras; human impacts.
Practicals based on above.

Recommended Texts:

BL 113 Marine Ecosystems (2 credits)
Plants and animals in rocky and sandy seashores, and coral and sandstone reef; plankton and floating organisms; squids and octopuses: fish, sea snakes and turtles; whales and sea cows and seals in open sea, sea birds; deep sea animals.
Practicals and field classes based on above.

Recommended Texts:

BL 114 Wetland Ecosystems (2 credits)
Plants and animals in lagoons, basin estuaries and river estuaries, mangroves and salt marshes, rivers, streams and canals, lakes, reservoirs (man – made lakes) and ponds, marshes, swamps, peat – bogs and paddy fields. Practical basis on field classes based on above.
Recommended Texts:
3. Biology, N.A. Campbell, J.B. Reece and L.G. Mitchel

200 LEVEL COURSES

ZL 201 Animal Embryology (2 credits)
Gametogenesis; Fertilization; Cleavage; Gastrulation; Neurulation; Early development of amphioxus, frog, chick, and man; Early development of selected invertebrates.
Practicals based on above.

Recommended Texts:
1. Animal Biology. Grove & Newell
2. Introduction to Embryology. B.I. Balinsky.

ZL 202 Invertebrate Biology (3 credits)
Classification, Characteristic features, Structure, Natural history and Phylogenetic relationships of the following groups: Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda, Annelida, Mollusca, Echinodermata, Minor phyla and Protochordata.
Practicals based on above.

Recommended Texts:
1. Integrated Principles of Zoology. E.E. Rupert & Barnes

ZL 203 Fish Biology (2 credits)
Practicals based on above.

Recommended Texts:

ZL 204 Modern Biology and Human Society (2 credits)
Scientific method; Reliability of published studies; Sources of information; Free Radicals, Antioxidants, Diseases and Aging; Nutrition, Diet, Diet-related diseases and Exercise; Cells, cell division and cancers; Biological clocks and human activities; Reproductive engineering; Test tube babies, Human cloning, Surrogacy, etc.; Reproductive health and STDs; New diseases (new bacteria, new viruses); Antibiotics and Drug resistance.
Recommended Reading:
Current newspaper articles, magazines such as Time, New Scientist, National geographic, etc.

ZL 205 Biostatistics (2 credits)
This course cannot be offered by students who offered ST 101 or ST 201. Some practical assignments will be given for this course.
(Same as ST 202)
Types of data, Data summarization: Histogram, Frequency polygon, Ogive.
Measures of location, Measures of Dispersion, Representation of data using Stem-Leaf diagrams and Box plots. Some Statistical distribution functions and their properties.
Test of hypothesis, Estimation and tests on difference between two means and proportions, Tests on variances.
Simple linear regression and correlation, Lack of fit residual plots, Introduction to Analysis of variance, and analysis of two-way contingency tables.

Recommended texts
ZL 211 Amphibian and Reptilian Biology (2 credits)
Amphibian evolution; Metamorphosis; Vocal communication in frogs and toads; Reproduction and Parental care; Protection against predators; Global and local threats to Amphibians. Reptilian organization; Temperature relations of Reptiles; Reproduction and mating strategies; Temperature and sex; Adaptations of Reptiles to arid climates. Amphibians and Reptiles of Sri Lanka; Conservation of Amphibians and Reptiles.
Practicals based on above.

Recommended Texts:

ZL 212 Avian and Mammalian Biology (2 credits)
Classification of birds and mammals. The concept of Aerial Space; Aerodynamics of Bird Flight; Bird Migration and Navigation; Food and Feeding Habits; Vocalizations; Territory and Territorial Behaviour; Reproduction and Mating Systems; Birds of Sri Lanka. Mammalian Characteristics; Mammalian Evolution and Radiation; Insectivores and their Relatives; Carnivores; Herbivores; Aquatic Mammals; human impact on Mammals. Mammals of Sri Lanka.
Practicals based on above.

Recommended Texts:

ZL 213 Animal Ecology (2 credits)
Structure and the function of Ecosystems; Terrestrial and Aquatic Ecosystems; Introduction to Population Ecology: Population Growth, Life Tables and Fecundity Tables, Population Regulation, Life History Characteristics; Introduction to Community ecology; Interspecific interactions: Competition, Niches and Resource Partitioning, Predation, Herbivory, Mutualism; Species Diversity; Community Similarity; Succession.
Practicals based on above.

Recommended Texts:

ZL 214 Coral Reef Biology and Ecology (2 credits)

Recommended Texts:

ZL 215 Zoogeography and Sri Lankan Fauna (2 credits)
Continental Drift and Plate Tectonics; Wegner’s Hypothesis; Earth’s mantle and core; Tectonic plates and their Motion; The supercontinent cycle; History of zoogeography; Patterns of zoogeography; Biological processes in zoogeography; Ecological zoogeography: dispersal of plants and animals and migrations, barriers for dispersal; Present biogeographic regions: terrestrial and oceanic biogeographic regions and inland waters; Centres of origination and divergence of species; extinction of species; island biogeography; patterns of biogeography. Taxonomy, distribution, habitat and mode of life, conservation status, endemism and threats to selected invertebrates & vertebrates with special reference to terrestrial fauna.
Practicals based on above.

Recommended Texts:

**300 LEVEL COURSES**

**ZL 301 Functional Histology (2 credits)**
Light and electron microscopy; Cell structure and function; Cell cycle and replication; structure and function of basic tissue types (epithelial, connective muscle and nervous tissues); Anatomic organization of organ systems (digestive, reproductive, excretory, nervous and sensory systems); Histological techniques (Fixation and fixatives, Tissue processing, microtomy and paraffin sections, staining, histochemistry); Safety.
Practicals based on above.

Recommended Texts:
1. *Histology: Cell and Tissue Biology*. L. Weiss (ed.)

**ZL 302 Comparative Anatomy and Animal Physiology (2 credits)**
Anatomy and Physiology of Digestion, and Nutrition; Excretion and Homeostasis; Respiration and Gas exchange; Circulation and Blood; Reproduction and hormones; their Action and Regulation; Muscular system and Movement; Nervous system, Sense organs and Coordination
Practicals based on above.

Recommended Texts:

**ZL 303 General Entomology (2 credits)**
Insect Structure and Function; Classification and Identification of insects, Methods of Collecting, Preserving and Curating different insect orders; Insect development and Role of hormones; Insects of Agricultural, Medical and Veterinary importance; Principles and Methods of Insect Pest Control.
Practicals and Field work based on above.

Recommended Texts:

**ZL 304 Biology of Parasites (2 credits)**
Symbiotic associations and definitions; Overview of parasitism; Ecology of parasitic infections; Taxonomy, Morphology, lifecycles and geographic distribution of selected parasites (representative of major taxa); Proteomics of parasites; Important pathogenic effects of parasitic infections; Methods of parasite identification.
Practicals based on above.

Recommended Texts:
1. *Introduction to Animal Parasitology*. J.D. Smith.

**ZL 305 Fisheries (2 credits)**
Importance of fisheries to Sri Lanka; Fishing gear and methods of fishing; Marine fisheries (fin fish & shellfish); Inland fisheries (finfish); Fisheries regulation and management; Fish preservation and processing; Ornamental fish trade in Sri Lanka: Species used, Current status; Potential and future prospects.
Practicals based on above

Recommended Texts:
1. *Fisheries Biology: Assessment and Management*. M. King.

**ZL 306 Biological Indicators in Environmental Assessments (2 credits)**
Changes and challenges of environment of emerging Asia. Indicator organisms: background, principles and examples; The use of Biota, sediments and water in environmental monitoring; indicators of land and water quality and sustainable
management; a systematic approach to measuring and reporting environmental problems such as acidification,
eutrophication, air pollution and climatic changes; Framework for the development of environmental health indicators;
Biological indicators of environmental health; Rapid urban environmental assessment and case studies or urban
development in the developing world; developing a national set of environmental indicators.

Recommended Texts:
   Cambridge University Press.

ZL 311 Ethology (2 credits)
Principles of Animal Behaviour; Ultimate and Proximate factors; Altrustic behaviour; Cost-benefit analysis; Social
organization; Fighting and Assessment; Sexual conflict and Sexual selection; Parental care and Mating systems; Co-
evolution.
Field work.

Recommended Texts:

ZL 312 Developmental Biology (2 credits)
(Prerequisite: ZL 201)
Introduction to Developmental Biology; Differentiation and morphogenesis in Dictyostelium; The cellular basis of
morphogenesis; Organizing multicellular embryo; Genomic constancy; Cytoplasmic determinants; Differential gene
expression during development; Maternal and zygotic control of gene expression; Maternal specification of embryonic
axes; Hox genes and establishment of body plan; Cell-cell interactions; Cell signalling; Cell adhesion; Programmed cell
death; Pattern formation; Establishment of segments, hierarchy of segments and segment identity of Drosophila; Sex
determination and differentiation; Life cycles and development patterns; Aging and senescence; Regeneration;
Teratogenesis; Cloning and transgenic animals.
Practical based on above.

Recommended Texts:
3. Evolutionary Developmental Biology. B.K. Hall.

ZL 313 Animal Genetics (2 credits)
Genetic systems and extra-chromosomal inheritance; Heteroploidy, Chromosomal aberrations and Point mutations;
Genetic variation; Hardy-Weinberg equilibrium; Factors affecting H-W equilibrium: migration, mutation selection,
genetic drift and effective population size; Inbreeding and outbreeding.
Practicals based on above.

Recommended Texts:

ZL 314 Evolutionary Biology and Systematics (2 credits)
Major phases of Evolutionary Theory; Major aspects of Evolutionary Biology; Evolutionary forces; Variation among
organisms; Natural Selection: Adaptation; Camouflage; Mimicry; Coevolution; Coadaptation; Exaptation; Reproductive
isolation mechanisms and Speciation; Extinction in evolution: Causes and consequences; Molecular evolution and
genetic variation; Principles of Cladistics.

Recommended Texts:
2. Evolutionary Biology. D. Futuyma.

ZL 316 Economic Zoology (2 credits)
An overview of Invertebrates and Vertebrates of Economic and Industrial importance; Methods of Rearing, Handling
and Marketing of commercially important selected animals or their products. Biology of commercially important animal
groups.
Practicals and field work based on above.
Recommended Texts:

**ZL 317 Primatology (2 credits)**
Origin and evolution of primates; Taxonomy and systematics of primates with special reference to Sri Lanka; Techniques for the study of primates; Population structure and factors affecting survival; Types of primate social organization; Social behaviour; Feeding and lifestyles; Home range and territoriality; Reproduction and mating systems; Management of primates in humans dominated landscapes; *In situ* and *ex situ* conservation of primates.

Recommended Texts:

**400 LEVEL COURSES**

**ZL 401 Taxonomy, Field Sampling and Biostatistics (2 credits)**
Use of taxonomic keys for the identification of selected animal groups up to generic and species levels. Methods of sampling different taxa and plant communities; Use of different types of Collecting and Sampling Equipment. Types of biological data, Methods of comparison of Sample Means; Determination of association between variables; One way analysis of variance, Regression and correlation; Diversity indices; Species richness and abundance; Estimation of relative and absolute densities of plant and animal communities.

Practicals based on above.

Recommended Texts:

**ZL 402 Techniques in Zoology (2 credits)**
Microtomy; Slide mounting and Staining of entire specimens, tissues and embryos; Determination of blood parameters; Biochemical tests; Taxidermy and preparation of skeletons; Preservation techniques of soft bodied animals.

Recommended Texts:

**ZL 403 Applied Entomology (3 credits)**
Insect taxonomy, Classification and Identification of selected taxa. Insect genitalia and their importance; Beneficial insects and Biological control; Chemical methods of pest control; Insecticide resistance and Mechanisms of resistance; Insect ecology, Insect communication; Insect population dynamics and Life tables; Insect conservation.

Practicals based on above.

Recommended Texts:
  1. *Agricultural Insect Pests of the Tropics and Their Control*. D.S. Hill.

**ZL 404 Applied Parasitology (3 credits)**
(Prerequisite: ZL 304)
Taxonomy, morphology, life cycles and geographic distribution of parasitic protozoa and metazoa (selected examples from taxa); Reproduction and larval stages; Parasite behaviour, nutrition and metabolism; genetics of parasites; Geomedical aspects and control of parasitic diseases; Epidemiology of parasitic diseases with special reference to Sri Lanka; Zoonoses; Serology and immunodiagnostic methods (DNA and protein) for parasite identification, Immunity to parasites; Biotechnology in parasitology; Parasitology and websites; Emerging diseases.

Practicals based on above.

Recommended Texts:


**ZL 405 Ecotourism and Nature Conservation (3 Credits)**

Types of tourism; Potential for ecotourism: Landscapes (ecosystems), Man-made ecosystems, Cultural background, Biological diversity, Protected Areas, Coral reefs, Elephant orphanage; Ecotourism services: Sources of information, Travel operators, Transport facilities, Hotel and other facilities; Potential for joint ecotourism with nearby countries; Constraints to tourism; Ancillary benefits of ecotourism; Negative impacts of tourism; Improvement of ecotourism facilities.

Recommended Texts:

**ZL 406 Environmental Biology (3 credits)**

Adaptation to environment and adapting the environment: Man’s position and his impact on earth; Overpopulation and environmental degradation; Worldwide population trends; Atmosphere; Greenhouse effect and Global warming; Ozone depletion; Types, Sources and Effects of air pollution: Acid rain, Photochemical smog; Organic pollution; Carcinogenic and mutagenic effects of chemicals; Pesticides and their problems; Aquatic pollution; Algal toxins; Heavy metal pollution; Thermal pollution; Sound and noise pollution; Biological effects of radiation; Health effects on humans and other animals; Land use; Urbanization; Sewage, Soil and land pollution; Industrial pollution; Introduction to Climatology; El Nino and Southern Oscillation; Earthquakes, volcanism & Tsunamis; Resource development and Environmental Impact Assessment (EIA) in Sri Lanka; Government and environmental policy; International conventions and protocols related to environment.

Practicals based on above.

Recommended Texts:
1. *Guidelines for Baseline Ecological Assessment*. Ed Institute of Environmental Assessment.

**ZL 407 Immunobiology (3 credits)**

Structure, function and evolution of immune systems of selected invertebrates and vertebrates; Evolution of immunity, Cells of the immune systems, Anatomic organization of the immune system, Basis and mechanisms of immunity, Antigen recognition and presentation, Heterogeneity and diversity of receptor molecules of immune systems, Mediators of antigen-antibody reactions of immune responses, Regulation of immune responses, Hypersensitivity reactions, Techniques in immunology, Interactive learning using the Internet.

Practicals based on above.

Recommended Texts:

**ZL 408 Inland Fisheries and Aquaculture (3 credits)**

(Prerequisite: ZL 203)
Fisheries of Sri Lanka, its importance, potential, regulation and management, fishing gear and methods of fishing, preservation and processing of food fish, techniques of natural stock enhancements in inland fisheries. General Principles and Economics of Aquaculture: Aquaculture methods and practices, culturable fish and shellfish, construction of fish farms, management of fish farms, fish nutrition, fish diseases, induced breeding and seed fish production, Culture of prawns and shellfish.

Practicals based on above.

Recommended Texts:

**ZL 409 Limnology and Wetland Ecology (3 credits)**

Lakes: Origins and morphometry, Physical factors, Water chemistry, Thermal stratification, Plant nutrients - N and P; Primary productivity; Plankton; Nektont; Benthos; Nutrient enrichment; Use of bioindicators; Acidification; Streams: Stream geomorphology; Rainfall, runoff and infiltration; Sedimentation and sediment transport; primary & secondary productivity; Invertebrates, fish and food webs; Ecology of riparian zones; Flood plains; River continuum concept; Wetland types and classification; World wetland distribution; Water budget and Biological effects; Wetland soils; Soil
aeration and development of anaerobic conditions; Effect of salinity and water logging; vegetation, fauna and their adaptations; Wetland creation and restoration; Constructed wetlands for wastewater treatment; Productive coastal ecosystems.
Practicals based on above.

Recommended Texts:

**ZL 410 Marine Biology and Fisheries (3 credits)**
The Ocean as a habitat: circulation, tides and Waves; properties of sea water; Marine habitats and biodiversity; deep sea, open ocean, coastal sea; The intertidal zone; Primary Productivity in the Sea: phytoplankton and macro-algae; Major invertebrate groups; Fishes, reptiles, birds and mammals; Larval Dispersal and Migrations; Coral and other reefs; Human impacts; over-exploitation of marine resources; pollution, introduced marine pests, tourism; Sri Lankan marine flora and fauna; Marine fisheries of the world; Inshore and offshore fishery; Fishing gear; Marine fishery of Sri Lanka; Mariculture of shellfish,
Practicals based on above.

Recommended Texts:
1. *The Effects of Fishing on Marine Ecosystems and Communities*. S.J. Hall.

**ZL 411 Wildlife Management (3 credits)**
Population: Growth and Regulation; Carrying capacity; competition; Sustainable Yield Harvesting; Vertebrate Pest Control; Management of threatened Wildlife; Wildlife and Society; Minimum Viable Population; Island Biogeography; *in-situ* and *ex-situ* conservation; Extinction; International Conventions.
Field work.

Recommended Texts:

**ZL 412 Biodiversity & Conservation Biology (3 credits)**
Ecosystem- and genetic diversity; Global patterns and Values of biodiversity; Effective population size, Inbreeding and Gene flow; Overexploitation; Demography and Extinction processes, Population viability analysis; Endangered species and their protection; Exotic introductions and Invasive species; Ecosystem degradation, Habitat fragmentation and Edge effects; Habitat pollution; Modified ecosystems, Ecosystems management and Restoring ecosystems; Protected areas; Captive breeding and reintroduction; Zoos and Gardens; Human population growth ; Human impact; Sustainable development; Law and politics; Social factors in conservation; Economics of conservation; Conservation politics.

Recommended Texts:

**ZL 413 Molecular Entomology (2 credits)**
(Prerequisites: ZL303, MB226)
(Same as MB 431)
Genome organization of insects; Sex determination in insects; Molecular systematics, evolution and genetics of insect populations; Developmental biology and Gene manipulation in insects; Molecular genetics of insect behaviour; Molecular biology of vector-parasite/virus interactions, and of midgut, haemolymph, and salivary gland targets for disruption of pathogen transmission; Up-regulation of specific genes as a response to the development of pathogens, Molecular targets of pesticides and Molecular basis of resistance development; transgenic insects for agricultural pest management and disease vector control.

Recommended Texts:
ZL 421 Scientific Writing and Seminar (3 credits)
Writing Scientific Papers and Project Proposals; Organization and Content; Guidelines for writing under different headings; Scientific presentations; Guidelines for preparation of presentations; Effective use of visual aids; Delivery and presentation style.

ZL 422 Essay (2 credits)
Three essays on assigned topics in Zoology should be written by the students.

ZL 431 Seminar (2 credits)
Seminars on assigned topics in Zoology should be presented after due preparation and literature survey by the students.

ZL 491 Research Project (6 credits)
A research project on a given zoological topic shall be carried out by those who specialize in Zoology. The normal duration of the project is six months. The student is expected to write the Research Proposal and present it, carry out a literature survey and, on completion of the project, make an oral presentation of the work and submit a written report. Marks will be allocated for the oral presentation and the written report.
SUPPLEMENTARY COURSE UNITS

ASTRONOMY

PH 263 - Introductory Astronomy (1 Credit)
PH 363 - Astrophysics (1 Credit)

BASIC COMPUTING

BC 201 Basic Computing I (2 credits)
(Prerequisites: CS 100)

Recommended Text:
1. French C.S.; (1990) Computer Science; DP Publications;

BC 202 Micro Computer Applications I (1 credit)
(Followed concurrently with BC 201)
Lab Course consisting of Practicals using Operating Systems and the Application Packages.

Recommended Text:

BC 301 Basic Computing II (2 credits)
(Prerequisites: BC 201, BC 202)
Database Management Systems: Advantages of DBMS Approach, E-R Modelling, Normalization, Data Sub Languages - SQL.

Recommended Text:

BC 302 Micro Computer Applications II (1 credit)
(Followed concurrently with BC 301)
Lab Course consisting of Practicals using a DBMS Package.

Recommended Text:

ECONOMICS

EC 201 Introductory Economic Theory (3 credits)
Introduction to microeconomics: Scopes, subject matter and concepts, economical problems; scarcity and choice, opportunity costs, different economic systems. Theory of price: theories of Demand and Supply, the price determination, theory of elasticity. Government role in the economy: Government intervention, taxation and expenditure. Theory of production: short run and long run production functions
Theory of costs: short run and long run costs, law of diminishing marginal productivity, law of returns to scale
Theory of the firm: perfect competition, monopoly and monopolistic competition
Money supply and demand; definition of money, creation of money, real GNP and price level.
The global economy: international trade, balance of payment and determination of exchange rate 6hrs

Recommended Texts:
EC 301 The Sri Lankan Economy (2 credits)

Recommended texts:

ELECTRONICS

PH 245 Electronics I (2 credits)

PH 285 Electronics Laboratory I (1 credit)
(Prerequisite: PH 245)

ENVIRONMENTAL SCIENCE

CH 361 Environmental Chemistry (3 credits)
(Prerequisites: CH 211, CH 221, CH 231)

PH 262 Energy, Weather and Environment (2 credits)

GL 204 Water resources (1 credit)
GL 307 Engineering Geology (2 credits)
GL 316 Remote Sensing and GIS (2 credits)

ZL 214 Coral Reef Biology and Ecology (2 credits)
ZL 215 Zoogeography & Sri Lankan Fauna (2 credits)
ZL 311 Ethology (2 credits)

FOOD SCIENCE

FS 202 Food Science I (2 credits)


Food Technology: Fruit & vegetable technology: Physical, Chemical and Biological methods used in preservation, Common unit operations, Post harvest handling of fruits and vegetables. Grain Technology: Cereals and pulses-composition, structure, effect of processing, functional properties, post harvest technology. Food of animal origin: Problems associated with keeping quality of meat, fish, eggs and milk, Methods of processing. Laboratory work Based on above topics.

Recommended Texts:
FS 302 Food Science II (2 credits)


Nutrition and Quality of Food: Biochemistry and Nutrition: Digestion and absorption. Food nutrients, their role in human nutrition, sources and availability. Food safety, hygiene and quality control: Natural and artificial toxicants in foods, Importance of hygienic handling, Principles of quality control; HACCP and GMP, Use of sensory evaluations, Food laws and standards, Role of International Bodies, i.e. WHO/FAO, International Standards Organization, Biosafety Regulations, Food control infrastructure in Sri Lanka. Laboratory work Based on above topics.

Recommended Texts:

MANAGEMENT STUDIES

MG 201 Management Studies I (2 credits)


Evolution of Management: Managerial Roles And Skills. Model of effective management

Planning: Plan, Goal Setting, Assess Alternatives, Selecting Best Path, Implementation of Plan


Controlling Accounting: Introduction to Financial Statements. Preparation & Analysis of Financial Statements

Recommended Texts:

MG 301 Management Studies II (2 credits)

Operation Management: The Process, Planning and controlling, scheduling & Loading and Designing, Quality control, Quality Circle. Industrial Engineering: Plat location & layout, Material handling, Work & Method Study, MIS for operation, Equipment Replacement Management. Design Project and Project management Inventory & Ware-House Management. Productivity and 5 S’ system


Recommended Texts:
SCIENCE EDUCATION

SE 101 Science and Society (3 credits)
The Scientific Method; Induction and Deduction; Scientific Revolutions: Ancient and Modern Science; Science of Non-Western Societies; Colonial Science; Science and Ethics; Values in Scientific Research and Results; Indigenous Knowledge systems; Technology and Science; Science and Technology in Development; Important Discoveries of Modern Science and their Development; Institutionalization of Science and Technology; Modern Scientific Research and its Funding; Role of Multinationals; Science and Warfare; Scientists and Social Responsibility; Risk and Uncertainty in Science; Science and the Media; Food and Population; Energy; Environment; Oceans; Outer Space; Technology and Trade; Science and Developing Countries

Recommended Text:

SE 201 Foundations in Science Education (2 credits)
How science and science education has progressed in Sri Lanka and globally. Philosophical background that supported to develop science as a discipline. Scientific inquiry and scientific thinking. Nature of science, Scientific method and applications. Cognitive and psycho-social development of the child. Socialisation process in the classroom, school and community.

Recommended text:
1. W.Harlen, Teaching, learning and assessing science.

SE 202 Educational Philosophy and Educational Management (2 credits)

Recommended texts:
1. RB Sund and LW Torbridge, Teaching science by inquiry in the secondary school
2. M.Braine, D.Kerry and M.Piling , Practical classroom management

SE 301 Methodology in Teaching Science (2 credits)
Preparation to be a science teacher. How to teach science using different methods and strategies to encourage active student learning with special reference to cooperative and collaborative learning and constructivism. A learning model towards meaningful learning. Teaching practice. Curriculum design. How to plan a science lesson, laboratory activity, demonstration.

Recommended texts:

*SE 302 Teaching practice (2 credits)
Lesson planning to teach a unit or two units in Grades 6-10 science/mathematics syllabus and implement those plans in classroom teaching.

Recommended texts:
2. JE Kemp, (2000) Instructional design, A plan for unit and course development, John Wiley 

SE 303 Assessing students in the learning process (2 credits)

Recommended texts:
APPLIED SCIENCES SUBJECT AREA

AS 400  Industrial Management (2 credits - Compulsory)  
*Course Objective:* To train students in the principles of modern industrial management.

AS 401  Industrial Placement (8 credits – Compulsory)  
*Course Objective:* To provide students with work experience in an industrial environment and introduce them to the world of work.

AS 402  Research Methodology and Scientific Writing (2 credits - Compulsory)  
*Course Objectives:* To provide skills of survey and quantitative research methods and improve report writing skills.

AS 403  Seminar (1 credit - Compulsory)  
*Course Objectives:* Training in independent literature survey and presentation

AS 405  Cleaner Production for Industry (2 credits)  
*Course Objectives:* To provide knowledge on the latest trends in industrial practices and meet ISO standards on Environmental management

AS 406  Energy: Use and Conservation (2 credits)  
*Course Objectives:* To provide a sound knowledge on energy management and conservation

AS 407  Industrial Waste Management (2 credits)  
*Course Objectives:* To train students in the modern concepts in waste management and provide skills to develop industries using waste as a resource

AS 408  Industrial Organic Chemistry (2 credits)  
(Prerequisite: Chemistry)  
*Course Objectives:* To impart a theoretical and practical knowledge of petrochemicals, antioxidants and industrial additives, essential oils, fats & oils, phospholipids, waxes, steroids; Surface active compounds, dyes and pigments, polymers, agrochemicals, organic pollutants, pharmaceuticals and nutraceuticals.

AS 411  Semiconductor Device Technology and Applications (2 credits)

AS 412  Science and Technology of Ceramic Materials (2 credits)  
*Course Objectives:* To provide knowledge and skills for jobs in ceramic related industries in Sri Lanka and abroad. Processing of ceramics and design considerations, powder processing, sintering, techniques for forming and densifying ceramics; Microstructure of ceramics and quality assurance; Introduction to glass and glass-ceramics, ceramic composites and ceramic coatings and films; Environmental issues related to ceramic industry:

Recommended texts:  
2. Richardson, David W. and Dekker, M., *Modern Ceramic Engineering* (1992), Marcel Dekker, New York

AS 414  Industrial and Environmental Microbiology (2 credits)  
*Course Objectives:* Impart knowledge and develop skills on water quality testing, industrial and medical microbiology and microbial biotechnology

AS 415  Biodiversity Conservation and Sustainable Development (2 credits)  
*Course Objectives:* Impart knowledge and develop skills on Biodiversity conservation and management, Sustainable use of Biodiversity, Soil fertility Management, Production Forestry and computer aided data analysis and management in Ecology and Forestry fields

AS 416  Fisheries and Aquaculture (2 credits)  
(Prerequisite: Biology)  
*Course Objectives:* To provide field training and experience for students in the rapidly developing industry of fisheries and aquaculture.

AS 417  Food and Fresh Produce Technology (2 credits)  
(Prerequisite: Biology)  
*Course Objectives:* Provide training on fresh produce handling, Food processing, packaging and analysis, Floriculture
AS 418 Ecotourism (2 credits)
(Prerequisite: Biology)
Course Objectives: Impart knowledge and develop awareness on non-detrimental tourism; develop skills as ecotourism guides and operators.

AS 420 Principles of Molecular Biology and Biotechnology (2 credits)
(Prerequisite: Biology)
Course Objective: To impart general knowledge in principles and applications of cell biology, molecular biology, immunology and biotechnology. The course is available for students without a biology background.

AS 421 Molecular Biology and Biotechnology Laboratory (2 credits)
(Prerequisite: Biology)
Course Objective: To provide training on a selection of techniques commonly used in biochemistry, molecular biology and biotechnology laboratory. This course complements the lecture course, Principles of Molecular Biology and Biotechnology

AS 422 Applied Geochemistry and Environmental Geology (2 credits)
(Prerequisite: Geology)
Course Objectives: To provide technical knowledge in applied geochemistry

AS 423 Applied Geology and Geophysics (2 credits)
(Prerequisite: Geology)
Course Objectives: To provide knowledge on applied geology

AS 424 Industrial and Economic Minerals (2 credits)
(Prerequisite: Geology)
Course Objectives: To provide knowledge of mineral resources.

AS 425 Design and Development of Software Systems (2 credits)
(Prerequisite: Computer Science)
Course Objectives: To provide hands-on training in designing and developing real software systems.

AS 426 Management of Computers and Computer Networks (2 credits)
Course Objectives: To provide hands-on training in hardware aspects related to computer networks and network communication, device interfacing, data acquisition and data processing, micro-controllers and embedded systems and instrument control.

AS 427 Visualizing Statistical Concepts using Java and Software Development (2 credits)
Course Objectives: To provide experience to undergraduate in Statistical software development.

AS 428 Statistical Applications in Industry and Project Presentation (2 credits)
(Prerequisite: Statistics)
Course Objectives: To provide experience to handling statistical problems in Industry and to improve project presentation skills and report writing.

AS 429 Industrial Mathematics using MATLAB (2 credits)
(Prerequisite: Mathematics *)
Course Objective: Designed to produce graduates who are competent in solving mathematical problems in industry using MATLAB. The MATLAB software package is introduced at an advanced level and students are trained to use software to solve mathematical problems related to industry through practical sessions.

AS 430 Financial Mathematics (2 credits)
(Prerequisite: Mathematics *)
Course Objective: To train students in Mathematical Models that comes under Finance. This course unit introduces MATHEMATICA software package at an advanced level and prepares students to use software to solve Mathematical problems related to finance through practical sessions.

AS 431 Chemical Technology (2 credits)

AS 435 Workshop Practice (2 credits)
Course Objective: To introduce technical Drawing methods, measuring instruments, handling of basic hand tools and portable machines used in sheet metal works; to gain experience in using lathe, milling and drilling machines, basic wood and plastic working methods in portable bench types machines, and glass cutting and blowing methods.
**AS 436 Remote Sensing and Geographic Information Systems Laboratory (2 Credits)**  
*Course objective:* To provide a basic knowledge and training in Geographic Information Systems (GIS) and Remote Sensing (RS). Students will gain a fundamental understanding and competence in developing systems and tools for acquisition, processing, transformation, analysis, storage, presentation and use of geospatial information. In addition, they will learn how to GIS and RS in industry.

**AS 437 Industrial Applications (Chemistry/Physics) Laboratory (2 credits)**  
(Prerequisite: Physics/Chemistry)  
*Course Objectives:* To provide hands-on experience on general chemical instrumentation, particularly analytical instruments and their use in chemical analysis.

**AS 438 Industrial Applications (Electronics/Hardware) Laboratory (2 credits)**  
(Prerequisite: Physics/Computer Science)  
*Course Objectives:* To provide hands-on experience on electronics and repair of instruments including the use of instruments for trouble-shooting.

**AS 439 Industrial Utilization of Local Raw Materials (2 credits)**  
*Course Objectives:* To survey applications of local raw materials in chemical industry and enhance the opportunities available for new industries.

**AS 440 Materials Science Related to Industry (2 credits)**  
*Course Objectives:* To provide the skills of selecting appropriate materials for different applications.

**AS 441 Semiconductor Related to Industry (2 credits)**  
*Course Objectives:* To provide essential knowledge of electronics to be able to contribute to industry.

**AS 442 Radiation Protection and Monitoring (2 credits)**  
*Course Objectives:* To learn radiation protection and monitoring techniques so as to be able to work in radiology departments in hospitals and industries which use radiation for sterilization of their products.

**AS 443 Environmental Degradation and Bioresources (2 credits)**  
*Course Objectives:* Impart knowledge and develop awareness on the environmental degradation due to man’s activities, and the effect of environmental degradation on bioresources, limited nature of bio-resources, and importance of sustainable development.
COMPUTATION AND MANAGEMENT SUBJECT AREA

Year One

**All students:** EN 100 - Basic English (2 credits)
**GCE (A/L) Arts, Biological Science & Commerce students:** MT 120 - Foundation Course in Mathematics (2 credits)
**GCE (A/L) Physical Science students:** FND 104 - Society, Culture and Environment (2 credits)

<table>
<thead>
<tr>
<th>Semester I</th>
<th>Semester II</th>
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<tbody>
<tr>
<td>CS 101 Introduction to Computer Science (3 credits)</td>
<td>CS 102 Programming Techniques (3 credits)</td>
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<td>ECN 101 Introductory Microeconomics I (3 credits)</td>
<td>ECN 102 Introductory Macroeconomics II (3 credits)</td>
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<td>MGT 101 Principles of Management (3 credits)</td>
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<td>CS 103 Programming Laboratory (2 credits – 1 credit per semester)</td>
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<th>Arts and Biological Science Stream:</th>
<th>Commerce Stream:</th>
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<tbody>
<tr>
<td>MGT 103 Introduction to Business Accounting (3 credits)</td>
<td>MT 121 Mathematics for Arts/Commerce I (3 credits);</td>
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<tr>
<td>MT 121 Mathematics for Arts/Commerce I (3 credits) and</td>
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<td>PSC 101 Introduction to State &amp; Government (3 credits) or</td>
<td>SE 101 Science and Society (3 credits)</td>
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<th>Physical Science Stream:</th>
<th>Arts, Biological Science and Commerce Stream:</th>
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<tr>
<td>MGT 103 Introduction to Business Accounting (3 credits) and</td>
<td>MT 122 Mathematics for Arts/Commerce students II (3 credits)</td>
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<td>PSC 101 Introduction to State &amp; Government (3 credits) or</td>
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<td>Physical Science Stream:</td>
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<td>FNA102 Introduction to Art History and Aesthetics (3 credits)</td>
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Year Two

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<tr>
<th>Semester I</th>
<th>Semester II</th>
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<tr>
<td>CS 201 Data structures (2 credits)</td>
<td>CS 203 Database Management Systems (2 credits)</td>
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<tr>
<td>CS 202 Data Structures Practical (1 credits)</td>
<td>CS 204 Programming using DMS Packages (1 credit)</td>
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<tr>
<td>ECN 201 Intermediate Microeconomics I (3 credits)</td>
<td>ECN 205 Intermediate Macroeconomics II (3 credits)</td>
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<td>MGT 206 Human Resource Management (3 credits)</td>
<td>MGT 207 Operations Management (3 credits)</td>
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<td>MGT 211 Business Accounting for Decision Making (3 credits)</td>
<td>MGT 208 Business Statistics (3 credits)</td>
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<tr>
<td>MT 221 Mathematics for Management Studies I (3 credits)</td>
<td>MGT 209 Project Management (3 credits)</td>
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Year Three

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<tr>
<th>Semester I</th>
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<tr>
<td>CS 301 Software Design and Development (3 credits)</td>
<td>CS 305 Computer Networks (2 credits)</td>
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<tr>
<td>CS 302 Design and Analysis of Algorithms (1 credit)</td>
<td>CS 309 Object Oriented Analysis and Design (3 credits)</td>
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<tr>
<td>CS 303 Operating Systems Concept (3 credits)</td>
<td>ECN 304 Econometrics I (3 credits)</td>
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<td>MGT 301 Marketing (3 credits)</td>
<td>MGT 304 Entrepreneurship (3 credits)</td>
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<td>MGT 305 Cost and Management Accounting (3 credits)</td>
<td>MGT 307 Business Law (3 credits)</td>
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<td>MT 321 Mathematics for Management Studies II (3 credits)</td>
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Year Four

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<th>Semester I</th>
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<tr>
<td>MGT 424 Strategic Management (3 credits)</td>
<td>MGT 421 Project involving Internship (6 credits)</td>
</tr>
<tr>
<td>MGT 438 Management Information Systems (3 credits)</td>
<td>MGT 423 Seminar (1 credit)</td>
</tr>
<tr>
<td>3 more credits from CS 4xx and 2 from MGT 4xx</td>
<td>9 credits chosen from CS4xx or MGT 4xx of which at least 3 must be from CS4xx and 3 from MGT4xx</td>
</tr>
</tbody>
</table>

111
100 LEVEL COURSES

SE 101 Science and Society (3 credits)
The Scientific Method; Induction and Deduction; Scientific Revolutions: Ancient and Modern Science; Science of Non-Western Societies; Colonial Science; Science and Ethics; Values in Scientific Research and Results; Indigenous Knowledge systems; Technology and Science; Science and Technology in Development; Important Discoveries of Modern Science and their Development; Institutionalization of Science and Technology; Modern Scientific Research and its Funding; Role of Multinationals; Science and Warfare; Scientists and Social Responsibility; Risk and Uncertainty in Science; Science and the Media; Food and Population; Energy; Environment; Oceans; Outer Space; Technology and Trade; Science and Developing Countries

Recommended Text:

MGT 101 Principles of Management (3 credits)
This is an introductory course in Management. It covers various definitions of Management as well as the evolution and social responsibility of Management. The main components of the course are the functions of Management: Planning, Organizing, Staffing, Leading and Controlling. The course will introduce and discuss case studies in business in order to provide students with a sound knowledge of Real World Management.

MGT 103 Introduction to Business Accounting (3 credits)
This course provides the basic knowledge in financial accounting, which ensures that the students are able to understand the issues in financial accounting relating to business entities.
The course includes: objectives, use & users, underlying assumptions, qualitative characteristics and the elements of financial statements; the understanding of the recording of transactions; the adjusting entries; the preparation of financial statements of Sole Proprietorships and Partnerships and the underlying systems, procedures & controls in preparation of such statements.

Recommended Text:
4. Relevant Journals and Books published by CIMA

PSC 101 Introduction to State and Government (3 credits)
This course introduces the basic concepts related to the state and government. The course commences by introducing the nature and scope of political science and the main approaches to its study. The course then focuses on the emergence, development, and the nature of the nation state and the key theories related to it. Particular attention is paid to study the position the nation state occupies in the contemporary international system, its relationship with the citizens, and how the process of globalization impacts upon the modern state. Some key political concepts such as sovereignty, separation of power, power and authority, civil society and governance will also be introduced to the students. Finally, the course will provide a basic understanding of public policy, policy formulation, and the process of policy implementation.

FNA 102 Introduction to Art History and Aesthetics (3 credits)
This course entails introductions to the study of art from historical and philosophical perspectives. The historical approach to art will be studied in relation to the critical approach. The significance of art as a source of the history of human society will be examined under the topic history in art. The concept of aesthetics and its basic tenets will be introduced.

MT 120 Foundation Course in Mathematics (2 credits)
Different types of numbers, Variables, Parameters, Computer arithmetic, Linear and Quadratic equations, Functions and graphs, Logarithmic and Exponential functions, Trigonometric functions, Cartesian coordinate system, Coordinate geometry of straight line and circle, Evaluation of limits, Derivatives: Derivatives of standard functions, Algebra of derivatives, Chain rule, Derivatives of functions in parametric forms, Anti-derivatives and Techniques of integration.
First order Difference Equations and Discrete models.
MT 121 Mathematics for Arts/Commerce I (3 credits)
Algebraic inequalities, Basic set theory, Permutations and Combinations, Mathematical Induction, Binomial Theorem, Vectors, Systems of Linear equations, Continuity and Differentiability, Applications of derivative, Curve sketching, Applications of definite integral, Convergence of sequences and Summation of series.

MT 122 Mathematics for Arts/Commerce II (3 credits)
Probability: Tree diagrams, Sample space and events, Axioms of probability and basic laws, Probability in discrete sample space, Conditional probability and multiplicative law, Baye's theorem, Independent events.
Descriptive Statistics: Graphical representation of statistical data, Mean, Median, Mode. Quartiles, Deciles, Inter quartile range, Standard deviation. Shapes of distributions
Linear and non-linear market models, Marginal functions in economics.

CS 100 Computer Applications (2 credits)
Introduction to Computer and operating Systems, Micro Computer Applications: Use of Software Packages- Spread Sheet applications, DBMS applications, Utility programs and Word processing.
Data Protection Techniques: Data security techniques, Computer Viruses and prevention. Data Communication: Email, Internet and Networking of Computers.
Introduction to a Programming Language: Procedures, Functions, File handling, Application of a DB management.
(This course includes both theory and practicals)
Recommended Texts:
1. Computer Science, C.S.French
3. Computer viruses, Robert Slade

CS 101 Introduction to Computer Science (3 credits)
Introduction and overview: Intelligent machines and systems applications, Business, Communications, Educational, Engineering, Environmental, Medical and Scientific applications.
Introduction to computing concepts: Basics of computer programming: data types, declarations, assignments, basic input and out put ASCII files, built-in functions.
Structured programming ideas: selection statements: sequence, iteration (counting loops, while loops, file pointers), conditional (if-then-else statements, case statements), matrix manipulations (addition, subtraction, multiplication, transposition).
Modular programming: functions, procedures with actual and formal parameters, simple sort algorithms, dynamic memory allocation and addressing.
Numerical methods: Linear interpolation, linear regression, pseudo random, roots of functions, solutions of simultaneous linear equations by Gaussian elimination, numerical integration.

Recommended Texts:
1. The Thinking Ape: Evolutionary Origins of Intelligence, R. Byrne.
3. Artificial Intelligence, E.Rich and K. Knight

CS 102 Programming Techniques (3 credits)
Basic concepts, basic components of programming languages, binding, simple algorithms operating on non-structured data, modularity in program construction.
Basics of constructing larger programs: abstraction and instantiation of program components, structured data (lists, stacks, queues, ordered binary trees), storing and accessing data structures, operations on mutable data, working with mutable data, object-based programming, data encapsulation

Recommended Texts:
2. Structured programming concepts, K. Labudde

CS 103 Programming Laboratory I (2 credits)
(Prerequisites: CS 101, CS 102, which shall be taken concurrently (1 cr. per semester))
Language constructs: data declarations, loops, decision structures, input/output, files, subprograms / procedures, numeric and non-numeric data. Design and construction of software: top-down and bottom-up design, decomposition, structuring, design for reuse, documentation, study of examples, writing software as a team, using software from others.
Programming assignments: A variety of progressively more complex assignments.
(Sections are offered in C, C++ and Java)
Recommended texts:
1. Turbo C++, F. Bryan Byron S. G. (1990),
3. JAVA: How to Program, H.M. Deitel and P.J. Ditel

FND 104 Society, Culture and Environment (2 credits)
There are four modules in this course. They are
I. Human Mind
II. World Religions
III. Law and Ethics
IV. Art and Art Appreciations

ECN 101 Introductory Microeconomics (3 credits)
This course is an introduction to microeconomic theory. No prior knowledge of economics is required.
Course topics include: Demand and supply. Theories of consumer behavior and cost. Market failure and Market structure
(perfect competition, monopoly, monopolistic competition and oligopoly). No prerequisites.

ECN 102 Introductory Macroeconomics (3 credits)
The course is an introduction to macroeconomic theory. No prior knowledge of economics is required
Course topics include: National income accounting. Circular flow of income: the Keynesian income/output
determination model: Fiscal policy, Deficit and debt: Money supply and demand: Monetary policy: Unemployment and
inflation: Debates in macroeconomics: and an introduction to international trade and finance No prerequisites.

200 LEVEL COURSES

MGT 206 Human Resource Management (3 Credits)
The course aims at providing students with a complete theoretical and operational approach to Human Resource
Management. The course provides a full length analysis of the importance of HRM, organization and functions of HR
department, HRM and environmental factors, historical development of HRM and current trends, human resource
planning (projection of HR needs, labour market analysis, analyzing demand and supply, job analysis and job design, job
description and employee specification, attraction, selection, recruitment and placement, process of selection, selection
methods), HR development (technological change and employee development, compensation and protection, employee
relations), and other functional areas of HRM.

MGT 207 Operations Management (3 Credits)
This course provides students with a knowledge in manufacturing and service sector operations.
Course topics include: Nature and importance of operations management; Production engineering; Systems approach to
operations management; Input-output relationship; Types of production; Introduction to work study; Production planning
and control (PPC); Product design and development; Planning and control techniques; Critical path analysis and
simulation models; Production control (control of value, quality control and inspection); Total quality management
(TQM); Inventory controls models; Just-in-Time system; Plant location analysis; Plant and process layout; Plant
housekeeping; Occupational health and safety; and Productivity and the 5’s system.

MGT 208 Business Statistics (3 Credits)
This is an introductory course in statistics. It will introduce computer applications to selected topics, and each student
will spend a minimum of ten computer hours.
Course topics include: Introduction to business statistics; Types of data; Presentation of data; Analysis and interpretation
of data; Exploratory data analysis; Theory of probability; Sampling techniques; and Index numbers.

MGT 209 Project Management (3 Credits)
This course is complementary to Operations Management (MGT 207) but there are no prerequisites for it. This course
aims at presenting a framework for evaluating and managing capital expenditure proposals, which have been developed
by financial economists.
The subject area of the course consists of four phases: 1) Planning—feasibility study, elementary investment strategies,
generation and screening of project ideas; 2) Analysis—market and demand analysis, technical analysis, financial
analysis; 3) Selection—project cash flows, time values of money, cost of capital appraisal criteria, social cost benefit
analysis, multiple projects and constraints, quantitative factors, strategic aspects, organization considerations; and 4)
Management—project management, project review and administrative aspects.

MGT 211 Business Accounting for Decision Making (3 credits)
This course enhances students the practical and functional nature of business decisions based on financial accounting. It
provides a solid foundation for studies in both accounting and non-accounting disciplines.
The course includes: Regularity framework within which financial statements are produced with a special reference to
SLASs and the Companies Act, preparation of financial statements of limited liability companies, financial statements analysis and computerized accounting systems covering the practical use of accounts in an information system and the financial control.

Recommended Text:
3. Relevant Journals and Books published by CIMA
4. The Institute of Chartered Accountants of Sri Lanka, Sri Lanka Accounting Standards Act No. 15 of 1995 together with subsequent amendments, Gazette, Democratic Socialist Republic of Sri Lanka
5. The Institute of Chartered Accountants of Sri Lanka web site: icasrilanka.com

MT 221 Mathematics for Management Studies I (3 credits)
Algebra and Advanced Calculus: Matrices, Determinants, Eigenvalues and Eigenvectors, Quadratic forms, Functions of several variables, Partial derivatives, Vector-calculus, Multi-variable Optimization.
Statistical Quality Control: SQC tools, Shewhart charts (Attributes and variables), Regression analysis.
Network Analysis: Graph theory, Minimum cost problem, Maximum flow problem, Critical path analysis.
Queuing Theory: Characteristics of queues, Simple queues, Queuing costs, Multiple-server queues.

CS 201 Data Structures (2 credits)
(Prerequisites: CS 101, CS 102, CS 103)
Introduction: 1. Arrays, records, pointers, indices, 2. Recursion 3. Objectives: (I) Timing comparisons, (ii) Memory comparisons, Implementation: array/linked; ordered/unordered, Searching: introduction to set abstract data type, Stacks and queues, Trees; Pointer implementation, traversal, Binary search; Definition, Searching, Creation and insertion, Good and bad trees, Deletion, B-trees, Hashing: initial hash, collisions, separate chaining, Graphs; Implementation of depth first search, breadth first search, topological numbering, connected, Sorting; Insertion sort, Quick sort, Heap as priority queue; Heap sort

Recommended Text:
1. Standish T. A.; Data Structures in Java; Addison-Wesley; 1998
2. Deitel, H. M.; Deitel, P. J.; Java how to Program; Prentice Hall; 1999

CS 202 Data Structures Practicals (1 credits)
(Prerequisite: CS 201)
Implementation of data structures studied in CS 201 using C, C++ and Java.

Recommended Text:
1. Standish T. A.; Data Structures in Java; Addison-Wesley; 1998
2. Deitel, H. M.; Deitel, P. J.; Java how to Program; Prentice Hall; 1999

CS 203 Database Management Systems (2 credits)
(Prerequisites: CS 101, CS 102)
Introduction, The entity-relationship model, Logical organization of databases; The relational model, Relational algebra, SQL, Physical organization of databases; Characteristics of disks and disk blocks, Storage of relations, Query processing and optimization, Concurrency control, Transactions, Serializability, Locking, Recovery, Distributed databases, Functional dependencies and normal forms.

Recommended Text:
1. Date, C. J.; An Introduction to Database Systems; Addison-Wesley; 2000

CS 204 Programming using Database Management Packages (1 credits)
(Prerequisites: CS 103, CS 202, CS 203)
Computer programming using database management packages such as Informix, Sybase, Oracle and FoxPro on PCs and workstations. Programming assignments: A variety of progressively more complex assignments.

Recommended Text:

ECN 201 Intermediate Microeconomics (3 credits)
This is an intermediate-level course in Microeconomic Theory. The basic approach will be partial equilibrium analysis. It is expected that during the course students would gain an understanding of the behaviour of individual economic agents such as consumers, producers and firms.
Course content: Theory of consumer behaviour; The cardinal utility theory. The indifference curves theory: The revealed preference hypothesis: applications of consumer theory: Theory of production and cost: Concept of production function:

ECN 205 Intermediate Macroeconomics II (3 credits)
The main objective of this course is to offer a broad outline of the development of economic thought from the sixteenth century to the present. It relates the history of social and economic thought and the paradigm shifts and the coexistence in economics of intellectual trends of the different periods. Student who follow this course are expected to detect the genesis and development of the different categories they learn in economic theory so that they will be able to trace the evolution of different policy strands. The course will emphasize the simultaneous presence of diverse theoretical positions on which empirical analyses and policy formulations are based. It will also examine the different epistemological approaches to social and economic theory.

Course content: Classical political economy; Economic thought before Adam Smith; Adam Smith’s Wealth of Nations; Robert Malthus; David Ricardo; Post-Ricardian economics; J.B. Say; J.R. McCulloch; The currency vs banking school; Nassau Senior; Sismondi; Contradiction in the system; John Stuart Mill Contradictions of modernity; Karl Marx and Max Weber; Post-Marxian economics; Neo-classicism and its critique; Marginalism; Jevons, Walras, and Menger; The Austrian school; Marshallian partial equilibrium analysis; Crisis of neo-classical theory and a paradigm shift; the political economy of development; Development economics; Modernization theory; Big push theories; Dependency theory; Neo-Marxian theories of development; Development economics—an opposite view: Bauer, Little and Deepak Lal.

300 LEVEL COURSES

MGT 301 Marketing (3 Credits)
The objective of this course is to provide students with a broad understanding of the concept of marketing, and a basic knowledge in total marketing. The course integrates key marketing concepts and marketing tools. The course will also consider ways of creating and maintaining a positive total marketing effort in business.

Course topics include: An introduction to marketing; Analysis of marketing opportunities; Planning marketing strategies and making marketing decisions; and Marketing management and the total marketing effort.

MGT 304 Entrepreneurship (3 Credits)
This is an intermediate course in Management specially designed to provide students eligible to take 300 or 400 level courses in Management with theoretical knowledge and academic training in the new entrepreneurship. It is expected that graduating students will find this course useful in formulating new ventures. While there are no prerequisites for this course, students with management, economics, or information technology backgrounds are encouraged to enroll.

Topics taught in the course include: The meaning and importance of the concept of entrepreneurship; Models for new ventures; Commercial opportunities and new ventures; Marketing research for new ventures; Organizing new ventures; Financing new ventures; and Managing growth and finance.

MGT 305 Cost and Management Accounting (3 Credits)
Cost accounting is a tool in Management. It provides management information regarding cost of products, operations, and services. It also provides data for special decisions to be made by management regarding planning and controlling the operations of the enterprise. As a subject, cost accounting is technical in nature, requiring an understanding of its complex concepts, methods, and techniques. Management Accounting is the application of accounting techniques to provide information designed to help all levels of management in planning and controlling the activities of a business enterprise and decision making. The objective of this course is to provide students with a sound knowledge of cost and management accounting theories and their use in problem solving. Course topics include: Cost accounting—basic nature and concepts, elements of cost, costing methods and accounting systems, cost analysis for planning control and decision making; Management accounting-concepts and applications.

MGT 307 Business Law (3 Credits)
This course provides a basic knowledge of the nature, constitution, and legal background of varied forms of business units and contracts such as sole trade ventures, partnerships, and companies.

Course topics include: General principles of the law of contract; Law of agency; Sale of goods; Carriage of goods by sea and air; Partnership; Insurance law; Hire purchasing; Banking; Customer relationships and negotiable instruments; and Company law.

MT 321 Mathematics for Management Studies II (3 credits)
Game theory: Pure strategies, Mixed strategies, Zero-sum games, Dominance, $2 \times n$ game, Graphical solutions, $m \times n$ game, Games with optimal pure strategies, Games with optimal mixed strategies.
Linear Programming: LP in two dimensional space, Graphical solution methods, General LP models, Primal simplex method, Big-M method, Two-phase simplex method, revised simplex method, Applications of duality, Dual simplex method.
Transportation model, Assignment model.

 Quadratic Programming: QP algorithms, Applications of QP.

CS 301 Software Design and Development (3 credits)
(Prerequisite: CS 201)
The software life cycle; Overview of software engineering; classic life cycle model, Project planning; Fundamentals of project and system planning, Requirements analysis Software design fundamentals; Stepwise refinement, bottom-up approach, modularity, Design techniques; Use of data flow vs. data structure vs. object oriented techniques; modularity, Testing: Testing objectives, test case design, white box vs. black box testing, overview of testing strategies, Maintenance; Overview of maintenance issues and software configuration management.

Recommended Text:

CS 302 Design and Analysis of Algorithms (1 credits)
(Prerequisites: CS 202, CS 301)

Recommended Text:

CS 303 Operating Systems Concepts (3 credits)
(Prerequisite: CS 203)
Introduction, Distributed OS Techniques; Naming, Inter-process communications and remote procedure calls Data and process migration, transactions, file systems, Parallel OS Techniques; Process management, scheduling, synchronization, Data management, caching, coherency, consistency, file systems, Load balancing, Advanced OS Concerns; Memory management, virtual memory, garbage collection, Fault-tolerance, reliability, replication, Protection, authentication, security, cryptography, I/O models, Performance, benchmarking, and monitoring, Client - Server Model.

Recommended Text:
1. Tanenbaum, A.S.; Modern Operating Systems ; Prentice Hall; 1992

CS 305 Communication Networks (2 credits)
(Prerequisite: CS 303)
Overview; Examples and concepts of layered architecture; overview of higher layer protocols. LAN - Network Topologies, Medium Access Control Methods, LAN Standards, WAN - Introduction to ISO/OSI Model, Introduction to Internet & TCP/IP Protocols, Transport layer; Internet addressing and Internet protocols; socket interface, Network layer, Taxonomies; relevant parameters of network and traffic, Multiple-access methods for broadcast networks, Taxonomies of multiple access methods; contention, methods; polling methods; reservation methods, Switched networks Architectures of switches; scheduling and admission control; routing, flow control, and congestion control, Interconnections of networks Logical data link protocols.

Recommended Text:
1. Tanenbaum, A.S.; Computer Networks; Prentice Hall; 1996

CS 309 Object Oriented Analysis and Design (3 credits)
(Prerequisite: CS 307)
Fundamental of Object-oriented design: Encapsulation, classes and objects, information hiding, operator overloading, inheritance, overriding, delegation; Analyze problems, determine objects that are necessary to model the system, determine what attributes the objects need to have, determine what behaviors the objects need to exhibit, develop conceptual models, generate designs from the models, and implement the models.

Recommended text:
ECN 304 Econometrics I (3 credits)
This course is designed as an introduction to the econometric method and to econometric estimation. Its objectives are, first, to impart a sound theoretical background of the classical linear regression model (CLRM) and second, to enable students to estimate and interpret such models.
The course will begin with a discussion of what constitutes “econometrics”. It will then move on to the concept of a “regression”. And discuss the estimation and interpretation of simple linear regression models. Students will be introduced to the assumptions of the CLRM and to properties of OLS estimators. Initial coverage of Interval Estimation. Testing of Hypotheses, $R^2$, and Prediction Error will be within the context of the simple linear regression model. These topics will then be studied with respect to the multiple linear regression model, which will also be extended to cover Dummy Variables. The course will conclude with (a) a preview of some violations of assumptions of the CLRM, i.e., Multicollinearity, Heteroscedasticity and Autocorrelation. and (b) a brief discussion of Specification Error.

400 LEVEL COURSES

MGT 421 Project involving internship (6 credits)
MGT 423 Seminar (1 credit)
MGT 424 Strategic Management (3 credits)
MGT 438 Management Information Systems (3 credits)
The aim of this course is to provide knowledge in building and maintaining an information system essential for making strategic decisions in a dynamic business environment through a learning organization/
The course consists of: Organizational, ethical, technical fundamentals of information systems; Building information and organizational support systems; Organizational Information System; Geographical Information System for business; Database management.

# STATISTICS & OPERATIONS RESEARCH SUBJECT AREA

## Year One

<table>
<thead>
<tr>
<th>Semester I</th>
<th>Semester II</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 101 Introduction to Statistics (3 credits)*</td>
<td>ST 102 Introduction to Probability Theory (3 credits)*</td>
</tr>
<tr>
<td>ST 103 Statistics Applications I (1 credit)#*</td>
<td>ST 104 Statistics Applications II (1 credit)#*</td>
</tr>
<tr>
<td>CS 101 Introduction to Computer Science (3 credits)*</td>
<td>CS 102 Programming Techniques (3 credits)*</td>
</tr>
<tr>
<td>CS 103 Programming Laboratory I (1 credit)</td>
<td>CS 103 Programming Laboratory I (1 credit)</td>
</tr>
<tr>
<td>MT 107 Mathematics for Operations Research (3 credits)*</td>
<td>MT 105 Real Analysis I (3 credits)*</td>
</tr>
<tr>
<td>MT 108 Operations Research I (2 credits)*</td>
<td>MT 109 Linear Programming (3 credits)#*</td>
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## Year Two

<table>
<thead>
<tr>
<th>Semester I</th>
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</tr>
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<tbody>
<tr>
<td>ST 201 Probability Theory (3 credits)*</td>
<td>ST 203 Theory of Statistics (3 credits)#*</td>
</tr>
<tr>
<td>ST 205 Statistical Simulation (2 credits)#*</td>
<td>ST 204 Sampling Techniques (2 credits)#*</td>
</tr>
<tr>
<td>CS 207 Statistical Information Processing (3 credits)*</td>
<td>ST 206 Introduction to Data Mining (2 credits)#</td>
</tr>
<tr>
<td>CS 208 Programming in Statistical Information Processing (1 credit)</td>
<td>CS 208 Programming in Statistical Information Processing (1 credit)</td>
</tr>
<tr>
<td>MT 202 Real Analysis II (3 credits)</td>
<td>MT 211 Integer Programming (3 credits)#</td>
</tr>
<tr>
<td>MT 204 Mathematical Methods (3 credits)</td>
<td>MT 212 Operations Research II (2 credits)*</td>
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<tr>
<td>MT 209 Graph Theory (2 credits)</td>
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<tr>
<td>MT 210 Advanced Linear Programming (3 credits)#*</td>
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## Year Three

<table>
<thead>
<tr>
<th>Semester I</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ST 301 Regression Analysis (3 credits)#*</td>
<td>ST 303 Design and Analysis of Experiments (3 credits)#*</td>
</tr>
<tr>
<td>ST 302 Statistical Quality Control (2 credits)#*</td>
<td>ST 304 Non Parametrics &amp; Categorical Data Analysis (2 credits)#*</td>
</tr>
<tr>
<td>ST 305 Multivariate Methods I (2 credits)#*</td>
<td>ST 307 Time Series Analysis (2 credits)#</td>
</tr>
<tr>
<td>ST 308 Bayesian Statistics I (2 credits)</td>
<td>ST 325/MT 325 Seminar (1 credit)#</td>
</tr>
<tr>
<td>ST 306 Data Analysis &amp; Preparation of Reports (1 credit)#*</td>
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<tr>
<td>CS 302 Design and Analysis of Algorithms (1 credit)#</td>
<td>MT 304 Partial Differential Equations (2 credits)</td>
</tr>
<tr>
<td>MT 313 Convex Analysis (2 credits)</td>
<td>MT 315 Operations Research III (2 credits)*</td>
</tr>
<tr>
<td>MT 314 Network Optimization Theory (3 credits)*</td>
<td>MT 316 Non-Linear Programming (3 credits)*</td>
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## Year Four

<table>
<thead>
<tr>
<th>Semester I</th>
<th>Semester II</th>
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<tbody>
<tr>
<td>ST 401 Actuarial Statistics (2 credits)</td>
<td>ST 404 Stochastic Processes (2 credits)</td>
</tr>
<tr>
<td>ST 402 Statistical Data Mining (3 credits)#*</td>
<td>ST 405 Multivariate Methods II (2 credits)#*</td>
</tr>
<tr>
<td>ST 403 Statistics for Bioinformatics (2 credits)</td>
<td>ST 406 Bayesian Statistics II (2 credits)</td>
</tr>
<tr>
<td>CS 403 Artificial Neural Networks (3 credits)</td>
<td>CS 405 Fuzzy Logic and Modeling (3 credits)#</td>
</tr>
<tr>
<td>MT 411 Optimization Modeling (2 credits)*</td>
<td>MT 412 Financial Mathematics (3 credits)*</td>
</tr>
<tr>
<td>MT 409 Selected Topics in Applied Operations Research (2 credits)</td>
<td>MT 410 Optimization for Engineering Design *(3 credits)</td>
</tr>
<tr>
<td>ST 425/MT 425 Project work/Industrial training (3 credits)#*</td>
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</tr>
</tbody>
</table>

* : Compulsory courses  # : Courses including practical

The following existing courses cannot be offered by the students who follow this degree programme.
MT 101, MT 103, MT 311, MT 407, CS 201, CS 203

The following course units maybe of interest to the students:
100 LEVEL COURSES

ST 101 Introduction to Statistics (3 credits)
Basic ideas in Statistics : Representation of data, Histogram, Frequency polygon, Ogive.
Measures of Location : Various Means (AM, GM, HM, TM), Median, Mode, Quantiles, Deciles, Percentiles. Measures of Dispersion : Range, Interquartile range, Variance, Standard deviation, Chebyshev’s rule for sample, Shepperd’s correction for variance, Coefficient of variance, Moments of higher order, Skewness, Kurtosis.
Representation of data using Stem-Leaf diagrams and Box plots.
Regression and Correlation: Scatter diagrams, Linear Regression, Method of least squares, Correlation, Coefficient of correlation, Rank correlation, Spearman's rank correlation coefficient.
Index numbers: Introduction, Price Relatives, Quantity Relatives and Value Relatives. Link and Chain Relatives, Cost of living Index Numbers, Methods of construction of Index Numbers, Quantity Index Numbers, Tests for Index numbers.

Recommended texts
2. A Basic Course in Statistics, G.M.Clarke, and D.Cooke

ST 102 Introduction to Probability Theory (3 credits)
Counting Techniques: Combinations, Permutations, Set partitions,
Elements of Probability: Experiments, Events, Sample space, Laws of Probability, Bayes’ Theorem, Independence of events. Random variables: Discrete and continuous r.v.’s, Probability mass function, Probability density function, Cumulative distribution function, Functions of a random variable, Expectation, Moments, Mean and variance, Moment Generating function.
Probability inequalities: Chebyshev's and Markov's etc.
Approximation to Binomial using Poisson, Binomial using Normal, and Poisson using Normal.

Recommended Texts
2. Basic Course in Statistics, G.M.Clarke and D. Cooke

ST 103 Statistics Applications I (1 credit)
(Prerequisite: ST 101 or any other Basic Statistics course)

Recommended Text
1. MINITAB Reference manual

ST 104 Statistics Applications II (1 credit)
(Prerequisite: ST 101 or any other Basic Statistics course)
Introduction to the SAS Display manager system, Structure of a SAS program, Editing, rearranging, displaying and summarizing data using PROC PRINT, PROC SORT, PROC FREQ, PROC MEANS, PROC UNIVARIATE, PROC FORMAT, PROC CORR PROC TABULATE, PROC STANDARD, PROC RANK etc. Creating Graphics using PROC PLOT, PROC CHART etc.
SAS Expressions, SAS Functions, Some SAS statements (ARRAY, DELETE, DO, DROP, FORMAT, GO TO, IF, INFILE, INFORMAT, INPUT, KEEP, LABEL MERGE, OUTPUT, PUT, SET, ID, VAR, TITLE, LIBNAME etc.) Applications.

Recommended texts:
1. SAS Reference manual

CS 101 Introduction to Computer Science (3 credits)
Introduction and overview : Intelligent machines and systems applications, Business, Communications, Educational, Engineering, Environmental, Medical and Scientific applications.
Introduction to computing concepts : Basics of computer programming : data types, declarations, assignments, basic input and output ASCII files, built-in functions.
Structured programming ideas : selection statements: sequence, iteration (counting loops, while loops, file pointers), conditional (if-then-else statements ,case statements ) ,matrix manipulations (addition, subtraction, multiplication, transposition ).
Modular programming: functions, procedures with actual and formal parameters, simple sort algorithms, dynamic memory allocation and addressing.
Numerical methods: Linear interpolation, linear regression, pseudo random , roots of functions, solutions of simultaneous linear equations by Gaussian elimination, numerical integration.

Recommended Texts
1. The Thinking Ape: Evolutionary Origins of Intelligence, R. Byrne.
3. Artificial Intelligence, E.Rich and K. Knight

CS 102 Programming Techniques (3 credits)
Basic concepts, basic components of programming languages, binding, simple algorithms operating on non-structured data, modularity in program construction.
Basics of constructing larger programs :abstraction and instantiation of program components, structured data (lists, stacks, queues, ordered binary trees ), storing and accessing data structures, operations on mutable data, working with mutable data, object-based programming, data encapsulation

Recommended Texts:
2. Structured programming concepts, K. Labudde

CS 103 Programming Laboratory I (2 credits)
(Prerequisites: CS 101, CS 102, which shall be taken concurrently (1 cr. per semester))
Language constructs: data declarations, loops, decision structures, input/output, files, subprograms / procedures, numeric and non-numeric data. Design and construction of software: top-down and bottom-up design, decomposition, structuring, design for reuse, documentation, study of examples, writing software as a team, using software from others.

Programming assignments: A variety of progressively more complex assignments.
(Sections are offered in C,C++, and Java )

Recommended texts:
1. Turbo C++, F. Bryan Byron S. G. (1990),
3. JAVA: How to Program, H.M. Deitel and P.J. Ditel

MT 105 Real Analysis I (3 credits)
Real number system as a complete ordered field, Complex number system, Topology of the real line, Neighborhoods, Sequences and limits, Limit theorems, Monotonic Sequences, Limit Concept of a Real-Valued Function, Algebra of limits, Continuity, Monotonic functions, Differentiability, Role’s Theorem, Mean-Value Theorems, L’Hospital’s Rule, Riemann Integral and the basic properties. Fundamental theorem of Calculus, Improper integrals.

Recommended text:
1. Elementary Real Analysis, H.G. Eggleston
2. Analysis, S.R. Lay

MT 107 Mathematics for Operations Research (3 credits)
Vector methods: Introduction to vectors, Linear combinations, Linear dependence and independence, Bases and dimension, Scalar product, Vector product
Differential equations: First order ordinary differential equations, Exact equations, Higher order linear ordinary differential equations with constant coefficients

Recommended Texts:
1. Elementary Vector Analysis, C.E. Weatherburn,(1982)

MT 108 Operations Research I (2 credits)

Recommended Text:
MT 109 Linear Programming (3 credits)  
(Prerequisites: MT 107, MT 108)  
Introduction, Convex sets and functions, The Simplex method, Big-M method, Revised simplex method, Dual simplex  
method, Sensitivity analysis, Introduction to LINGO.  
Some practical assignments will be given for this course.  

Recommended Text:  
1. Linear and Nonlinear Programming, David G. Luenberger,(1997)  

200 LEVEL COURSE  

ST 201 Probability Theory (3 credits)  
(Prerequisite: ST 102)  
Joint distribution of two (or more) discrete or continuous random variables, Marginal distribution, Conditional distribution,  
Independence of random variables, Expectation, Conditional expectation, Covariance, Correlation coefficient,  
Transformations involving two or more random variables, Probability density functions of (a) sum and difference, (b) product  
and quotient of two random variables, Random samples, Empirical distributions, Order statistics, Distributions of MIN \( X_i \), MAX \( X_i \), etc., Distributions of sample mean and sample variance; t, F and \( \chi^2 \) distributions and their properties, Laws of large numbers, Central limit theorem.  

Recommended texts  

ST 203 Theory of Statistics (3 credits)  
Some practical assignments will be given for this course. (Prequisite: ST 201)  

Estimation: Point estimation: Properties of estimators; Unbiasedness, Consistency, Relative efficiency, Efficiency,  
Sufficiency, Factorization theorem, Rao-Blackwell theorem, UMVUE, Exponential families, Cramer-Rao inequality,  
Methods of obtaining estimators; Method of moments, Maximum likelihood estimators etc.  
Interval estimation: Constructing confidence intervals for population parameters under various assumptions, Tolerance limits.  

Testing Hypothesis: Tests on population parameters, Tests on independent and paired samples, Neyman-Pearson lemma,  
Uniformly Most Powerful tests, Likelihood Ratio tests.  

Recommended texts  

ST 204 Sampling Techniques (2 credits)  
Some practical assignments will be given for this course. (Prequisite: ST 203)  
Principal steps in a Sampling Survey, Probability sampling, Simple random sampling, Sampling proportions and  
percentages, The estimation of sample size, Stratified random sampling, Methods of allocations, Ratio estimators,  
Regression estimators, Introduction to Cluster sampling and Systematic sampling, Estimating the population size.  

Recommended texts  

ST 205 Statistical Simulation (2 credits)  
(Prerequisites: CS 102, CS 103, ST 203)  
Introduction and overview of simulation analysis, Modeling and estimating input processes, Random-number generation,  
Generation of random variates, vectors, and processes, Statistical analysis of simulation output, Comparison, ranking,  
and selection of simulation models, Variance-reduction techniques, Designing simulation experiments, gradient estimation,  
and optimization, Monte Carlo simulation  
Some practical assignments will be given for this course  

Recommended Texts:  

122
ST 206 Introduction to Data Mining (2 credits)
(Prerequisites: CS 101, ST 101)
Data Mining Techniques, A statistical perspective on Data Mining, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms. Classification – Statistical Based Algorithms, Distance-Based Algorithms, Decision Tree Based Algorithms
Some practical assignments will be given for this course

Recommended Texts:

CS 207 Statistical Information Processing (3 credits)
(Prerequisites: CS 101, CS 102)
This course cannot be offered by students who offer CS 201 and CS 203.
Data Structures: arrays, structures, linked list, stacks, queues and trees: binary search threes, splay trees, 2-3-4 trees. Analysis of algorithms, sorting algorithms: bubble sort, selection sort, insertion sort, quick sort, heap sort, merge sort and external sorting methods.

Recommended Texts:
2. An Introduction to Database Systems; Date C.J. Addison Wesley(2000)

CS 208 Programming in Statistical Information Processing (2 Credits: 1 Credit per semester)
(Prerequisite: CS 207)
Computer programming using database management packages, Programming Assignments: A variety of progressively more complex assignments.

Recommended Texts:

MT 202 Real Analysis II (3 credits)
(Prerequisite: MT 105)
Cauchy sequences, Convergence tests, Absolute and conditional convergence, Power series, Integration and differentiation of power series, Taylor series, Uniform continuity, Upper and lower Riemann integrals, Characterization of Riemann integrable functions, Functions of several variables, Limits and continuity, Partial derivatives, Differentials, Chain rule, Extrema of functions of several variables, Lagrange Multipliers.

Recommended Texts:
2. T. M. Apostol (1974), Mathematical Analysis, Addison-Wesley

MT 204 Mathematical Methods (3 credits)
(Prerequisite: MT 101)
Differentiation of Vectors: Scalar and vector point functions and their partial derivatives with respect to coordinate variables, Gradient of a scalar point function; Directional derivative, Divergence and curl of a vector point function. Integration of Vectors: Line integrals and their evaluation using parametric representation, Surface integrals, Green’s theorem in the plane Stokes theorem, Circulation and flux of a vector point function, Volume integrals, Divergence theorem, Irrotational and Solenoidal vector fields, Orthogonal Curvilinear Coordinates, Grad, Div, Curl in OCC, Cylindrical polar and spherical coordinate systems, Use of these coordinate systems in evaluation of surface and volume integrals. Special Solution of Laplaces Equation: Solutions in two-dimensions, Axi-symmetric solutions. Integral Transforms:
Recommended Texts:
2. M.D. Raisinghania (1997), Vector Analysis, S. Chand & Comp. Ltd.

MT 209 Graph Theory (2 credits)
Isomorphism of Graphs, Paths, Circuits, Eulerian graphs, Hamiltonian graphs, Shortest path problem, Chinese postman problem, Directed graphs, Graph Colouring, Four colour problem, Proof of five colour theorem, Planar graphs, Trees and Searching: Properties of trees, Travelling salesman problem, Tree Analysis of sorting algorithms, Hall’s Theorem, Transversal theory, Applications to game theory.

Recommended Texts:
1. F. Harary (1988), Graph Theory, Narosa Publishing House
2. R. J. Wilson (1996), Introduction to Graph Theory, Addison-Wesley Longman

MT 210 Advanced Linear Programming (3 credits)
(Prerequisite: MT 109)
Transportation problem, Assignment problem, Goal programming, Dantzig-Wolfe Decomposition algorithm, Interior point algorithms, Bounded variable Simplex algorithm.
Some practical assignments will be given for this course.

Recommended Text:

MT 211 Integer Programming (3 credits)
(Prerequisite: MT 210)
Introduction to Integer Programming, Modeling and applications, Dual of Primal Cutting Plane algorithms, Branch and Bound Enumerations, Search Enumerations, Partitioning in Mixed Integer Programming, Group Theory in Integer programming.
Some practical assignments will be given for this course.

Recommended Text:
1. Integer programming, Applications and Computations, Hamdy A. Taha, (1998)

MT 212 Operations Research II (2 credits)
(Prerequisite: MT 109)
Theory of games, Queuing theory, Inventory management.

Recommended Text:

300 LEVEL COURSE

ST 301 Regression Analysis (3 credits)
Some practical assignments will be given for this course. (Pre requisite: ST 203)
Simple linear regression, Tests for regression coefficients, Interval estimation, Prediction, Analysis of variance approach, Diagnostic and remedial measures, Matrix approach to simple linear regression, Multiple regression, Polynomial regression. Introduction to logistic regression and nonlinear regression, Introduction to Time series Analysis.

Recommended texts

ST 302 Quality Control (2 credits)
Some practical assignments will be given for this course. (Pre requisite: ST 203)
Control charts for mean, variance, range etc, Properties of control charts, Acceptance sampling procedures and consumer risks, Operating characteristic curves, Process capability analysis, Introduction to Quality assurance and acceptance control, Lot-by-Lot acceptance sampling by attributes, Acceptance procedure based on AQL, Other acceptance procedures, Continues acceptance sampling by attributes, Acceptance procedures for variable characteristics.

Recommended texts
ST 303 Design and Analysis of experiments (3 credits)
Some practical assignments will be given for this course. (Prerequisite: ST 203)
Comparison of two samples (independent, dependent), One-way ANOVA: Assumptions, Normal theory, F-tests. Multiple
comparisons: LSD method, Tukey's method, Bonferroni method, Scheffe's method, Duncan's multiple range method.
Two-way ANOVA: Normal theory, Randomized block design, The two factor factorial, Multifactor Factorials,
Confounding, Introduction to Analysis of covariance, Latin square.

Recommended texts

ST 304 Non-parametrics and categorical data Analysis (2 credits)
Some practical assignments will be given for this course. (Prerequisite: ST 203)
Non-Parametrics: One sample sign test, Binomial test, Two sample sign test, Wilcoxon paired samples, Signed rank test,
Wilcoxon and Mann Whitney test, Correlation tests, Tests of independence, Wald-Wolfowitz runs test, Kruskal-Wallis test,
Friedman test.
Categorical Data Analysis: Multinomial distribution, Goodness of fit tests, The Kolmogorov-Smirnov Statistics, Testing

Recommended texts

ST 305 Multivariate Methods I (2 credits)
(Prerequisite: ST 203)
Properties of random vectors and Matrices, The Multivariate Normal distribution, Estimation of parameters in the
Multivariate Normal distribution, Wishart distribution, Inferences on multivariate mean, and Hotelling's $T^2$ tests,
Multivariate Analysis of Variance, Cluster Analysis.
Some practical assignments will be given for this course

Recommended Texts:

ST 306 Data Analysis & Preparation of Reports (1 credit)
(Prerequisites: ST 301, ST 302)
Students will be grouped, and assigned instructors. The skills of data analysis, statistical software development and
report writing will be given. Initially the student groups are given case studies. Gradually the students will be assigned
small projects taken from Industry. At the end of the course students are expected to write reports of their findings.

Recommended Text:
1. SAS Reference Manuals

ST 307 Time series (2 credits)
(Prerequisites: ST 203, ST 301)
Introduction; Objectives of time series analysis, Components of time series, Traditional method of time series analysis;
Estimation of trend, seasonal effect forecasting; Auto-correlation & Auto-covariance functions Correlogram; Probability
models for time series; Stationary processes; Second order stationary processes; Purely random processes; Random
walk; Moving average processes; Auto-regressive processes; Mixed models (ARMA, ARIMA); Estimation of
parameters; Testing adequacy; Forecasting; Exponentially smoothing forecasting procedure; Non Stationary and
Seasonal Time series models (SARIMA); Box-Jenkins forecasting procedure. Introduction to non linear models and
Multivariate time series modelling
Some practical assignments will be given for this course

Recommended Texts:
1. Introduction to Time Series and Forecasting, P.J. Brockwell and R.A. Davis (2000)

ST 308 Bayesian Statistics I (2 credits)
(Prerequisite: ST 203)
Introduction: Statistical and Non-statistical decisions, Profit, Loss, Risk and utility, Expected Value, Bayes' Theorem,
Prior Distribution, Bayesian Inference; Non-statistical Decisions: Maximin, Maximax, Minimax Regret and Hurwicz.
Recommended Texts:

**ST 325/MT 325 Seminar** (1 credit)
(Prerequisites: ST 306, ST 307)
A student is expected to carry out an extensive literature survey on a topic assigned to him/her by a senior staff member.
At the completion of the course the student is expected to write a report of not less than ten pages, and make a presentation.

**CS 302 Design and Analysis of Algorithms** (1 credit)
(Prerequisites: CS 207, CS 208)

Recommended Text:

**MT 304 Partial Differential Equations** (2 credits)
(Prerequisite: MT 103)
*First order partial differential equations*: Linear equations, Non-linear equations, Characteristics.
*Second order partial differential equations*: Equations with constant coefficients, Equations with variable coefficients, Laplace equation, Wave equation, Diffusion equation, Boundary value problems, Use of Fourier series.
Numerical methods of solving partial differential equations.

Recommended Texts:

**MT 313 Convex Analysis** (2 credits)
(Prerequisite: MT 202)
Convex sets, Convex functions, Continuity and Differentiability of convex functions, Minimum and maximum of a Convex function over a Convex set, Lagrange multipliers, Minimax theorems and duality, Saddle-functions

Recommended Text:

**MT 314 Network Optimization Theory** (3 credits)
(Prerequisite: MT 210)

Recommended Text:

**MT 315 Operations Research III** (2 credits)
(Prerequisites: MT 109, MT 314)
Simulation, Network Scheduling, Information Theory.

Recommended Text:

**MT 316 Non-Linear Programming** (3 credits)
(Prerequisite: MT 210)
Quadratic programming, Dynamic programming, Geometric programming, Probabilistic programming, Fractional programming, Gradient Search methods.

Recommended Text:
400 LEVEL COURSES

ST 401  Actuarial Statistics (2 credits)
(Prerequisite: ST 203)
Applications to individual risk models. Failure rates and the force of mortality. Mixtures of random variables and
applications of statistical inference. Compound distribution. Collective risk models. Ruin theory. Lundberg's Inequality,
Introduction to credibility theory. Compound stochastic processes. Applications of risk theory in insurance problems. No
claims discounting. Run off triangles.

Recommended Texts:
2. Life Contingencies ( Chapters 1-6)A. Neill,(1999)
3. Actuarial Mathematics (Chapters 3-8), N.L. Bowers Jr, ... [et al.],(2001)

ST 402  Statistical Data Mining (3 credits)
(Prerequisites: ST 206, ST 305)
Classification –Neural Network Based Algorithms, Rule Based Algorithms, Combining Techniques.
Clustering – Similarity and Distance Measures, Hierarchical Algorithms, Partition Algorithms, Clustering Large Data
Bases, Clustering with Categorical Attributes, Comparison.
Association Rules – Large Item Sets, Basic Algorithms, Parallel and Distributed Algorithms, Comparing Approaches,
Incremental Rules, Advanced Association Rule Techniques, Measuring the Quality of Rules.
Web Mining – Web Content Mining, Web Structure Mining, Web Usage Mining.
Spatial Mining – Spatial Data Overview, Spatial Data Mining Primitives, Generalization and Specialization, Spatial
Rules, Spatial Classification Algorithm, Spatial Clustering Algorithms.
Temporal Mining – Modeling Temporal Events, Time Series, Pattern Detection, Sequences, Temporal Association
Rules.
Some practical assignments will be given for this course

Recommended Texts:
1. Data Mining Introductory and Advanced topics, M.H. Dunham (2003)

ST 403 Statistics for Bioinformatics (2 credits)
(Prerequisites: CS 207, CS 208)
Review of the following in the context of bioinformatics: Basic probability, statistical inference, stochastic processes,
computer intensive approaches to statistical inference, applications. Mathematical models and computational methods of
statistical genetics including mendelian genetic traits, population genetics, pedigree relationships and gene identity,
meiosis and recombination, linkage detection, multipoint linkage analysis. Course work involves some computation in a
Unix environment.

Recommended Texts:

ST 404  Stochastic Processes (2 credits)
(Prerequisites: ST 201, ST 203)
Introduction to Stochastic processes: Markov Chains, Markov Processes with Discrete state space, Markov Processes
with Continuous state space, Stationary processes, Branching Processes, Stochastic processes in Queueing and
Reliability

Recommended Text:

ST 405 Multivariate methods II (2 credits)
(Prerequisite: ST 305)
Discriminant analysis of two group and multiple groups, Principal component analysis (PCA). Interpretation using
illustrative examples. Factor analysis. Comparison with PCA, factor loadings, rotations, Interpretation, Canonical
correlation, Covariance structure models.
Some practical assignments will be given for this course
Recommended Texts:

**ST 406 Bayesian Statistics II (2 credits)**
(Prerequisite: ST 308)
Decision Rules; Making Decisions when data is not available: Specifying a prior distribution, Making decisions with only prior information; Making Decisions when data is available: Decision trees, Expected Value of Perfect Information (EVPI), Expected Value of Sample Information (EVSI), Non-informative and natural conjugate prior, Bayesian confidence intervals.

Recommended Texts:
   1. Statistical Decision Theory and Bayesian Analysis, J.O. Berger (1985)

**ST 425/MT 425 Project Work/Industrial Training (3 credits)**
Students are expected to carry out an independent research project on a topic assigned to him/her under the supervision of a senior staff member or spent 6 weeks in industry working in a relevant project. At the completion of the project students are expected to write a report and make a presentation.

**CS 403 Artificial Neural Networks (3 credits)**
(Prerequisites: CS 207, CS 208, CS 302)

Recommended Text:
   1. Haykin, S.; Neural Networks: A comprehensive foundation; Prentice-Hall; 1999

**CS 405 Fuzzy Logic and Modeling (3 credits)**
(Prerequisites: CS 207, CS 208, CS 302)
Fuzzy system models, Fuzziness and certainty, fuzzy sets, basic properties and characteristics, Domains, Alpha- level sets and support sets, Linear representation, Fuzzy set operators, Conventional (crisp) set operations, basic Zadeh type operations, intersection, union and complement of fuzzy sets, General algebraic operations, Fuzzy set hedges, Fuzzy reasoning, linguistic variables, Fuzzy models, Fuzzy systems and modeling, Design methodologies, modeling and utility software.

Recommended Text:
   1. Nguyen H.T.; Walkey E.A; A first course in Fuzzy Logic; Chapman and Hall; 1996.
   2. Ross T.J.; Fuzzy Logic with Engineering Applications; McGraw Hill ;1995

**MT 409 Selected Topics in Applied Operations Research (2 credits)**
(Prerequisites: MT 315, MT 316)
Topics will be selected from significant areas in Operations Research. Topics may vary each year.

**MT 410 Optimization of Engineering Design (3 credits)**
(Prerequisites: MT 315, MT 316)
Introduction, Single-variable optimization algorithms, Multivariable optimization algorithms, Constrained optimization algorithms, Specialized algorithms, Nontraditional optimization algorithms.

Recommended Text:

**MT 411 Optimization Modeling (2 credits)**
(Prerequisites: MT 315, MT 316)
Optimization models in Linear programming, Nonlinear programming and Integer programming. Students are expected to develop reasonable modeling skills allowing them to cast appropriate real world problems as optimization problems and solve them with available software.

**MT 412 Financial Mathematics (3 credits)**
An introduction to options and markets, Interest and present value analysis, Geometric Brownian Motion, Pricing contract via arbitrage, Arbitrage theorem, Black-Scholes option pricing formula, The binomial option pricing model, More results on options, Valuing by expected utility, Exotic options.

Recommended Texts:
ENGLISH COURSES

EN 100 Basic English (2 credit)
This course will be conducted over two semesters of the same academic year.

Grammar: Parts of speech, Active & passive voice structures and Modals. Sentence Structure
Paragraph Writing: a simple description (object/element), a comparison, a process.
Conditionals - Relating to discussion part of report, Conjunctions, Prepositions of time/place. It/There Structure,
Reported Speech, Perfect tense.
Listening: Listening Skills: Identification, Labelling, Drawing, Taking down specific information in the form of
diagrams, tables, graphs, tree-diagrams and filling in blanks. Prediction and Taking down important points using above
strategies. Language through Popular Songs, Dictation & Punctuation Listening Comprehension, Listening and Note-
taking.
Reading: Surveying a textbook, skimming and scanning, main idea and the details; Description, definition, cause and
effect, steps, comparison, characteristics, reasons, examples etc., Language through Poetry, Speech: Communicative
activities
Consolidation of reading skills, Skimming and scanning, Cohesive devices - Arrangement of a Paragraph, Reading and
Note-taking skills, Reading Comprehension (General Reading, Subject Reading).
Writing: Report Writing, Content vocabulary and structure vocabulary, Paragraph Writing: Main idea, Supporting
details, Organisation of Written discourse, Making Inferences (Logical Inferences)

EN 200 English for Academic purposes (2 credits)
Interactive Teaching (90 hrs.)
(This course will be conducted over two semesters of the same academic year)
Project report writing and oral presentation skills. Interpreting graphs (bar graphs, pie charts, histograms etc.). Academic
writing (Essay and Précis). Letter writing (Bio-Data, official and personal). Grammar pertaining to above areas. Reading
and listening comprehension and speech using TOEFL material at the Language Centre.

Recommended Texts: