UNIVERSITY OF PERADENIYA
FACULTY OF SCIENCE

STUDENT HANDBOOK - 2016/2017

Suplimentary e version
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It is with great pleasure that I, as the Vice-Chancellor, welcome all the new entrants to the Faculty of Science on behalf of the University of Peradeniya. We believe those who gain admission to the University are indeed a privileged group considering the numbers who qualify to enter the Sri Lankan University system. Since you have gained this rare opportunity, it is your prime duty to fulfill your higher educational objectives and become a balanced individual using all the resources available in this university to be a valuable citizen of this country. The University offers an environment conducive for intellectual pursuits of a diverse nature.

Hence, my earnest request to the new entrants is to use the unique and countless opportunities available to them in this university to the maximum, in order to enrich their physical and mental wellbeing in their journey towards reaching the ultimate goal.

I take this occasion to wish all of you a very pleasant and a memorable stay at the university and every success in your future academic activities.

Professor Upul B. Dissanayake
Vice-Chancellor
University of Peradeniya

10 January 2017
MESSAGE FROM THE DEAN

On behalf of the Faculty of Science, University of Peradeniya, I welcome you to the largest and the best science faculty in Sri Lanka which offers an academically sound, technologically advanced and socially conducive learning environment with a wealth of resources to the study of science. People of our country have made a great investment in your education. I request you to make use of this opportunity so that you and our country will benefit from the investment. Your undergraduate programmes leading to the degree of M.Sc. runs for three to four years. They have been designed to teach basic and applied sciences together with comprehensive skill development components. Academic staff members of the faculty are globally, regionally and nationally renowned, highly accomplished scientists with international collaborations. Industrial training component included in most of the four year degree programmes is conducted for about four months at the leading industries in the country. Faculty has some of the best teaching and research laboratories with “state of the art” technology. At the end of the programme you should not only be a science graduate equipped with knowledge and skills but one who possesses necessary attitudes to be a kind, caring and compassionate human being. You should abide by the University rules and the law of the country. Your predecessors by their commitment and hard work have brought fame and pride to this Faculty locally as well as globally. I hope you too would work towards achieving similar or even better standards and keep the Peradeniya University flag flying. Enjoy your stay in the faculty.

Professor Saluka Kodituwakku,
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INTRODUCTION

The Faculty of Science, comprising the Departments of Botany, Chemistry, Mathematics, Physics and Zoology were initially located in Colombo along with other Faculties of the University of Ceylon. It had been decided to have the permanent home of the University in Peradeniya and accordingly, the Faculty of Arts, Oriental Studies, Law, Agriculture, Veterinary and Dental Sciences were established at Peradeniya by the early part of the 1951-60 decade.

The admission of the first batch of students took place in the 1961 –62 academic year. In order to accommodate the increasing demand for science education in the country the Faculty of Science in Colombo was allowed to form a second Faculty in Peradeniya and a part of the staff from the Colombo Faculty moved to Peradeniya Faculty at the early stages, while the latter gradually built up the staff by direct recruitment. Both branches of the Faculty functioned under common administration at each of the levels of department and faculty, with common curricula and examinations. In 1967 those segments of the University of Ceylon which were situated in Colombo which were constituted as a separate and independent University. Thus, the second Faculty of Science at Peradeniya comes into being on its own, as the Faulty of Science, University of Ceylon, Peradeniya.

Presently the Faculty consists of eight academic departments and two units namely, Department of Botany, Chemistry, Geology, Mathematics, Molecular Biology & Biotechnology, physics, Statistics & Computer Science, Zoology and Computer Unit and Science Education Unit. At present, 530 students are admitted annually student enrolment stands at about 1700 undergraduate and 200 postgraduate research students. There are 110 academic and 120 non – Academic members of staff in the Faculty. The Faculty of Science offers course of study leading to General and Honors Bachelor of Science (B.Sc.) Degrees. From the academic year 2001/2002 the courses are offered on a semester based course unit system. This has significantly increased the course combinations available to students allowing far more flexibility of selection of subject areas. With the introduction of the Course Unit System, the medium of instruction for all course of study offered by the Faculty was be confined to English.

The general degree programme has been broad-based and restructured to allow increased flexibility, with options to offer minor subjects outside the main disciplines. The major subjects offered are: Applied Mathematics, Biostatistics, Botany, Chemistry, Computer Science, Geology, Higher Mathematics, Molecular Biology & Biotechnology, Physics, Pure Mathematics and Statistics. The minor subjects are Basic Computing, Basic Electronics, Earth Science, Economics, Environmental Science, Foods Science, Management and Science Education. The Faculty at present offers Honors degree programmes in Botany, Chemistry, Computer Science, Environmental Science, Geology, Mathematics, Molecular Biology & Biotechnology, Physics, Statistics and Zoology.

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.
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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 matters in courses get 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.

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/tutorials or 30 - 45 hours of laboratory work, field classes etc. Course units of one credit, two credits and three credits are available. The contents of a three credit course unit, for example, are 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 E. These are called grades and grade points are assigned as follows:

\[
\begin{align*}
A^+ &= 4.0 \\
A &= 4.0 \\
A^- &= 3.7 \\
B^+ &= 3.3 \\
B &= 3.0 \\
B^- &= 2.7 \\
C^+ &= 2.3 \\
C &= 2.0 \\
C^- &= 1.7 \\
D^+ &= 1.3 \\
D &= 1.0 \\
E &= 0
\end{align*}
\]

(Note: A+ and A have the same grade points.)

Grade Point Average (GPA): The grade point average for each level is the credit weighted mean of grade points obtained by a student for the course units he/she has offered at that level. It is calculated to the second decimal place and is an indicator of the academic performance of the student. The final GPA is computed using these level GPAs’ by giving percentage weights for different levels as described under item 6.

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. At the beginning of the academic year each department will announce 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 the academic counselor and academic advisors who will help them to select appropriate subject combinations. Students are responsible for planning their programmes, but they will be guided by the academic counselor and 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 the relevant 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.

3. TYPES OF COURSE UNITS AND SUBJECTS

Course units are derived from the following categories:

- **I. Foundation Courses**
- **II. Principal Subject Area**
- **III. Supplementary Courses**
- **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 and a course on basic Biology/Mathematics/Law and Ethics. The grade earned in EN 100 will not be counted in the computation of GPA. Students who have entered to different Degree Programmes through different A/L subject streams should follow foundation courses as depicted in the table below:
### Degree Programmes

<table>
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<th>Foundation Courses</th>
<th>General/Special/Applied Sciences Degree Programmes</th>
<th>Statistics and Operations Research Degree Programme (SOR)</th>
<th>Computation and Management Degree Programme (CM)</th>
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<td></td>
<td>Biological Science stream</td>
<td>Physical Science stream</td>
<td>Arts, Commerce or Biology stream at G.C.E (A/L)</td>
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<td></td>
<td></td>
<td></td>
<td>Physical Science stream at G.C.E. (A/L)</td>
</tr>
<tr>
<td>EN 100 Basic English</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>CS 100 Computer Applications</td>
<td>√</td>
<td>√</td>
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</tr>
<tr>
<td>MT 100 Mathematics for Biological Sciences</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BL 100 Basic Life Sciences</td>
<td>√</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>MT 120 Foundation Course in Mathematics</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>FND114 Law and Ethics</td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

### II. Principal Subject Area

#### 100 level courses

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

- Biology*
- Biology**
- Chemistry
- Computer Science
- Geology
- Mathematics
- Physics
- Statistics

#### 200/300/400 level courses

Course units in the following subjects will be available:

- Biology
- Botany
- Chemistry
- Computer Science
- Geology
- Physics
- Mathematics
- Molecular Biology & Biotechnology
- Statistics
- Zoology
III. Supplementary Courses

- MG 201 Management Studies I (2 credits)
- MG 301 Management Studies II (2 credits)
- EC 201 Introductory Economic Theory (3 credits)
- EC 301 Sri Lankan Economy (2 credits)
- SE 201 Foundations in Science Education (2 credits)
- SE 202 Educational Philosophy and Educational Management (2 credits)
- SE 301 Methodology in Teaching Science (2 credits)
- SE 302 Teaching Practice (2 credits)
- SE 303 Assessing Students in the Learning Process (2 credits)

Supplementary courses are not compulsory. A student cannot offer more than 12 credits from the above supplementary courses for a General/Special/Applied Sciences Degree Programme.

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 Sciences Degree Programme.

V. Statistics and Operations Research (SOR) 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 (CM) 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. honors Degree Programmes. 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 Honors Degree Programme. The second option is possible only if he/she fulfills certain criteria as stipulated in the section "Criteria for Selection to a Honors Degree Programme". The duration of a General Degree Programme is three academic years, while that of a Honors Degree Programme is four
academic years. General Degree students, may at the end of 3rd year, be selected, based on performance to follow a B.Sc. Degree Programme in Applied Sciences in place of a General Degree. The Faculty also conducts four-year B.Sc. Honors Degree Programmes in Computation and Management (jointly with the Faculty of Arts) and in Statistics and Operations Research for students admitted through separate windows.

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 a 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, 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 credits.

During the first year, students other than those who have been admitted through a separate window shall be selected for a combination of three subjects from the principal subject area and select the course units coming under these subjects (subject combinations will be offered are listed end of this section). 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 courses. 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.

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 at least 30 credits at the 400 level from the Applied Sciences subject area including a four-month 8-credit course unit in industrial training.

During the third and fourth years of the Honors Degree Programme, the students shall select course units from the subject of specialization at 300 and 400 levels, so that their credits will add up to at least 24 per academic year. The relevant department may specify the remaining course units that should be offered. Further, the Honors Degree students will do a research project, in addition to following course units, which will carry a minimum 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.

Following subject combinations will be offered under Physical and Biological Science streams (There should be a minimum number of 10 student enrollments to offer a combination).
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 for each level is calculated using the formula \( \text{GPA} = \frac{\sum c_i g_i}{\sum c_i} \), where \( c_i \) and \( g_i \) are the number of credits and the grade point for the \( i^{th} \) course unit respectively, offered at that level. Following percentage weights will be given for different levels in the computation of the final GPA:
<table>
<thead>
<tr>
<th>Level</th>
<th>General Degree (%)</th>
<th>Honors Degree/Applied Sciences Degree/SOR/CM (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 level</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>200 level</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>300 level</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>400 level</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

**Other Types of Grades**

**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 affected, except on medical grounds or other valid reasons. These courses will be assigned a grade W.

**Grade I:** A grade “I” should be given for a student who has sufficiently covered the course but not sat for the end semester examination. If a reason acceptable to the Faculty Board of Science is not given, the grade will be computed with the available marks and that grade will be assigned replacing the grade “I”. If an acceptable reason is given for being absent, the student will be allowed to sit for an end semester examination as a proper candidate and a new grade will be assigned replacing “I”. This may be the next available attempt or a make-up examination as decided by the Dean in consultation with the Head/Coordinator on a case-by-case basis.

Student should inform his/her absence to the dean or assistant registrar within 7 days due to illness. Once informed within 7 days, the medical certificates should be submitted within 14 days of the recovery of illness.

**7. EVALUATION PROCEDURE**

The Instructor, 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 continuous assessments (assignments, quizzes and mid-semester examination) and end-semester examination, etc. Mid-semester examination is optional and the method of evaluation of each course will be announced at the beginning of the course. Following weights will be given the calculation of the final mark.

- Continuous assessments (with or without mid-semester examination) : 20 - 40 %
- End semester examination (comprehensive) : 60 - 80 %

To earn credits 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 the course will be graded E.
A student who obtains grades of C-, D+, D or E for a course unit may repeat that course unit by sitting the final examination, in order to improve his/her grade. 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 TO PROCEED TO THE 200 LEVEL OF THE DEGREE PROGRAMME

A student should obtain a minimum GPA of 1.70 at the 100 level to enter the 200 level. The maximum period a student is allowed to stay at 100 level is four years.

10. CRITERIA FOR SELECTION TO THE APPLIED SCIENCES DEGREE PROGRAMME

The Applied Sciences Degree Programme will be offered to a limited 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 among the students admitted to the General Degree Programme. The minimum requirements necessary to apply for selection to the Applied Sciences Degree Programme are as follows:

I. Satisfy requirements 1, 2 and 3 given under the section titled “Requirements to Pass the General Degree” and,
II. GPA of at least 2.50.

Students selected to the Applied Sciences Degree Programme must be prepared to undertake a four-month industrial training in any part of the island at the discretion by the Faculty.

11. REMOVAL/WITHDRAWAL FROM THE APPLIED SCIENCES 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.

12. CRITERIA FOR SELECTION TO A HONORS DEGREE PROGRAMME

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

The minimum requirements necessary to apply for selection to the Honors Degree Programme are:
- At least a GPA of 2.50 from the 100 and 200 level course units that are considered for the degree in the selected subject of specialization.
• 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.
• At least grade \( C \) for each of the foundation courses offered.

Any deviation from the above minimum requirements should be done in consultation with the Dean of the Faculty.

Course units from Biology\(^*\) can be counted as 100 level course units under Botany. Course units from either Biology\(^*\) or Biology\(^**\) can similarly be considered for Zoology. Specified course units from Botany, Molecular Biology & Biotechnology, and Zoology can be counted as 200 level course units for selection to the Special Degree in Biology.

13. REMOVAL/WITHDRAWAL FROM THE HONORS DEGREE PROGRAMME

In the event a student wants to opt out from a Honors 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 Honors 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.

14. REQUIREMENTS 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 requirements:

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

II. At least 90 credits (excluding EN 100) 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. Not more than 12 credits are allowed from the supplementary courses.

In the case of Botany, course units from Biology\(^*\) can be counted as 100 level course units under Botany. Similarly for Zoology, course units from either Biology\(^*\) or Biology\(^**\) can be considered for Zoology.

III. \( E \) grades should not appear within the minimum number of credits required.

IV. Obtain a \( GPA \) of at least 2.00.

Note: (i) Students who fulfill all the above requirements may apply for the award of the Bachelor of Science Degree (General Degree).
A student who has not fulfilled any of the above requirements may repeat the course units in order to fulfill the requirements.

15. AWARD OF CLASSES 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 classes, if he/she fulfills the following additional requirements:

First Class
(i) GPA of 3.70 and over
(ii) At least grade C for all the course units whose credits will add up to at least 84
(iii) Completion of the Degree Programme within three years

Second Class
(Upper Division)
(i) GPA of 3.30 – 3.69
(ii) At least grade C for all the course units whose credits will add up to at least 76
(iii) Completion of the Degree Programme within three years

Second Class
(Lower Division)
(i) GPA of 3.00 - 3.29
(ii) At least grade C for all the course units whose credits will add up to at least 76
(iii) Completion of the Degree Programme within three years

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

16. REQUIREMENTS 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 90 credits (excluding EN 100) from the 100, 200 and 300 levels together with the compulsory courses as specified in Section 14 (Requirements to Pass the General Degree Examination).

III. At least 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 at least 106 (excluding EN 100).

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

VI. E grades should not appear within the minimum number of credits required.
VII. Obtain a GPA of at least 2.00.

**Note:**

(i) Grades obtained 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.

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

(iii). 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.

17. AWARD OF CLASSES 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 classes, if he/she fulfills the following additional requirements:

**First Class**

(i) GPA of 3.70 and over

(ii) At least grade C for all the course units whose credits will add up to at least 114

(iii) Completion of the Degree Programme within four years

**Second Class (Upper Division)**

(i) GPA of 3.30 – 3.69

(ii) At least grade C for all the course units whose credits will add up to at least 106

(iii) Completion of the Degree Programme within four years

**Second Class (Lower Division)**

(i) GPA of 3.00 - 3.29

(ii) At least grade C for all the course units whose credits will add up to at least 106

(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

18. REQUIREMENTS TO PASS THE SPECIAL DEGREE

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

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

II. At least 120 credits (excluding EN 100) with the following minimum credit requirements:

105 credits from the Principal Subject Area with at least 72 credits from the subject of specialization 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 courses.

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

III. Obtain at least grade C for course units whose credits will add up to 106 (excluding EN 100)

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. E grades should not appear within the minimum number of credits required.

VII. Obtain a GPA of at least 2.00.

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

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

19. AWARD OF CLASSES ON COMPLETION OF THE HONORS DEGREE PROGRAMME

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

First Class

(i) GPA of 3.70 and over
(ii) At least A grades for at least 50% of the credits in 300 and 400 levels 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 - 3.69
(ii) At least grade B for at least 50% of the credits in 300 and 400 levels 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

19
Second Class (Lower Division)  
(i) GPA of 3.00 - 3.29  
(ii) At least grade B for at least 50% of the credits in 300 and 400 levels, 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.

20. 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 120 credits (excluding EN 100) 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 106 (excluding EN 100).

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. E grades should not appear within the minimum number of credits required.

VII. Obtain a GPA of at least 2.00.

Note:  
(i) Students who fulfill all the above requirements may apply for the award of the relevant Bachelor of Science Degree.

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

21. AWARD OF CLASSES 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 classes, if he/she fulfills the following additional requirements:

First Class  
(i) GPA of 3.70 and over  
(ii) At least grade C for all the course units whose credits will add up to at least 114
(iii) Completion of the Degree Programme within four years

Second Class (Upper Division)

(i) GPA of 3.30 - 3.69
(ii) At least grade C for all the course units whose credits will add up to at least 106
(iii) Completion of the Degree Programme within four years

Second Class (Lower Division)

(i) GPA of 3.00 - 3.29
(ii) At least grade C for all the course units whose credits will add up to at least 106
(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.

22. COMPLETION OF DEGREE

Students should complete all three year Degree Programmes in six academic years from the date of admission to the Faculty. In the case of students offering a four year Degree, this period will be eight academic years.

Students who have completed all requirements of a Degree should claim for the Degree using the course selection form prepared for each student by the faculty.

23. ENTRIES IN THE TRANSCRIPT

Course units with the corresponding grades and grade points obtained will appear in the transcript. E 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. E grades which have not been upgraded will appear in the transcript. The final GPA and the Class (if any) will also appear in the transcript. Courses of which the grades are not taken for the calculation of the final GPA (except for foundation courses) will not appear in the final academic 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
SCHOLARSHIPS, PRIZES AND MEDALS

Nimal and Savithri Gunatilleke gold Medal for excellence in Biology
This Medal is awarded to the students who shows the greatest performance at all 100, 200, 300 and 400 level Special Degree programme examinations in Biology. A minimum of B+ or its equivalent at the first available attempt has to be earned for these courses and student should pass all the course units at the first available attempt in the relevant examinations conducted by the Faculty of Science. A minimum of a second Class (Upper Division) pass or its equivalent Cumulative or Final GPA should be obtained to be eligible for the award.

Prof. M.D. Dassanayake Gold Medal for Botany
This gold medal is awarded to the student who shows the greatest competence in Botany at the Special Degree Examination in Botany.

Prof. M.D. Dassanayake Prize for Botany
This Prize is awarded to the student who shows the greatest competence in botany at the 200 level

Savitri and Nimal Gunatilleke Scholarship for Excellence in Ecology
This Scholarship is awarded annually to a 400 level students who has recorded the best performance in the subjects of BT 201 – Plant Diversity I, BT 202 – Plant Diversity II, BT 203 – Vegetation Dynamics and Measurements, BT 309 – Biodiversity Conservation and Management, BT 310 – Ecosystems of Sri Lanka, their Ecology and Conservation, and also passed all the courses at the first available attempt to the satisfaction of the Faculty Board of Science.

S.A. Kulasooriya Gold Medal for Excellence in Microbiology
This gold medal is awarded annually to the student who has recorded the best performance at the 100, 200, 300 and 400 level examinations in the area of Microbiology (i.e., BL 107 – Basic Microbiology, BT 201 – Plant Diversity I, BT 302 – Advanced Microbiology and BT 412 – Applied Microbiology).

Sultanbawa Prize in Organic Chemistry
This prize is awarded to the student who shows the greatest competence in Organic Chemistry with a minimum GPA of 3.9 for 300 and 400 level Organic Chemistry course unites (or papers) at the special degree examination in chemistry.

Bhikaji Framji Khan Gold Medal for Chemistry
This medal is awarded to the student who shows the greatest competence in Chemistry at Special Degree Examination in Science.

P.W. Vitanage Memorial Scholarship
This scholarship is awarded to the student who shows the best performance by obtaining the highest GPA for 100 and 200 series courses offered by the Geology Department.

Dr. C.A. Hewawitharana Memorial Prize for Physics:
This prize is awarded to the student with best overall performance in the Special Degree Programme in Physics.
Prof. V. Appapillai Memorial Scholarship in Physics:
This scholarship is awarded to the student with the best performance in 100 and 200 Level Physics courses and was selected and registered to follow the Special Degree Programme in Physics.

Prof. A.W. Wolfendale Prize for Physics:
This prize is awarded to the student with the best performance during the first year of the Special Degree Programme in Physics.

George Dissanaike Memorial Gold Medal for Physics:
This gold medal awarded to the student with the best performance at the examinations of the 300 and 400 Level compulsory courses in Physics.

Felix Prashantha Amarasinghe Memorial Gold Medal for Excellence in Zoology
This gold medal is awarded to the student who obtained the highest final GPA at the B.Sc. Zoology Special Degree on the basis of the criteria determined by the Faculty of Science and all the courses required for the B.Sc. Special Degree of the Zoology at the first available attempt. A minimum of 3.5 final GPA should be obtained to be eligible for the award.

Coomaraswamy Prize for Science
Three prizes are awarded to the students who show the greatest competence at the General Degree Examination in Science of which one is for the student who scores over 60% in Biological Science and the other two for the students who secure 1st and 2nd places in Physical Science in order of merit.

Chemical Industries (Colombo) Ltd. Prize
Two awards are given each year on the basis of the performance at the 200 level examination (General / Special Degree programmes)

Prof. Lakshman Dissanayke Gold Medal for Excellence in Physics
The gold medal awarded to the physics special student who has recorded the highest GPA of not less than 3.70 for the compulsory physics courses at 100, 200, 300 and 400 levels based on the criteria as determined by the Faculty.
REGULATIONS RELATING TO EXAMINATION PROCEDURE, OFFENCES & PUNISHMENTS FOR EXAMINATION CONDUCTED UNDER THE SEMESTER BASED COURSE UNIT SYSTEM

Regulations made by the Senate of the University of Peradeniya and approved by the Council under Section 136 read with Sections 29, 45 and 46 of the Universities Act No. 16 of 1978 as amended by the Universities (Amendment) Act No. 7 of 1985.

Examination of a course/course unit may consist of several assessment components (quizzes, within semester and end-semester examinations, term papers, assignments, etc.)

1. Regulations

These Regulations may be cited as the Examination Procedure, Offences & Punishment Regulation No.1 of 2008.

1.1. Part I - Examination Procedure

1. A candidate is expected to be outside the examination hall at least 15 minutes before the commencement of each paper, but shall not enter the hall until he/she is requested to do so by the supervisor.

2. On admission to the hall a candidate shall occupy the seat allotted to him/her and shall not change it except on the specific instruction of the Supervisor.

3. For examinations which have duration of one or more hours, a candidate shall not be admitted to the examination hall after the expiry of half an hour from the commencement of the examination. A candidate shall not be allowed to leave the hall until half an hour has elapsed from the commencement of the examination or during the last 15 minutes of the paper.

4. However, under exceptional circumstances or in cases where examinations have duration of less than one hour, the supervisor in consultation with the Dean of the Faculty concerned may use his discretion in the enforcement of Rule 3.

5. A candidate shall have his/her student record book/student identity card/admission card with him/her in the examination hall on every occasion he/she presents himself/herself for a paper. His/Her candidature is liable to be cancelled if he/she does not produce the student record book/student identity card/admission card when requested to do so. If he/she fails to bring his/her student record book/student identity card/admission card, he/she shall sign a declaration in respect of the paper for which he/she had not produced the student record book/student identity card/admission card in the form provided for it, and produce the student record book/student identity card/admission card to the Registrar or the relevant Senior Assistant Registrar/Assistant Registrar within the next three working days. If a candidate loses his/her student record book/student identity card/admission card during the examination period,
he/she shall obtain a duplicate of student record book/student identity card/admission card as the case may be from the Registrar or relevant Senior Assistant Registrar/Assistant Registrar for production at the examination hall.

6. A candidate shall not have on his/her person or in his/her clothes or on the admission card, time-table, student record book/student identity card, any notes, signs or formulae etc., except those items that are permitted. All unauthorized items which a candidate has brought with him/her should be kept at a place indicated by the Supervisor/Invigilator.

7. A candidate may be required by the supervisor to declare any item in his/her possession or person.

8. No candidate shall copy or attempt to copy from any book or paper or notes or similar material or from the scripts of another candidate. A candidate shall neither help another candidate nor obtain help from another candidate or any other person. A candidate shall not conduct himself/herself so negligently that an opportunity is given to any other candidate to read anything written by him/her or to watch any practical examination performed by him/her. No candidate shall use any other unfair means or obtain or render improper assistance at the examination.

9. If any candidate was found to have copied from another candidate by an examiner at the time of marking, he/she would be treated as having committed a punishable offence.

10. No candidate shall submit a practical book or field book or dissertation/thesis or project study or answer script or assignment which has been prepared wholly or partly by anyone other than the candidate himself/herself.

11. A candidate shall bring his/her own pens, ink, mathematical instruments, erasers, pencils or any other approved equipment or stationery which he/she has been instructed to bring. The use of a calculator will be permitted only for papers that contain a rubric to that effect.

12. Examination stationery (i.e. writing paper, graph paper, drawing paper, ledger paper, precise paper etc.) will be supplied at the examination hall as and when necessary. No sheet of paper or answer book supplied to a candidate may be torn, crumbled, folded or otherwise mutilated. No papers other than those supplied to him/her by the Supervisor/Invigilator shall be used by candidates. All material supplied, whether used or unused, shall be left behind on the desk and not removed from the examination hall.

13. Every candidate shall enter his/her Index Number/Registration Number on each answer book and on every continuation paper. He/She shall also enter all necessary particulars as required. A candidate who inserts on script an Index Number/Registration Number other than his/her own is liable to be considered as having attempted to cheat.
A script that bears no Index Number/Registration Number, or has an Index Number/Registration Number which cannot be identified, is liable to be rejected. No candidate shall write his/her name or any other identifying mark on the answer script unless otherwise authorized.

14. All calculations and rough work shall be done only on paper supplied for the examination, and shall be cancelled and attached to the answer script. Such work should not be done on any other material. Any candidate who disregards these instructions runs the risk of being considered as having written notes or outline of answers with the intention of copying.

15. Any answer or part of an answer, which is not to be considered for the purpose of assessment, shall be neatly crossed out. If the same question has been attempted in more than one place the answer or answers that are not to be considered shall be neatly crossed out.

16. Candidates are under the authority of the supervisor and shall assist him/her by carrying out his/her instructions and those of the Invigilator during the examination and immediately before and after it.

17. Every candidate shall conduct himself/herself in the examination hall and its precincts as not to cause disturbance or inconvenience to the supervisor or his staff or to other candidates. In entering and leaving the hall, he/she shall conduct himself/herself as quietly as possible. A candidate is liable to be excluded from the examination hall for disorderly conduct.

18. Candidates shall stop work promptly when ordered by the Supervisor/Invigilator to do so.

19. Absolute silence shall be maintained in the examination hall and its precincts. A candidate is not permitted for any reason whatsoever to communicate or to have any dealings with any person other than the Supervisor/Invigilator. The attention of the Supervisor/Invigilator shall be drawn by the candidate by raising his/her hand from where he/she is seated.

20. During the course of answering a question paper no candidate shall be permitted to leave the examination hall temporarily. In case of an emergency, the Supervisor/Invigilator may grant him/her permission to do so but the candidate will be under his/her surveillance.

21. No person shall impersonate a candidate at the examination, nor shall any candidate allow himself/herself to be impersonated by another person.

22. Any candidate receiving unauthorized assistance from any person shall be deemed to have committed an examination offence.

23. If circumstances arise which in the opinion of the supervisor render the cancellation or postponement of the examination necessary, he/she shall stop the examination, collect the scripts already written and then report the matter as soon as possible to the Dean of the relevant faculty.
24. The Supervisor/Invigilator is empowered to require any candidate to make a statement in writing on any matter which may have arisen during the course of the examination and such statement shall be signed by the candidate. No candidate shall refuse to make such a statement or to sign it. If such a candidate refuses to make such a statement or refuses to sign it, the Supervisor/Invigilator shall make his own statement and report the matter to the Dean of the relevant faculty.

25. No candidate shall contact any person other than the Vice-Chancellor, Dean, Head of the Department, the Registrar or the relevant Senior Assistant Registrar regarding any matter concerning the examination.

26. Every candidate shall hand over the answer script personally to the Supervisor/Invigilator or remain in his/her seat until it is collected. On no account shall a candidate hand over his/her answer script to an attendant a minor employee, or another candidate.

27. Every candidate who registers for a course/course unit shall be deemed to have sat the examination of that course/course unit unless he/she withdraws from the course/course unit within the prescribed period for dropping courses/course units. He/She should submit a medical certificate in support of his/her absence, prior to the commencement of the examination. If such a document cannot be submitted before the commencement of the examination, a candidate shall inform of his/her inability to attend the examination to the Dean of the Faculty within a week after the commencement of the examination. The medical certificate shall conform to the Senate Regulations. (See Appendix I.)

28. When a candidate is unable to present himself/herself for any part/section of an examination of a course/course unit, he/she shall notify or cause to be notified this fact to the Dean of the Faculty and relevant Senior Assistant Registrar or Assistant Registrar immediately. This should be confirmed in writing with supporting documents by registered post within two weeks.

29. A student will be eligible for honours if all requirements for the award of honours are met within the prescribed period for the Degree. However, candidates found guilty of an examination offence shall not be eligible for honours.

30. No student shall sit an examination of a course/course unit, if he/she has exhausted the number of attempts that he/she is allowed to sit that particular examination, unless he/she has been granted special permission to do so by the Dean of the relevant faculty.

2. Part II – Examination Offences and Punishments

2.1. Offences

1. Any candidate who violates Examination Rule 6 shall be deemed guilty of the offence of possession of unauthorized documents/items and his/her candidature
for the examinations of that semester shall be cancelled and he/she shall be prohibited from sitting any examination of this university for a period varying from 1 - 5 semesters.

2 Any candidate who violates Examination Rule 8 or 9 shall be deemed guilty of the offence of copying and therefore his/her candidature shall be cancelled from the examinations of that semester and he/she, shall be prohibited from sitting any examination of this university for a period of five semesters.

3 Any candidate who violates Examination Rule 10 shall be deemed guilty of the offence of having cheated at the examination and his/her candidature for the examinations of that semester shall be cancelled and he/she shall be prohibited from sitting any examination of this university for period varying from 1 - 9 semesters.

4 Any candidate who is detected removing examination stationery and other material provided for the examination (Rule 12) shall deemed guilty of an examination offence and his/her candidature for the examinations of that semester shall cancelled and he/she shall be liable to be prohibited from sitting any examination of university for a period of three semesters.

5 Any candidate who violates any one or more of the rules in 7, 16, 17, 18, 19 and 20 shall be deemed guilty of the offence of disorderly conduct and his/her candidature shall cancelled from the examinations of that semester and he/she shall be prohibited from sitting any examination of this university for a period of three semesters.

6 Any candidate who violates Examination Rule 21 shall be guilty of the offence of impersonation and his/her candidature for the examinations of that semester shall be cancelled and he/she shall be prohibited from sitting any examination of this university. Impersonator/s may also be liable to any punishment under the Penal Code/Criminal Law. In the event the impersonator is found to be a graduate of this university, his/her Degree shall be withdrawn.

7 Any candidate who violates Examination Rule 22 shall be guilty of an examination offence and his/her candidature for from the examinations of that semester shall be cancelled and he/she shall be prohibited from sitting any examination of this university for a period of 1 - 5 semesters.

8 Any candidate found aiding and abetting in the commission of any of the above examination offences shall be deemed to have committed that offence and shall be punished in respect of the offence in accordance with the provisions of the relevant section.

9 Any other offence which is not covered in the above sections alleged to have been committed by a candidate and reported to the relevant authority by a supervisor or Examiner shall be inquired into and appropriate action taken.

3. Part III - Procedure Regarding Examination Offences Committed by Candidates

1. There shall be an Examination Disciplinary Committee of not less than 3 members of whom at least one member is from outside the Faculty, appointed
for each case by the Dean of the relevant faculty to inquire into and make recommendations (including punishments) on examination offences referred to it. Member(s) outside the Faculty shall be selected from a panel of members appointed for this purpose by the Vice Chancellor.

2. Classification of Offences

Examination offences may be broadly classified as follows:

2.1 Possession of unauthorized documents/items
2.2 Copying
2.3 Cheating
2.4 Removal of stationery
2.5 Disorderly conduct
2.6 Impersonation
2.7 Unauthorized assistance
2.8 Aiding and abetting in the commission of above offences
2.9 Other offences.

3. Punishments
(As specified in Part II -1.1 -1.9)

4. Procedure

4.1 In all cases of violation of examination rules detected, the supervisor shall take action as outlined below and forward his/her report to the relevant Dean/Senior Assistant Registrar or Assistant Registrar

4.2 In cases of disorderly conduct the supervisor shall in the first instance warn the candidate to be of good behaviour. Disorderly conduct shall be considered grave, only if such conduct in the opinion of the supervisor is considered as causing a disturbance in the conduct of the examination. Where the candidate persists in unruly or disorderly conduct the supervisor may exclude the candidate from the examination hall and issue him a letter with a copy to the relevant Dean/Senior Assistant Registrar/Assistant Registrar, cancelling his/her candidature from the examination.

4.3 In all cases of examination offences detected, the supervisor shall send a report to the relevant Dean along with any material taken into custody. Material taken into custody should be authenticated by placing the signatures of the candidate and the Supervisor/Invigilator and the date, time and place of detection. A supervisor should give particulars of any incriminating material of which he/she cannot take possession. The Supervisor's report should be countersigned by one of the Invigilators.

4.4 The Dean after preliminary inquiry shall place all reports of examination offences submitted by supervisors for action of the relevant Examination Disciplinary Committee for further action.
4.5 Supervisor, Examiner, Head of Department or any other official of the University who detects an examination offence shall report the matter in writing to the relevant Dean, who shall after preliminary inquiry submit his findings to the relevant Examination Disciplinary Committee for further action.

4.6 Any allegations regarding the commission of examination offences from whomsoever received shall be submitted by the Dean after preliminary inquiry to the relevant Examination Disciplinary Committee for further action.

5. The Decision

5.1 The punishment recommended by the Examination Disciplinary Committee shall be submitted to the relevant Faculty Board for a decision and the decision will be reported to the Senate.

Senior Assistant Registrar/Assistant Registrar of the relevant Faculty shall be the Convener/Secretary of the inquiring committee on examination offences.

6. Appeals Board

6.1 There shall be an Appeals Board, consisting of three members, appointed by the Vice Chancellor to consider appeals regarding the decision referred to in 5.1 above. Any student on whom a punishment has been imposed may, within a period of two weeks from the date of communication to him/her of such punishment, appeal against such punishment to the Vice Chancellor.

7. Postgraduate Institutes

7.1 In the case of Postgraduate Institutes the functions of the Dean and the Faculty Board with regard to these regulations shall be performed respectively by the Director and the Coordinating Committee of the relevant Institute.

4. Appendix I - Procedure Approved by the University of Peradeniya for the Acceptance of Medical Certificates Submitted by Students for Work and Examinations

1. Students are requested to support the absence from course work or examination due to illness by a valid medical certificate conforming to the format of a medical certificate issued by a government hospital. Such medical certificate should be obtained from the following persons:

University Medical Officer (UMO)
District Medical Officer
Consultant Specialist in the particular field
Head of a Government Base Hospital
Medical Superintendent of a Provincial Ayurvedic Government Hospital
Ayurvedic Physician registered in the Council
Under exceptional circumstances, medical certificates issued by private hospitals or registered private practitioners could be considered by the University Medical Board.

2. Students who fall ill during sessions or examination time should contact the University Medical Officer at the University Health Centre immediately.

If a student falls sick at home or elsewhere during sessions or examination time he/she or his/her guardian should inform the Dean of the respective Faculty within seven (7) days by telegram/fax/e-mail followed by a letter indicating the nature of the illness and the name of the attending doctor etc. A medical certificate supporting the illness of the student also should be sent to the Dean.

Under exceptional circumstances if a student was not able to meet the deadline mentioned above, he/she could send his/her appeal to the relevant Faculty Board.

The Dean on receipt of such medical certificate/s should follow the following procedure:

i. In case of Western Medical Certificates submitted by students to cover absence from course work or examination:
   a. The medical certificate should be referred to the Chief Medical Officer (CMO) of the university for his/her observations and recommendations.
   b. The CMO in turn examines the certificate and if he/she wishes could summon the student for examination and thereafter send his/her observations, recommendations to the Dean.
   c. In cases where the CMO wishes to convene the Western Medical Board he/she may make arrangements to convene the Western Medical Board and refer the recommendations of the Board to the Dean.
   d. The Dean on receipt of such recommendations from the CMO or Western Medical Board should send it to the Faculty Board for ratification.

ii. In the case of Ayurvedic Medical Certificates submitted by students to cover absence from course work or examinations the following procedure should be followed:
   a. Ayurvedic medical certificates submitted by student in respect of absence from examinations or course work should be circulated among the members of the Ayurvedic Medical Board for their observations by the Senior Assistant Registrar/Assistant Registrar in charge of student registration of each Faculty in consultation with the Deans of the respective Faculties.
b. Each member of the Ayurvedic Medical Board may send his/her observations and recommendations on the face of the medical certificate to the Dean of the respective Faculty through the Senior Assistant Registrar/Assistant Registrar of the Faculty;

c. In case where the opinion of the members of the Ayurvedic Medical Board vary the Senior Assistant Registrar Assistant Registrar of the Faculty in consultation with the Dean of the Faculty may take steps to convene a meeting of the Ayurvedic Medical Board.

d. If the members of the Ayurvedic Medical Board think that the medical certificates should be examined at a meeting of the Board, the Dean of the Faculty should be informed accordingly.

e. If the members wish to examine students concerned, they could be summoned before the Medical Board through the Senior Assistant Registrar/Assistant Registrar of the Faculty.

f. The recommendation of the Ayurvedic Medical Board should be sent to the Faculty Board through the Dean of the Faculty for ratification.

g. The original copies of the Ayurvedic Medical Certificate submitted by students should be kept in the files of the students concerned and copies of such certificates should be sent to the Chief Medical Officer for purposes of record.

3. There shall be two Medical Boards in the University, viz. Western Medical Board and Ayurvedic Medical Board.

i. Western Medical Board

Terms of Reference

a. The Western Medical Board shall consider cases where the Chief Medical Officer of the University has doubt about the validity of the grounds (including medical certificate) upon which the request of students to be excused for absence from course work of examinations.

b. The Chief Medical Officer of the University shall convene the Western Medical Board if and when necessary.

c. The Board has the right to call students before the Board when necessary for purposes of interview, examination and investigations.

d. Recommendations of the Medical Board should be sent to the Faculty Board through the Dean of the respective Faculty.

e. The Western Medical Board should consist of the Heads of the Departments of Medicine, Surgery and Psychiatry of the Faculty of Medicine or their nominees and the CMO of the University.

ii. Ayurvedic Medical Board

Composition

The Ayurvedic Medical Board shall consist of three (3) persons appointed by the senate of the University.
Terms of Reference

a. The Ayurvedic Medical Board shall consider Ayurvedic Medical Certificates submitted by students requesting exemption from examinations or course work and make recommendations to the Senate through the Deans of the respective Faculties.

b. The Board shall meet at least once within a semester. The Senior Assistant Registrar/ Assistant Registrar in charge of student registration in consultation with the Dean of the respective Faculty shall convene meetings of the Ayurvedic Medical Board whenever necessary and co-ordinate the work between the Faculty and the Ayurvedic Medical Board.

c. The board has the right to call students before the Board when necessary for purposes of interviews, examination and investigations. Such requests should be sent to the students through the Senior Assistant Registrar/Assistant Registrar in charge of student registration of each Faculty.

Guidelines for the Functioning of the Ayurvedic Medical Board

a. When accepting Ayurvedic Medical Certificates, caution is to be exercised by accepting from only those who are registered in the Ayurvedic Medical Council.

b. General or Special registered Ayurvedic Medical Practitioners could recommend on anyone occasion leave up to 14 days at a stretch. Those with more than the above amount should get an endorsement from the Medical Officer in charge of the closest Government Ayurvedic Hospital or Government Ayurvedic Dispensary.

c. The decision on leave stipulated in Medical Certificates from Ayurvedic Hospitals, Government Dispensaries or Local Government Ayurvedic Dispensaries rests with the Board.

d. This Board possesses the right to question the validity of any Ayurvedic Medical Certificate.

e. The Board possesses the right to summon before them any student submitting an Ayurvedic Medical Certificate, if necessary.

4. When students request exemption from examinations of course work upon the basis of illness, the ultimate decision on question of exemption, repetition of course and of eligibility for honours, shall be the functions of the relevant Faculty Board upon the recommendation of the Medical Board or the Chief Medical Officer.
STUDENT LIFE
The University of Peradeniya was built with the goal of providing an environment suitable for the intellectual, emotional and personal development of students. The unique setting and infrastructure of the university together with the diverse student population creates an opportunity for a fulfilling lifestyle.

Students of the Faculty of Science are afforded all of the services and opportunities of the University of Peradeniya. More information on university facilities and resources can be found through the official university website at: https://www.pdn.ac.lk/student/student.php

Welfare Services

I. Residence
The University provides accommodation to the students in the Halls of Residence situated within the University premises. The basis on which the students are allocated to Halls of Residence may change from time to time, depending on the number of vacancies available in the Halls of Residence.

II. Sports and Recreation
For recreation, facilities such as playgrounds, tennis courts and a cinder running track are located within the University premises. Students can participate in a variety of team and individual sports including cricket, rugby, soccer, hockey, tennis volley-ball, athletics etc. A modern gymnasium is situated about 500 meters away from the faculty equipped for badminton, basketball, netball, volleyball, table-tennis, trampolining, weight lifting, etc.

Department of physical education/Gymnasium
Phone  intercom 2164 (Director)
        intercom 2162 (office)
        intercom 2163 (swimming pool)
opening hours  7.00 a.m. to 8.00 p.m.

The Faculty of Arts Theatre often screens cinematic films of international renown, which are usually free for students. The Sarathchandra open-air amphitheatre is a landmark of the university, where most dramas performed in the university are staged.

III. Medical Centre
The University Health Centre is open to all students during week days in two sessions (morning and afternoon) per day. During the weekends and public holidays, only emergency cases are treated. University Medical Officers are on call to attend to emergencies.

Contact Information
Chief Medical Officer  Dr. P.M.A. Samarakkody
                      081-238-8152 (direct)
                      2024 (intercom)
Office/Lab              2028
Female wards/Pharmacy  2022, 2026
IV. Computer and Internet Access
The Faculty Computer Centre is located at the ground floor of the administrative building. The centre is open to all science faculty students where computers with most current software and broadband internet facilities are available.

V. Student Counseling
The faculty of Science maintains a student counseling service to assist and guide students who have problems pertaining to academic, social and personal matters. These services are offered by senior members of the academic staff.

VI. Banking Facilities
The People's Bank and the Bank of Ceylon have their sub-branches in the University premises in addition to the main branches at Peradeniya. Mahapola scholarships to students are paid through the Bank of Ceylon, campus branch, which is located in the students centre.

VII. Canteen
The University maintains a canteens in each of the Halls of Residence. In addition, the Science Faculty has its own canteen at ground floor of the Science Education Building. The Students' Centre which is situated near the Gymnasium also houses a canteen for students.

VIII. Post Office and Telephone Exchange
A Sub Post Office and the University Telephone Exchange are located on the hill opposite the New Arts Theatre.

IX. Barber saloon, Laundry and Tailoring Shop
These are available in the Students' Centre and at the Peradeniya town.

X. Police and Security Service
The closest police station is situated on the Kandy-Colombo road near the Peradeniya Teaching Hospital. Any incidents regarding the security of University property or any incident of breach of law may be reported to the security personnel in the security posts at the faculties and the senate building. The main Security Office is located near the New Arts Theatre.

Marshals division
Contact information
    Office 081-239-2423
    2423 (intercom)
Chief Marshal 077-599-6290

Security office
    Office 081-238-9182
    Chief security officer 2134 (intercom)
XI. Book Shops and Grocery Shops
The faculty book shop is situated at ground floor of the Science Education Unit building, next to the faculty canteen. The main book shop of the university is situated in the University Students’ Centre. University publications can be purchased from the sales Outlet at the Senate building. Groceries are available in the cooperative store at the North End (known as USO), and at Peradeniya town.

XII. Places of Worship
A Buddhist Temple, a Hindu Temple, a Mosque, a Christian church and a Catholic Church are located in the premises of the University.

STUDENT SOCIETIES
Students are encouraged to join the societies in the Faculty and in the University for the purpose of furthering academic and social objectives. There are a number of societies and associations registered in the University. Some of them are listed below.

Societies of the University and Faculty of Science

1. Applied Sciences Society
2. Art Circle of Faculty of Science
3. Botanical Society
4. Buddhist Brotherhood
5. Chemical Society
6. Computer Society
7. English Drama Society
8. Gandarwa Sabhawa
9. Hantana Conservation Society
10. Helahanda Students' Society
11. Hindu Students Society
12. Mathematics Society
13. Muslim Majlis
14. Music Society
15. Newman Society
16. Photographic Society
17. Physical Society
18. Rotaract Club
19. Sinhala Natya Mandalaya
20. Sinhala Sangamaya
21. Soba Sansadaya
22. Socialist Students' Union
23. Student Christian Movement
24. Tamil Sangeetha Natya Sangam
25. University Botanical Society
26. University Explorers' Club
27. University Geological Society
28. Zoologists' Association of 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 EN 100 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>Compulsory for</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>General Degree</td>
</tr>
<tr>
<td>EN 100</td>
<td>Basic English</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>CS 100</td>
<td>Computer Applications</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>BL 100*</td>
<td>Basic Life Sciences</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>MT 100†</td>
<td>Mathematics for Biological Sciences</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>MT 120†</td>
<td>Foundation Course in Mathematics</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>FND 114‡</td>
<td>Law and Ethics</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

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

• PRINCIPAL SUBJECT AREA

BIOLOGY

At the 100 Level, Biology is offered as principal subject areas, Biology* (8 credits) and Biology** (16 credits) jointly by the Departments of Botany, Molecular Biology & Biotechnology and Zoology. Both Biological and Physical Science students can offer these subjects.

<table>
<thead>
<tr>
<th>100 LEVEL - BIOLOGY</th>
<th>Course Title</th>
<th>No. of credits</th>
<th>Compulsory for</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Biology*</td>
</tr>
<tr>
<td>BL 101</td>
<td>Basic Biology</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>BL 102</td>
<td>Plant &amp; Animal Form &amp; Function</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>BL 103</td>
<td>Basic Ecology</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>BL 107</td>
<td>Basic Microbiology</td>
<td>2</td>
<td>√</td>
</tr>
<tr>
<td>BL 115</td>
<td>Biomolecules</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BL 116</td>
<td>Introductory Environmental Biology</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BL 117</td>
<td>Biotic Interactions</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BL 118</td>
<td>Introductory Evolutionary Biology</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BL 120*</td>
<td>Introduction to Biotechnology and its Applications</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

*optional course
Selection for the Special Degree in Biology

The Special Degree Program in Biology will be offered jointly by the Departments of Botany, Molecular Biology & Biotechnology and Zoology to undergraduates in the Biological Science stream who have successfully completed Biology* or Biology** program at 100 level and the stipulated course units from Botany, Molecular Biology & Biotechnology and Zoology at 200 level.

<table>
<thead>
<tr>
<th>200 LEVEL – BIOLOGY</th>
<th>Course Title</th>
<th>No. of credits</th>
<th>Prerequisites</th>
<th>Compulsory for Special Degree</th>
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<tbody>
<tr>
<td>BT 201</td>
<td>Plant Diversity I</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>BT 202</td>
<td>Plant Diversity II</td>
<td>2</td>
<td></td>
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<tr>
<td>BT 203</td>
<td>Vegetation Dynamics &amp; Measurements</td>
<td>2</td>
<td></td>
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<tr>
<td>BT 205</td>
<td>Angiosperm Morphology &amp; Anatomy</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT 206</td>
<td>Plant Physiology</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT 207</td>
<td>Plant Biochemistry</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MB 201</td>
<td>Biological Chemistry</td>
<td>3</td>
<td>BL 101, CH 101, CH 102</td>
<td>√</td>
</tr>
<tr>
<td>MB 206</td>
<td>Principles of Genetics</td>
<td>3</td>
<td>BL 101</td>
<td>√</td>
</tr>
<tr>
<td>MB 226</td>
<td>Molecular Genetics</td>
<td>3</td>
<td>BL 101, CH 101, CH 102</td>
<td>√</td>
</tr>
<tr>
<td>ZL 201</td>
<td>Animal Embryology</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>ZL 206</td>
<td>Invertebrate Diversity</td>
<td>3</td>
<td></td>
<td>√</td>
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<tr>
<td>ZL 215</td>
<td>Zoogeography &amp; Sri Lankan Fauna</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>ZL 216</td>
<td>Vertebrate Diversity</td>
<td>3</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>ST 202 / BT 209 †</td>
<td>Applied Statistics / Biostatistics †</td>
<td>2</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td>33</td>
<td></td>
<td>21</td>
</tr>
</tbody>
</table>

† BT 209 is equivalent to ST 202.

The students for Biology Special Degree will be selected from among those who have successfully completed 100 and 200 level courses.

Selection of Course Units for the Special Degree in Biology

For students who are selected for the Special Degree in Biology, specified course units from Botany, Molecular Biology & Biotechnology and Zoology at 300/400 levels, given in the table will be considered as one principal subject area - Biology.
## 300 AND 400 LEVEL BIOLOGY

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>No. of credits</th>
<th>Prerequisites</th>
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When Biology is selected as the subject of specialization (Requirements to pass the Special Degree – item 17 of page 07 of the Faculty Handbook), a minimum total of 77 credits may be earned over a period of four years. The balance credit requirement to make up a minimum total of 105 credits from the Principal Subject Areas may be selected from any Principal Subject Area subject to the approval of the respective Department of Study.

**BOTANY**

At the 100 Level two principal subject areas, Biology* and Biology**, having 8 and 16 credits respectively are offered jointly by the Departments of Botany and Zoology. Both Biological and Physical Science students could offer these subjects.

From the 200 Level onwards Botany is offered as a principal subject area. The students who have followed Biology* 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 subjected to their fulfillment of compulsory requirements for the botany special course. 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 Sciences Degree Programme. The General Degree students after successful completion of three years with required GPA are permitted to register for the Applied Sciences Degree.

The laboratory work of all course units offered by the Department of Botany shall be evaluated on a continuous assessment basis as well as an end semester examination.
### 100 LEVEL - BIOLOGY

Offered jointly by the Departments of Botany, and Zoology.

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**Total**  
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* Optional subject

### 200 LEVEL – BOTANY

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**Total**  
18 | 4 | 8

† Equivalent to MB 221 offered by the Department of Molecular Biology & Biotechnology.

†† Equivalent to ST 202 offered by the Department of Statistics & Computer Science and ZL 205 offered by the Department of Zoology.

### 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.)

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*Equivalent to SE 402

**CHEMISTRY**

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*Total* 413

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### 400 LEVEL – CHEMISTRY

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**Total** 43-45 28
### COMPUTER SCIENCE

#### 100 LEVEL - COMPUTER SCIENCE

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<td>CS 402</td>
<td>Intelligent Systems in CIM</td>
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| CS 421      | Project in Computer Science II - Individual Project Work | 6-8    | CS 304            | √
| CS 423      | Seminar                                           | 1       |                   | √
| ST 402      | Data Mining Techniques                            | 3       | CS 409            |
| ST 403      | Statistics for Bioinformatics                     | 2       |                   |
| **Total**   |                                                   |         | **40-42**         | **9**

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
- MT311 (3 credits) Linear Programming
- MT407 (3 credits) Optimization Theory
- GL316 (2 credits) Remote Sensing and GIS

**Credit requirement for special students**
ENVIRONMENTAL SCIENCE

Those students who have completed Chemistry as a principal subject at the 200 Level shall be eligible for selection to a Special Degree in Environmental Science at the end of the second year subjected to their fulfillment of compulsory requirements to be selected for the Environmental Science Special Degree Programme.

### 300 LEVEL – ENVIRONMENTAL SCIENCE

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Total: 40-42

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3 Equivalent to BT 310  
4 Equivalent to CH 341  
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7 Equivalent to BT 302  
8 Equivalent to AS 432  
9 Equivalent to ZL 405  
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11 Equivalent to GL 406  
12 Equivalent to MB 416  
13 Equivalent to BT 412  
14 Equivalent to AS 402

GEOLOGY

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**Total** 54-56

† Only one of these course units is compulsory

### MATHEMATICS

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* Mathematics as a single subject
** Mathematics as two subjects

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‡Available to students who have not offered biology in GCE (A/L).
## PHYSICS

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** Equivalent to MT 107 offered by the Department of Mathematics

** Total 14  8  8

### 200 LEVEL – STATISTICS

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** Total 22  8  8
†† For students who do not offer Statistics as a major subject. Equivalent to BT 209 offered by the Department of Botany and ZL 205 offered by the Department of Zoology

### 300 LEVEL – STATISTICS

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Students opting to follow the Special Degree Programme in Statistics are required to follow BC201, BC202, BC301 and BC302 if they did not follow Computer Science as a major subject.

### 400 LEVEL – STATISTICS

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

GL316 (2 credits) Remote Sensing and GIS
MT311 (3 credits) Linear Programming
MT407 (3 credits) Optimization Theory
**MT412 (3 Credits)** Financial Mathematics

### ZOOLOGY

The Department of Zoology offers Biology* and Biology** 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* or Biology** 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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### 200 LEVEL – ZOOLOGY

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† Equivalent to ST 202 offered by the Department of Statistics & Computer Science and BT 209 offered by the Department of Botany.

### 300 LEVEL – ZOOLOGY

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† Same as MB 431
### SUPPLEMENTARY COURSES

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### APPLIED SCIENCES SUBJECT AREA

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**Category I (Biology – based Courses)**

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<td>AS 482</td>
<td>Biochemistry and Molecular Laboratory Instrumentation</td>
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<td>AS 483</td>
<td>Bioinformatics</td>
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**Category II (Chemistry - based Courses)**

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<td>AS 431</td>
<td>Chemical Technology</td>
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<td>AS 432</td>
<td>Cleaner Production for Industry</td>
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<td>AS 433</td>
<td>Industrial Waste Management</td>
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<td>AS 434</td>
<td>Industrial Organic Chemistry</td>
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**Category III (Geology - based Courses)**

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<tr>
<td>AS 444</td>
<td>Industrial and Economic Minerals</td>
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<tr>
<td>AS 445</td>
<td>Remote Sensing and Geographic Information Systems</td>
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**Category IV (Mathematics - based Courses)**

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<td>AS 451</td>
<td>Industrial Mathematics</td>
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<td>AS 452</td>
<td>Financial Mathematics</td>
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**Category V (Physics - based Courses)**

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<tr>
<td>AS 461</td>
<td>Semiconductor Device Technology and Application</td>
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<tr>
<td>AS 462</td>
<td>Science and Technology of Ceramic Materials</td>
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<td>AS 463</td>
<td>Energy; Sources, Use and Conservation</td>
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<td>AS 464</td>
<td>Workshop Practice</td>
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<td>AS 465</td>
<td>Industrial Applications (Electronics/Hardware) Laboratory</td>
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<td>Category VI (Statistics/Computer Science - based Courses)</td>
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<tr>
<td>AS 471 Design and Development of Software Systems</td>
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<tr>
<td>AS 472 Management of Computers and Computer Networks</td>
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<tr>
<td>AS 473 Visualizing Statistical Concepts using Java and Software Development</td>
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<td>AS 474 Statistical Applications in Industry and Project Presentation</td>
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<td>CS 104</td>
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<td>MT105</td>
<td>Real Analysis I</td>
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<td>Mathematics for Arts/Commerce Students I</td>
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<td>MT 122</td>
<td>Mathematics for Arts/Commerce Students II</td>
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<td>ECN 101</td>
<td>Introductory Microeconomics I</td>
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<td>ECN 102</td>
<td>Introductory Macroeconomics II</td>
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<td>Principles of management</td>
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<td>MGT 103</td>
<td>Introduction to Business Accounting</td>
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<td>FNA 102</td>
<td>Introduction to Art History and Aesthetics</td>
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<td>PSC 101</td>
<td>Introduction to State and Government</td>
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<td>SE 101</td>
<td>Science and Society</td>
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<td>Database Management Systems</td>
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<td>CS 204</td>
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<td>MT 221</td>
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<td>ECN 201</td>
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<td>Project Management</td>
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<td>MGT 211</td>
<td>Business Accounting for Decision Making</td>
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<td>CS 303</td>
<td>Operating Systems Concepts</td>
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<td>CS 305</td>
<td>Communication Networks</td>
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<td>CS 309</td>
<td>Object Oriented Analysis and Design</td>
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<td>CS 310</td>
<td>Server side web programming</td>
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<td>CS 311</td>
<td>Software Engineering</td>
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<td>CS 315</td>
<td>Design and Analysis of Algorithms</td>
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<td>MT 321</td>
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<td>ECN 304</td>
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<td>MGT 304</td>
<td>Entrepreneurship</td>
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<td>Cost &amp; Management Accounting</td>
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<td>Business Law</td>
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<td>MGT 438</td>
<td>Management Information Systems</td>
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**BS - BioScience**  **PS - Physical Science**  **AR - Arts**  **CO - Commerce**

*Compulsory for Physical Science and 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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<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>No: of Credits</th>
<th>Pre-requisites</th>
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<td>Introduction to Statistics</td>
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<td>Introduction to Probability Theory</td>
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<td>Statistics Applications I</td>
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<td>ST 104</td>
<td>Statistics Applications II</td>
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<td>ST 101 or any other basic statistics course</td>
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<td>Programming Techniques</td>
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<td>Mathematics for Operations Research</td>
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<td>Linear Programming</td>
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<td>Design and Analysis of Experiments</td>
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<td>Bayesian Statistics I</td>
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<td>ST 309</td>
<td>Non Parametric and Categorical Data analysis</td>
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<td>Partial Differential Equations</td>
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<td>Selected Topics in Applied Operations Research</td>
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<td>Project work/Industrial training</td>
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**Total** 126-128  86
SYLLABI OF COURSES OFFERED

FOUNDATION COURSES

BL 100  Basic Life Sciences (2 credits)
*Current trends in human Biology*: Recombinant DNA technology, GM foods, cancer, DNA forensics, Biological agents as weapons.
*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. C.S.French, *Computer Science*
3. Robert Slade, *Computer viruses*

EN100 Basic English Foundation Course
This compulsory course will be conducted over two semesters of the same academic year
Interactive teaching – 90 hrs per academic year
Four skills in language learning will be covered
*Grammar and writing* – part of speech, active and passive voice structures, conditionals, conjunctions, prepositions, relative clauses, tenses, sentence structures, writing simple descriptions, process writing, recording a practical, how to organize a paragraph with main idea and supporting details using cohesive devices, sequence markers, structure vocabulary related to comparison, classification, cause and effect, spatial relations, chronological order
*Reading* – surveying a text book, skimming and scanning, identifying main ideas and supporting details, guessing contextual meanings of words using definition signals and reference markers, punctuations, prefixes, reading comprehension (general and subject related), reading and note taking
*Listening* – listen to a text or a recorded lecture and take down specific information in the form of diagrams, tables, graphs, filling in blanks, listening and note taking, answer questions based on dialogues and short conversations
Speaking – give a speech using guidelines given in a cue card, develop a story based on a picture, role play, debates, describe an incident, create stories

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

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.

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

FND 114  Law and Ethics  (3 credits)
This course will be taught in two sections on law, ethics emphasizing the differences and interfaces.

Section I: What is Law; Branches of Law; The Legal System of Sri Lanka; The Court Structure; Services of law; The constitution: Separation of power, Sri Lankan constitution, Fundamental Rights; Law in relation to Religion, Morals, Gender, Justice and punishment, Freedom, Sovereignty and the State; International Law, Legal concepts: Emergency laws, Intellectual Property Law, Public Trust, Right /Duty, Democracy /minorities, torture.

Section II: What is Ethics; Ethics and Morality; Nature of ethical propositions; Religious ethics; Theories of Ethics: Aristotelian Ethics - Nocomachean Ethics, Kantian Ethics - Categorical Imperative, Levinasian Ethics - Responsibility to Other, Derridian Ethics- Forgiveness, Alain Budiou - Understanding of Evil; Professional Ethics, Teacher and student, Doctor and patient, Lawyer and client; Trials against Socrates, Christ, Eichmann; Bio Ethics and Animal Ethics; Selected ethical concepts: sex, adultery, marriage, divorce, abortion ,love, prostitution, plagiarism , ragging, student politics, racism.
PRINCIPAL SUBJECT AREA

BIOLOGY

BT Course Units - See under Botany
MB Course Units - See under Molecular Biology & Biotechnology
ZL Course Units – See under Zoology

BL 401 Evolutionary Biology (2 Credits)
History of evolutionary biology; Phylogenetic and ecological bases of evolution; Geography of evolution; Evolutionary processes in populations and species; Molecular evolution and Macroevolution; Human evolution.

Recommended Texts:

BL 402 Scientific Writing & Ethics (1 credit)
Writing Scientific Papers; Organization and Content; Guidelines for writing under different headings; Plagirism in scientific writing.

BL 403 Independent Study (1 credit)
(Equivalent to BT 414)
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.

BL 404 Research Project (8 credits)
A research project on a biological topic shall be carried out in the final year under the supervision of staff members. The student is expected to carry out a literature survey, write the Research Proposal and present it. On completion of the project, make an oral presentation of the work and submit a written report.

SI 401 Industrial training (2 credits)
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.
BOTANY

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:

BL 102 Plant and Animal Form and Function (2 credits)
Plant Form & Function: Tissue types; Internal structure of plants and organs; Photosynthesis; Transport systems; Plant nutrition. Animal Form & Function: Levels of body organization, body form and symmetry; Major animal groups and their basic needs for survival; How different animal groups solve problems of survival and challenges of the environment through form and function; Functional adaptations of animals under extreme environmental conditions.
Practicals based on above.

Recommended Texts:
BL 103 Basic Ecology (2 Credits)
Ecological levels (individuals, populations, communities, habitats, ecosystems, biomes, biosphere); Components of the physical environment (energy, water, atmospheric gases, wind, fire, gravity, topography, geologic substratum and soil); Energy flow in ecosystems (trophic levels, food webs, productivity); Cycles of materials (hydrological cycle, carbon cycle, biogeochemical cycles). 
Practicals based on above.

Recommended Texts:

BL 107 Basic Microbiology (2 credits)

Recommended Texts:

BL 115 Biomolecules (2 Credits)
Essential classes of biomolecules - nucleic acids, proteins, fatty acids & lipids and carbohydrates; structure and function; chemistry, properties and interactions of biomolecules; applications of biomolecules in agriculture, medicine, forensics and industry. 
Laboratory exercises based on above topics.

Recommended Texts:

BL 116 Introductory Environmental Biology (2 Credits)
Basic concepts in environmental biology; Hydrosphere; Lithosphere; Atmosphere; Biosphere; renewable & nonrenewable resources and cycling of energy & matter; Climate & life; human population growth & problems of overpopulation; Atmospheric pollution and global changes: impacts of atmospheric pollution on biota- plants, animals, humans, carbon footprint; World food resources & green revolution; Effect of agriculture on environment; Water resources: pollution and treatment methods; Solid and hazardous wastes; Environmental health & toxicology; Sustaining terrestrial biodiversity and urban biodiversity. Global resources and associated problems.
Practicals based on above.
Recommended Texts:

BL 117 Biotic Interactions (2 Credits)
Nutralisum verses interactions among plants, animals and microbes; kinds of biotic interactions with examples, intraspecific interactions and interspecific interactions – symbiotic relationships, protection and defense, competition & allelopathy. The role of trophic interactions in community initiation, maintenance and degradation. Biotic interactions affecting the sizes of species populations and diversity. Community consequences of biotic interactions and co-evolutionary dynamics. Biotic interactions in human dominated landscapes. Application aspects of biotic interactions. Laboratory exercises based on above topics.
Recommended Texts:

BL 118 Introductory Evolutionary Biology (2 Credits)
Introduction; Evidence for evolution; Mechanisms of evolution; Micro and macroevolution; Speciation; Co-evolution; Adaptation; Adaptive radiation; Phylogenetics; Phenotypic plasticity; Kin selection; Parent offspring conflict; Human evolution; Health and evolution; Evolution of photosynthesis, angiosperms and crop plants. Practical exercises based on above.
Recommended Texts:


**BL 120 Introduction to Biotechnology and its Applications (2 credits)**

Introduction to Molecular Biology and Biotechnology, historical development, landmark discoveries and pioneering scientists, diverse applications of Biotechnology in medicine, food production and environmental protection. World Wide Web Resources on Biotechnology and their reliability, the fraudulent nature of bioterrorism and how to circumvent it through proper and safe use of Biotechnology. In the contexts of humanitarian and environmental catastrophes, the use of Biotechnology as a developmental tool to face the challenges in the present and future.

Recommended Text:


4. International Service for the Acquisition of Agri-biotech Applications (ISAAA), Operated in USA, Kenya and Philippines. Website: http://www.isaaa.org/.

5. GMO Compass, the task of GMO Compass is to collect objective, science-based information on the use of genetic engineering in the agri-food industry and present it to the public in a way that is easy to understand and readily accessible. Maintained at Genius GmbH, Robert-Bosch-Str. 7, 64293 Darmstadt, Germany. Website: http://www.gmo-compass.org/eng/.

**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)
(Equivalent to MB 221)
Laboratory exercises based on above topics.

Recommended Texts:

**BT 205 Angiosperm Morphology and Anatomy (2 Credits)**
Stem, root and leaf morphology, reproductive morphology, seedling morphology and vegetative morphology.
Laboratory exercises based on the above.

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)**

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:


**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:


**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)
practices. Soils and the quality of the environment. 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 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 and Management (2 Credits)**

Biodiversity – Introduction, Global and national Biodiversity estimates; Measuring Biodiversity; Loss of Biodiversity; Threats to Biodiversity; Biodiversity Conservation: *In situ* and *Ex situ* conservation, Sustainable Management, Environmental education, Conservation through legislation; Setting conservation priorities; Ecotourism; Indigenous
knowledge and Biodiversity; International conventions on Biodiversity; Laboratory and field exercises related to above topics.

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 damanas).

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:

**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, fiber 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:**


**BT 313 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 research/scientific articles and a deliver seminar.

**FS 302 Food Science II (2 credits)**


**Recommended Texts:**

HR 301 Human Resource Management (2 credits)

Recommended Text:

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)
Introduction to the family Leguminosae & the nodule forming bacterium. Rhizobium characteristics. Counting Rhizobium in soil. Ecology of Rhizobium, rhizosphere of legumes. Abiotic and biotic factors affecting rhizobial growth in soil, numbers and distribution in soil, artificial introduction of Rhizobium into soil. Species relationships
and cross inoculation groups. Effective and ineffective nodulation. Census of nitrogen fixers. Study of infection, nodulation.
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:
5. Vries, D. J. (1997). Food Safety and Toxicology. CRC Press, USA.

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:**
9. 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; Forests and forest policy in Sri Lanka. Forest mensuration; Silvicultural systems; Species selection and nursery practices; Forest genetics; Site preparation before planting; After-care of plantations: weeding, fertilizing, pruning, thinning; protection from diseases, pests and fire; Harvesting and marketing; Sustainable forest management; Field exercises based on above topics.

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 (6-8 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.

**BT 416 Seed Biology and Technology (2 credits)**
Introduction to seeds and seed science; reproductive development of plants; development of fruits and seeds; desiccation tolerance of seeds, seed quiescence, dormancy and non dormancy; seed longevity and seed banks; seed germination; molecular genetic advances of seeds and its consequences; seed production; seed harvesting; Seed purity; Seed handling techniques; post production improvement of seeds; seed vigor and vigor tests; seed deterioration and seed storage; preservation of seeds; somatic embryogenesis and artificial seed production.
Practical component: Seed deterioration experiments; seed moisture measurements; types of seeds; desiccation sensitivity of seeds; seed dormancy; seed vigor and standard germination; seed purity; imbibition of seeds and seed priming; seed isotherms, seed pathology and artificial seed production.

Recommended Texts:

**BT 417 Phytogeography (2 credits)**
Introduction to biogeography, phytogeography and its history as a discipline; geodispersal, speciation and isolation barriers; plate tectonics and palaeoclimates; vicariance biogeography; island biogeography; tertiary relict floras.
Practical component: testing phytogeographic hypotheses using phylogenetic trees; multiple sequence alignment techniques; dating phylogenies, vicariance (cladistic) biogeography methods.

Recommended Texts:

**BT 418 Evolution and Diversity of Cryptogamic Plants (2 credits)**
Introduction to Cryptogamic Plants: algae, lichens, bryophytes and pteridophytes; morphological, reproductive and taxonomic diversity of Cryptogamic Plants; evolutionary origins, diversification and phylogenetic relationships among the major lineages of Cryptogamic Plants; economic and ecological importance of Cryptogamic Plants.
Practical component will be based on the above topics.

Recommended Texts:

95
BT 419  Physiology and Management of Ornamental Plants (2 credits)
Introduction to floriculture; Plant propagation; Pre- and post-harvest physiology: ultra-
structural and biochemical changes related to growth, maturation, senescence, respiration
and water relations; Improving the postharvest longevity of ornamental plants; Pests,
diseases and their control; Value addition in consumer usage; Flower and foliage supply
chain; Laboratory practicals related to above topics and industrial visits.

Recommended Texts:
   Postharvest. An Introduction to the Physiology and Handling of Fruit,

BT 420 Biological Nitrogen Fixation (2 credits)
(Prerequisites: BT 302)
Introduction to biological nitrogen fixation: Nitrogen cycle, Organisms and systems that
fix Nitrogen, Mechanism and requirements for nitrogen fixation: Enzymology of
nitrogen fixation, Genetics of nitrogen fixation. Methods of measuring nitrogen fixation,
Applications in biological nitrogen fixation: Biofertilizers, Biofilms, Species
relationships and Cross inoculation groups, Effective and ineffective nodulation. Future
directions in biological nitrogen fixation.

Recommended Texts:
   Blackwell Publishing Ltd, UK.
   Soil Ecology. Elsevier Inc.
   Chapman and Hall, London.
   Utilization. Peradeniya Science Publication No 27, Science Education Unit,
   Faculty of Science, University of Peradeniya.

SI 401 Industrial training (2 credits)
Each student will undergo full time training in the industry for the prescribed period on
projects assigned by the industry. Students are required to have a duly maintained ‘Daily
Diary’ which should be submitted to the Head of the Department within two weeks after
completion of the training. In addition, the students are expected to write a report and
make a presentation on the work carried out by them.
CHEMISTRY

Compulsory courses for the General degree: CH 101, CH 102, CH 108, CH 109, CH 211, CH 218, 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 218, CH 221, CH 222, CH 228, CH 231, CH 232, CH 238, CH 317, CH 319, CH 321, CH 324, CH 326, 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 435, at least two out of (CH 436, CH 437, 438), CH 443, CH 448, CH 455, CH 491, CH 492, CH 499.

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; Electromagnetic radiation, atomic spectrum of hydrogen, Bohr model, the quantum mechanical description of the atom, quantum numbers, 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, Hund’s rule, Aufbau principle, electron configurations of elements of periodic table and periodic trends in atomic properties; Lewis structures, octet rule and VESPER model, Bonding: Types of chemical bonds, covalent bonds, electronegativity, polarity and dipole moment, ionic bond, ionic lattices, partial ionic character of covalent bond, 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 Huckel’s Rule; Reactions in functional group analysis and their mechanisms. IUPAC Nomenclature

Fundamentals and Energetics (15L): The scientific method, microscopic and macroscopic theories, units and dimensions; Stoichiometry: mass balance, charge balance, extent of reaction, equilibrium constants, limiting reactants, calculations involving various chemical reactions; 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, exogernic and endogernic reactions,

Recommended Texts:

**CH 102 Principles of Chemistry II (3 credits)**
(Prerequisite: CH 101)

*General Chemistry II* (15 L): Hybridization of atomic orbitals, molecular orbital theory, magnetic properties. Three-center bond, resonance, bonding in homonuclear and heteronuclear diatomic models; applications of size and energy factors in chemistry; Electrode potentials and Nernst equation and their inorganic applications. Basic concepts in chemical analysis: titrations, buffers, indicators, solubility equilibria and applications.

*Kinetic Molecular Theory (KMT) and Chemical Kinetics* (15L): 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; 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, Steady-state approximation, pre-equilibrium.

*Stereochemistry* (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, Stereochemical course of organic reactions (SN1, SN2, E1,E2) and effect of solvent on substitution reactions.

Recommended Texts:

**CH 108 Elementary Chemistry Laboratory I (1 credit)**
Qualitative analysis; Analysis of inorganic anions, cations, Introduction to measurements and errors, Quantitative Inorganic analysis by volumetric titrations.

Recommended Texts:
1. A.I. Vogel, A.I. Vogel, *Qualitative Inorganic Analysis* (2004), Longman Scientific

**CH 109 Elementary Chemistry Laboratory II (1 credit)**
(Prerequisite: CH108)
Organic functional group analysis.
200 LEVEL COURSES

CH 211  Inorganic Chemistry I (2 credits)
(Prerequisites: CH 101, CH 102)
Some selected trends in the chemistry of elements; 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, symmetry elements; Powder diffraction methods.

Recommended Texts:
1. JD Lee (1999) Concise Inorganic Chemistry,
2. SFA Kettle (1999) Coordination Chemistry, Appleton Century,

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

Recommended Texts:

CH 218  Inorganic Chemistry Laboratory I (1 credit)
(Prerequisite: CH 108, CH 211)
Gravimetric analysis, determination of anions and cations by gravimetry, complexometric titrations involving EDTA, synthesis of inorganic complexes and their analysis, qualitative analysis of simple mixtures.

Recommended Texts:
1. A.I. Vogel, Qualitative Inorganic Analysis (2004), Longman Scientific
2. A.I. Vogel, Quantitative Inorganic Analysis (2004), Longman Scientific

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; Electrophilic and nucleophilic addition to double bonds; Reactions of carboxylic acids and derivatives; Reactions of carbonyl compounds – carbanions, enols, enolates; Rearrangements reactions;

**Spectroscopy I** (15 L): UV, IR, \(^1\)H-NMR and \(^13\)C-NMR spectroscopy; one dimensional and two dimensional NMR spectroscopy; 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, Claisen ester condensation, Dieckmann condensation, Thorpe nitrile condensation, Knoevenagal condensation; C=C formation - Wittig reaction and its modifications; Diels Alder reaction; Cope rearrangement; Claisen rearrangement

Recommended Texts:

CH 228 Organic Chemistry Laboratory I (1 credit)
(Prerequisites: CH 109, 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, 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-dimentional 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) Recommended for Chemistry (Special) students  
Chemistry of the transition elements; Lanthanides; Actinides; Transuranium compounds; Rare Earths: Chemistry and extraction (15 L).  
Silicates; Boranes; Metal clusters; Intercalates and their applications (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 (10 L).  
Spectroscopic Methods: NMR, NQR, ESR, Mossbauer, spectroscopy and inorganic applications (10 L).
**Advanced Co-ordination Chemistry:** Ligand field theory, electronic spectra of complexes, magnetochemistry (15 L)

**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. (10 L)

Recommended Texts:
1. FA Cotton (1990), *Chemical Applications of Group Theory*; Oxford University Press, UK.

**CH 319 Advanced Inorganic Chemistry Laboratory (2 credits)**
(Prerequisites: CH 218)
Analysis of rare earths, insoluble mixtures, magnetic measurements, X-ray diffraction, UV-visible spectra of transition metal complexes, synthesis of special inorganic compounds.

Recommended Texts:
1. A.I. Vogel, *Qualitative Inorganic Analysis* (2004), Longman Scientific

**CH 321 Chemistry of Biomolecules (1 credit)**
(Prerequisite CH 221)
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 324 Organic Chemistry II (2 credits)**
(Prerequisites: CH 221, CH 222)

**Organic Reaction Mechanisms II** (15 L): Reactive intermediates – reactions of free radicals, carbenes and nitrenes; Symmetry controlled reactions; Electrocyclic reactions, cycloadditions and sigmatropic rearrangements. Reactions of carbocyclic and heterocyclic aromatic compounds.

**Organic Synthesis II** (15 L): Retrosynthetic analysis - disconnection, functional group interchange, transform, synths, 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-dicarbonyl compounds, β-hydroxy carbonyl compounds, α,β-unsaturated carbonyl compounds, specific enolates, intramolecular aldol reaction, 1,5 - dicarbonyl compounds; Strategies in ring synthesis; Free radicals in organic synthesis
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, Stereoelectronic 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)
Recommended Texts:
2. GM Loudon (1995);

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

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: Review of the particle-in-a-box model, simple harmonic oscillator, rigid rotator, the H-atom, eigen value relationships for observables; Approximate methods: Variation and perturbation theories, the He-atom; Electron spin and the Pauli principle, Slater determinants, spin magnetic moment. Many electron atoms: Atomic units, Hartree-Fock equations and the self-consistent field method, antisymmetric wave functions, Slater determinants, Hartree-Fock-Roothaan method, correlation energy, atomic term symbols; Molecules and Born-Oppenheimer approximation; Quantum mechanical interpretation of molecular orbital and valence bond theories.

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

CH 331  Physical Chemistry II (2 credits)
(Prerequisite: CH 231)

Advanced Thermodynamics (10L): 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-Helmholtz 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 real gases, reaction 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, Gibbs and Langmuir adsorption isotherms; Enthalpy of adsorption; 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, kinetics of complex reactions, catalysis, photochemistry

**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

**Nanotechnology:** Timeline, definition, nanotechnology in nature, synthesis and characterization of nanomaterials, industrial applications

Recommended Texts:
2. RJ Young and PA Lovell, Introduction to polymer, Oxford University Press

**CH 338  Physical Chemistry Laboratory II (1 credit)**
(Prerequisite: CH 238)

Experiments in physical chemistry: Electrochemistry, chemical kinetics, spectroscopy.

Recommended Texts:
3. P Mathews (1985), Experimental Physical Chemistry; Oxford University Press

**CH 339  Advanced Physical Chemistry Laboratory II (2 credits)**
(Prerequisite: CH 238)

Experiments in advanced physical chemistry: Electrochemistry, kinetics, spectroscopy.

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-Deement equation, ion-exchange chromatography, thin layer and paper chromatography, introduction to liquid-liquid chromatography.

Recommended Texts:
1. DA Skoog, West and Holler (2005), *Analytical Chemistry*; Marcel Dekker.

**CH 342 Computer Applications and Instrumentation (2 credits)**
(Prerequisite CH 231). Maximum of 60 students will be allowed to register including chemistry special students. Selection of the general degree students will be based on the GPA. Not allowed for those who have been offered CS 206.

Introduction to computers: Number systems (decimal, binary, octal and hexadecimal)
Logic gates: Combinational and sequential logic, de Morgan’s theorems, flip flops, counters, shift registers, computer memory organisation, analog to digital conversion (ADC), data acquisition and Instrument control, Introduction to computational chemistry:
Electronic structure calculations, molecularmechanics, force fields, molecular dynamics, monte-carlo simulation.

Recommended Text:

**CH 348 Analytical and Inorganic Chemistry Laboratory (1 credit)**
(Prerequisite: CH 218)
Inorganic preparations, colorimetry, applications of physical methods to study inorganic reactions, quantitative analytical methods.

Recommended Text:

**CH 351 Biological Chemistry I (2 credits)**
(Prerequisite: CH 321; 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 Texts:

CH 361 Environmental Chemistry (3 credits)
(Prerequisites: CH 211, CH 221)
Theory Component (30 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 (30 hr): Analysis of water quality parameters, 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)
(Prerequisites: CH 221, CH 231)
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 Texts:
1. PG Cooray (1964) Geology of Sri Lanka, Ceylon Museum
2. Industrial organic Chemistry by V, Karunaratne, Publisher:Science Education Unit, Faculty of Science, University of Peradeniy

MB 331 Fermentation Technology (2 credits)
(Prerequisites: CH 101, CH 102)
Microorganisms used in industrial fermentation; isolation and preservation of pure cultures; mutants, factors influencing rate of mutation; bioreactor design and operation; fermentation kinetics; culture media; sterilization; control of different parameters; process monitoring; isolation of products; current applications, synthesis of secondary metabolites, strain improvement applications of functional genomics in fermentation technology.
Recommended References:

HR 301 Human Resource Management (2 credits)

Recommended Text:

400 LEVEL COURSES

CH 411 Advanced Radiochemistry (1 credit)
(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)

Recommended Texts:

CH 414 Bio-Inorganic Chemistry (1 credit)
(Prerequisites: CH 211)
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:
2. SJ Lippard and JM Berg Principles of Bio-inorganic Chemistry, University Science Books, Mill Valley California
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:

CH 417  Topics in Solid State Chemistry (2 credits)
(Prerequisite: CH 211)

Advanced ceramics, inorganic polymers, conducting polymers and their applications, solid state batteries, nanostructures, sol-gel technology, semiconductor catalysts, photoelectrochemical solar cells, photovoltaics (15 L).

Crystal Lattices, metallic elements, alloys, ionic solids, defects, ceramics, glasses, layered MS₂ structures, Chevural phases, solid state electrolytes, solid state batteries, solid state synthesis, thermal techniques (15 L).

Recommended Texts:

CH 424  Special Topics in Organic Chemistry (1 credit)
(Prerequisites: CH 221, CH 326)

Molecular modeling for organic chemistry: Molecular mechanics, force fields, conformational searches, ensemble averaged properties, molecular dynamics, computational study of biomolecules, supra-molecules and self assembly (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): Stereochemical control in cyclic and acyclic systems. Chiral catalysis.

**Problem Solving** (15 L): Application of principles of stereochemistry, reaction mechanisms, organic synthesis and spectroscopy in solving problems in organic chemistry.

Recommended Texts:
CH 426  Natural Product Chemistry (3 credits)
(Prerequisite: CH 324)
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)
mechanism, molecular beam studies, examples of catalysis. Colloidal systems: classification and purification, stability of colloids, zeta potential, isoelectric point; Industrial applications.

**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:

**CH437 Modern Topics in Physical Chemistry (2 Credit)**
(Prerequisite: CH 330, CH 342)


**Electronic Structure Calculations** (10 L): Computer lab sessions on practicals regarding the above topics. Weekly assignments for calculations of: optimized geometry, absolute energy, molecular orbitals, predicting IR, NMR, and UV spectra, ab initio treatment of chemical reactions.

**Nano Technology** (10 L): Introduction to nanoscience, divergence of physical properties with particle size, quantum confinement, particle motion, carbon based nanoparticles (graphene, nanotubes, spherical fullerenes), quantum dots, noble metal nanoparticles, nanoporous materials, 'soft' nanoparticles.

Recommended Texts:
1. R. Leach, (2001), Molecular Modelling Principles and Applications, Longman

**CH 438 States of Matter: (2 credits)**
(Prerequisites: CH 317, CH 330)

Gas laws, intermolecular forces and potential energy functions, theories and models of liquids, properties of liquids, ionic liquids; Liquid crystals: Types, properties and applications. Bonding in solids: ionic forces, gadwalls forces, covalent bonding, H-bonding and metallic bonding; Cohesive energy of ionic crystals, calculation of crystal energies, heat capacity of crystals. Theories of solids: Classical theory, Einstein model, Debye model, free electron theory of metals; Properties of solids: conductance, thermal, mechanical, optical and magnetic properties, crystal engineering.
CH 443 Advanced Analytical Chemistry (3 credits)
(Prerequisites: 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, Capillary electrophoresis and electrochromatography.

Recommended Text:

CH 448 Analytical/Instrumental Chemistry Laboratory (1 credit)
(Prerequisite: CH 443)
Experiments in advanced analytical chemistry: Error Analysis as applied to instrumental techniques, Analytical atomic spectrometric methods, Analytical Molecular spectroscopic methods, Advanced electrochemical methods: Cyclic voltammetry and Amperometry, Gas liquid chromatographic and High Performance Liquid Chromatographic techniques in analysis.

Recommended Text:

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:

**CH 456 Proteins (1 Credit)**  
(Prerequisite: CH 321)  

Recommended Texts:

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

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

Recommended Texts:

**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 (6-8 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.

**SI 401 Industrial training (2 credits)**
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.

**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:
4. *An Introduction to Computer Science: An Algorithmic Approach*, Jean-Paul Tremblay & Richard B. Bunt

**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 104 Structured oriented Programming practical (1 credit)**
(Prerequisites: CS101, CS102)
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

Recommended Text:

**CS105 Object oriented Programming practical (1 credit)**
(Prerequisites: CS101, CS102)
Implementation of programs with object oriented language constructs: classes, objects, inheritance, aggregation, composition and polymorphism.

Recommended Texts:
2. *Java Programming: From the Beginning*, K. N. King, Georgia State University

**200 LEVEL COURSES**

**CS 201 Data Structures (2 credits)**
(Prerequisites: CS 101, CS 102)
Data Structures: linear and non-linear data structures. Arrays, lists: linked list, ordered linked list, and doubly linked list; push down stacks; queues: FIFO queue and deque. Tree structures – trees in general, binary search tree (BST), root insertion to BST, splay tree, 2-3-4 trees, radix tree and red-black tree; Graphs; Implementation of depth first search, breadth first search; Hashing: initial hash, collisions, separate chaining.
Recommended Texts:
2. Standish T. A.; Data Structures in Java; Addison-Wesley; 1998
3. Gregory L., Heilemen; Data Structures, Algorithms, & Object-Oriented
   programming; McGraw-Hill

CS 202  Data Structures Practicals (1 credits)
(Prerequisites: CS 104, CS105, CS 201)
Implementation of data structures studied in CS 201 using C, C++ and Java.
Recommended Texts:
1. Standish T. A.; Data Structures in Java; Addison-Wesley; 1998
2. Deitel, H. M.; Deitel, P. J.; Java how to Program; (5th Edition), Pearson
   Education Inc., USA, 2003

CS 203  Database Management Systems (2 credits)
(Prerequisites: CS 101, CS 102)
Overview: What is a database? Data and metadata. Conceptual Modeling: Entities,
attributes, associations, functional determination, 3-level structure, graphical
representation. Relational Databases: Relational algebra, Relational databases and
tables, Query languages. The entity-relationship model, Logical organization of
databases; Physical organization of databases; Characteristics of disks and disk blocks,
Storage of relations, Query processing and optimization, Concurrency control;
Transactions, Serializability, Locking, Recovery, Functional dependencies and forms,
Introduction to Distributed DBMS, OO DBMS, ORDBMS.
Recommended Texts:
1. Connolly, Begg; Database Systems: A Practical Guide to Design,
   Implementation and Management; 4th Edition; Dorling Kindersley ( India) Pvt.
   Ltd., Delhi, India, 2005
2. Ramez Elmasri and Shamkant B. Navathe; Fundamentals of Database Systems;
3. Date, C. J.; An Introduction to Database Systems; Addison-Wesley; 2000

CS 204  Programming using Database Management Systems (1 credits)
(Prerequisites: CS 104, CS 105, 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 (3 credits)
(Prerequisites: CS 101, CS 102)
Computer structure: processor, memory, I/O, Secondary storage, buses, clocks,
sequential operation, Fetch-Execute cycle. Data representation: Binary and hex integer
representations and conversions. Fixed-length arithmetic. 2's complement representation.
Memory organization into bytes, words, longs. Memory-mapped i/o. Processor: Simple
internal structure. Registers, program counter etc. The execution cycle. Instructions: The

Recommended Texts:

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; (2nd Edition), Cambridge Univ. Press; 1989

CS 209  Concurrent Programming (1 credits)
(Prerequisite: CS 105, CS 201)

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

Recommended Text:

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

Recommended Text:

300 LEVEL COURSES

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:

CS 304  Project in Computer Science I (3 credits)
(Prerequisites: CS 311, CS 315, CS 303 which shall be taken concurrently).
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:

CS 306 Compiler Construction (3 credits)
(Prerequisites: CS 315, 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 315)
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 Texts:

**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: CS104, CS 105, 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 Texts:
2. *Java 2 with Swing*; Deitel and Deitel

**CS 311  Software Engineering (2 Credits)**
(Prerequisites: CS 201)
Overview of software engineering; software process; classic life cycle model, iterative models, incremental model. Project planning; Fundamentals of project and system planning, Requirements analysis, Software design fundamentals; Stepwise refinement, bottom-up approach, modularity. Design techniques; Use of UML and design patterns, 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 Texts:
CS 312  Human Computer Interaction Design (2 Credits)
(Prerequisites: CS 201, CS 315)

Recommended Text:

CS 313  Digital Image Processing (2 Credits)
(Prerequisites: CS 315)
Introduction to digital images: why digital images, the digital camera, data types and 2D, 3D and higher dimensional representations, fundamental steps in digital image processing, elements of visual perception, light and electro-magnetic spectrum, image sensing and acquisition, sampling and quantization, relationships between pixels, Image transformations: histogram processing, spatial filtering, fuzzy techniques, Filtering in the frequency domain: Fourier transform, DFT, filtering. Morphological image processing: erosion, dilation, opening, closing, hit-or-miss transform, gray scale morphology, Image segmentation: point, line and edge detection, threshold, region based segmentation, watersheds. Representation and description: boundary descriptors, regional descriptors, Object recognition: patterns, pattern classes, classification. Color image processing: color models, image segmentation based on color. Performance evaluation and ROC analysis

Recommended Text:

CS 314  Image Processing practical (1 Credit)
(Prerequisites: CS 313)
Introduction, digital image representations, reading, displaying and writing images, data classes, image types, histogram processing, filtering, morphological processing, image segmentation, classification, Final group assignment

Recommended Texts:

CS 315  Design and Analysis of Algorithms (2 Credits)
(Prerequisites: CS 201, CS 202)
Analysis of Algorithms, NP-completeness; Classification by Field of Study: Searching, Sorting, String matching, Graph, Machine Learning; Genetic algorithms

Recommended Texts:

**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:

**HR 301 Human Resource Management (2 credits)**

Recommended Text:

**400 LEVEL COURSES**

**CS 401 Artificial Intelligence and Expert Systems: (3 credits)**
(Prerequisite: CS 311)
and components of Expert systems, Machine learning, Knowledge base and bank, Rule Knowledge, Inference engine, transit fare rule, Rule interpreter, Inference tree.

Recommended Texts:

**CS 402 Intelligent Systems in CIM (2 credits)**
(Prerequisite: CS 409)

Recommended Text:

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

Recommended Text:

**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 Texts:
CS 408  Computer Vision (2 Credits)
(Prerequisites: CS 313, CS 314)
Discrete geometry and quantization, length estimations, automated visual inspection, object recognition and matching, depth perception problems, stereo geometry and correspondence, motion analysis, optical flow, applications of Computer Vision, remote sensing, biomedical imaging, document processing, target tracking

Recommended Texts:

CS 409 Neural Networks and Fuzzy Logics (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. Parallel and distributed processing, Neuron, Connectivity, Activation function, propagation rule, Learning rules, pattern Preparation, Perceptron, Multilayer perceptron, Associative memory, Hopfield neural networks, Self organizing map (SOM), Adaptive Resonance theory, topologies, Training methods, supervised and unsupervised learning

Recommended Texts:

CS 410  Internet and Multimedia Systems (2 Credits)
(Prerequisites: CS 305)
IP Multicast: Service Model Layered transmission Multicast congestion control. Digital rights management: Legal issues Watermarking

Recommended Texts:
1. Introduction to Multimedia Systems (Communications, Networking and Multimedia), by Sugata Mitra and Gaurav Bhatnagar

CS 411 Multimedia practical (1 Credit)
(Prerequisites: CS 410)
Introduction to multimedia packages, sound editing, video editing, 2D and 3D animation design

Recommended Text:
1. Introduction to Multimedia Systems (Communications, Networking and Multimedia), by Sugata Mitra and Gaurav Bhatnagar

CS 412 Mobile and Pervasive Computing (2 Credits)
(Prerequisites: CS 305, CS 406)
Introduction and overview: A look at the general issues that will be addressed on this module. Properties of wireless PANs, LANs, WANs: Basic structure and operation. Ad-hoc and infrastructure networks. Physical constraints and limitations (transmission & reception). Network structures and architectures, including hand-off and mobility support at the physical/link level. Example technologies at the physical/link layers: PANs - Bluetooth. LANs - IEEE802.11, HiperLAN. Basic GSM and GPRS (2G/2.5G) network structure and protocol architecture. Next generation wireless overview (3G/4G) including UMTS, IMT-2000 and W-CDMA. Mobile IP: Mobile IPv4 and Mobile IPv6. Problems with routing, QoS and security. Overview of use of intelligence in mobile systems: Power management, replication, adaptation etc. Power management issues: From the lowest (physical device) levels, through communication protocols, broadcast methodologies, transcoding, etc. File systems, Mobile infrastructure support: Mobile middleware. Resource/neighbour discovery including peer-to-peer and gossip protocols. Adaptive and reconfigurable systems, Mobile multimedia and its relationship to proxying, Context sensitive applications, Ubiquitous computing, pervasive computing and ambient networking, Overlay networks and vertical hand-offs, Programmable networking and applications for mobile systems, Code mobility and control/signaling

Recommended Text:

CS 413 Information and Network Security (2 Credits)
(Prerequisites: CS 305)

Recommended Text:
CS 414  Software Project Management (2 Credits)
(Prerequisites: CS 311)
Project Management Life Cycle, Managing Project Teams, Managing Project Communication, Managing Project Scope, Managing Project Scheduling, Managing Project Resources, Managing Project Quality, Managing Project Risk, Managing Project Execution

Recommended Text:
1. Information Systems Project Management: A Process and Team Approach; Mark Fuller, Joe Valacich, and Joey George, Prentice Hall, 2007

CS 415  Industrial Training (3 Credits)
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained 'Daily Diary' and 'Students Record Book' which should be submitted to the Head of the Department within two weeks after completion of training. In addition, the students are expected to write a report and make presentation on the work carried out by them.

CS 421  Project in Computer Science II – Individual Project Work (6-8 credits)
(Prerequisite: CS 311)
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.

ST 402  Data Mining Techniques(3 credits)
(Prerequisites: CS 409)
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)
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:

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
MT209 (2 credits) Graph Theory
MT308 (2 credits) Combinatories
MT311(3 credits) Linear Programming
MT407 (3 credits) Optimization Theory

ENVIRONMENTAL SCIENCE

300 LEVEL COURSES

ES 301 Concepts in Environmental Science (3 credits)
Human Civilization: Development of human civilizations, man’s special place on earth, conflicts with nature, environmental effects of developments in science and technology on human civilization; Addressing environmental problems; Scientific method; Inductive and deductive reasoning, prediction, experimental controls, theories and principles, scientific design and uncertainty; An assessment of risks; Government and environment policy. Environment and society: Interaction between human society and the environment; Environmental literacy; Tradeoffs of industrialization and unanticipated natural disasters; Well managed environment and continued economic prosperity with quality of life; Technological, political and social options and strategies for managing the society and the environment; Food resources and world food problem; Agriculture and its impact on the environment and man; Crop disasters.

Recommended Texts:
ES 302 Biological Indicators in Environmental Assessments (3 credits)  
(similar to ZL 306)  
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 using indicator organisms to measuring and reporting environmental problems such as acidification, 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 of urban development in the developing world; developing a national set of environmental indicators.

Recommended Texts:

ES 303 Water and Soil Pollution (3 credits)
Aquatic environment and water resource; Properties of freshwater and seawater; Lotic and lentic waters; Man-made lakes and other aquatic facilities; Water pollutants; Types and sources of pollutants; Eutrophication and algal toxins; Biological oxygen demand and chemical oxygen demand and opacity; Run-off from agricultural land and roads; Sediment pollution; Seepage from mine tailings and landfill operations; Water quality parameters and standards; Chemical and ecological water pollution control; Techniques of containment and dispersal; Water-borne diseases.
Chemistry of soil, The classification of common pollutants in soils, soil functions, soil and sediment, soil pollutant load and soil quality parameters; Soil pollution.
Groundwater geochemistry: Fundamentals; Aquifer geochemical system; Rain water and groundwater; Solute transport; Contaminant interactions and reactive transport; Vadose zone processes; Water/rock interactions; Solution, redox and gas exchange processes; Classification of groundwater quality; Contamination of groundwater by inorganic and organic compounds and by microorganisms; Groundwater monitoring and remediation; Practical applications- landfills, metals contamination, acid mine waste, organic compound contamination; Water quality standards; Development of conceptual geochemical models; Numerical modeling.

Recommended Texts:
ES 304 Environmental law and Environmental Impact Assessment (2 credits)
Environmental acts and their enforcement. Legal aspects of environmental standards, case studies. Resource development and Environmental Impact Assessment (EIA) in Sri Lanka; Resources needed for EIA; Important principles in managing an EIA; The EIA process and Case studies.

Recommended Texts:

ES 305 Remote sensing and GIS (2 credits)
(similar to GL316)
Fundamental characteristics of electromagnetic radiation and the interaction of radiation with matter; Concepts of spectral resolution and detection; Remote sensing platforms; Active and passive sensing systems; Visual-digital interpretation; Applications of remote sensing in geology; Resource Exploration; Land use and land pattern analysis; Environmental and natural hazards; 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 work with GIS programs (e.g., Arcview and arc-Info).

Recommended Texts:

ES 306 Ecosystems of Sri Lanka: Their Ecology and Conservation (2 credits)
(similar to BT 310)
To provide a background on toxicological aspects of environmental chemicals and on mitigation of environmental toxins.
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 damanas).

Recommended Texts:

**ES 307 Wetlands and Their Exploitation (2 credits)**
Wetland types; Wetlands and wildlife; Fauna and flora of wetlands; Threats to wetlands; environmental problems associated with wetland exploitation; Salinisation and desalinization of wetlands; Ancient and recent irrigation systems of Sri Lanka; Water based tourism and its environmental effects; Wetland reclamation; Wetland and fisheries; Capture and culture fisheries; Effects of fisheries on the environment.

Recommended Texts:

**ES 308 Marine Resources and Marine Pollution (2 credits)**
Marine resources; Marine habitats and biodiversity (fauna and flora): coastal zone, open water and deep sea; coral and other reefs, Mangroves and salt marshes. Fishing and whaling; Over exploitation of marine resources; Marine and coastal pollution; Marine transportation and its effects on the sea; Desalination; Salt and chemical production.

Recommended Texts:

**ES 309 Analytical Chemistry (3 credits)**
(similar CH 314)
(Prerequisite: CH 231)
Advanced Calculations: 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; Inter laboratory 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: Atomic absorption and emission methods, molecular uv and visible absorption spectroscopy. Electroanalytical Chemistry: 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: 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. Analytical Chemistry, D.A. Skoog, West and Holler, Saunders College Publishing 1998

ES 310 Hydrology (2 credits)
(similar to GL 309)
Introduction to basic principles 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, evapotranspiration, 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:


ES 311 Mining and the Environment (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; Use of minerals, mineral distribution and formation, mining, processing and extraction. Environmental implications, Mineral conservation and recycling; Mining and its environmental problems in Sri Lanka (gems, dolomite, sand, clays, silica).

Recommended Texts:


ES 312 Biodiversity Conservation & Management (2 credits)
(similar to BT 309)
Biodiversity : Introduction, global biodiversity estimates, measuring biodiversity, loss of biodiversity, threats to biodiversity; Biodiversity conservation and sustainable development, setting conservation principles, species management, habitat management,
conservation education & ecotourism; Indigenous knowledge and biodiversity, international conventions on biodiversity, Field visits.

Recommended Texts:

ES 313 Energy, Weather and Environment (3 credit)
Renewable and non-renewable energy sources; The nature of electricity; The World’s energy problem; Generation of electricity/Basic mechanics; Potential/ Kinetic energy: frictional energy losses; Exponential growth and energy usage; Feedback Loops/ Hydrological Cycle; Fossil fuel production/ Consumption; Nuclear structure and energy; How a reactor works; Nuclear waste management; Urbanization and environment. Energy conservation I: Lightning and Insulation; Energy conservation II: Transportation and fuel savings; an overview of alternative energy; Atmosphere: Composition and structure; Earth –sun geometry; Energy and energy transfer; Nuclear radiation; Energy balance; Temperature; Atmospheric moisture; Atmospheric stability; Clouds and precipitation; Forces and winds; Wind systems; Weather systems; Severe storms; Climate change.

Recommended Texts:

ES 314 Geological Environment and Earth Resources (2 credits)
Evolution of the earth, minerals and rocks, formation of rocks, rock cycles, weathering and soil formation, processes of landform development, interior of the earth, earth’s internal processes, geological time scale, earth’s resources. Environmental effects of resource extraction, conserving geological resources, introduction to geological hazards (landslides and mass wasting, earthquakes and tsunamis, volcnoes, erosion).

Recommended Texts:

ES 315 Advanced Microbiology (2 credits)
(similar to BT 302)
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:

ES 316 Mathematics for Environmental Modeling (3 credits)
Linear Algebra: Introduction to matrices, the algebra of matrices, the transposed matrix, the inverse matrix, solving simultaneous linear equations by Gaussian elimination, finding the inverse of a matrix, determinants, eigenvalues and eigenvectors, numerical methods. Ordinary differential Equations: Introduction to differential equations, first order differential equations. (Variables separable differential equations, population models, epidemic models), linear differential equations, systems of first order differential equations. Recurrence equations: Introduction recurrence equations, first order recurrence equations, linear constant coefficient recurrence equations.
Mathematical modeling: Mathematical modeling through ordinary differential equations, Mathematical modeling through difference equations, mathematical modeling through mathematical programming.

Recommended Texts:

400 LEVEL COURSES

ES 401 Geological and Hydrologic Hazards (2 credits)
(similar to GL 417)
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:

**ES 402 Cleaner Production for Industry (2 credits)**
(similar to As 432)
Introduction to cleaner production, cleaner production tools; assessment and audits; Introduction of cleaner production in an enterprise and cleaner production methodology; Prerequisite for success of cleaner production; Cleaner production assessment, cleaner production team, process mapping and process flow diagram, data sources, material balance, energy balance, costing of waste; Alternating option generations; Better process control, equipment and product modification, technology change, onsite recovery/reuse; implementation of cleaner production options and pay back period; ISO 14000 standards; case studies and group exercises.

Recommended Texts:

**ES 403 Environmental Management and Sustainable Development (2 credits)**
Basic principles of management; Renewable and non renewable natural resources; Management of natural resources; Sustainable development; Local and international quality standards; Traditional and recent management practices; Land use policies and legislation; Education and research in conservation management.

Recommended Texts:

**ES 404 Air and noise Pollution (2 credits)**
Atmospheric composition and climate: Air pollution: Classes of air pollutants; Urban air pollution, air pollution modeling, global warming; Possible effects of greenhouse gasses; Ozone layer depletion and the Montreal protocol; Acid rain and its effects on biota; Air quality standards; causes and consequences of photochemical smog; Kyoto protocol, clean development mechanism, carbon trading.
What is sound pollution, sources of sound pollution, measurements, Decibel scale, adverse effects, legal aspects and regulations, Noise prevention and reduction.
Laboratory Component: Air sampling and air quality monitoring, biomonitoring of air pollution, Effects of pollutants on plants.

Recommended Texts:

**ES 405 Waste and Waste Management (3 credits)**
Disposal of waste water and waste water treatment: physical, chemical and biological. Design and specification of air, land and water pollution control and systems. Hazardous waste management and treatment; Industrial effluent treatment; Hospital waste treatment. Types of solid waste, disposal of solid waste; Municipal waste management, 3R’s (reduce, recover and recycle) strategy, Incineration of solid waste, Biological treatment
and its incineration; Waste as a resource for energy and fertilizer; Useful products from waste; Control of gaseous pollutants, cyclones, electrostatic precipitators. Laboratory exercises and field studies.

Recommended Texts:

ES 406 Environmental Analysis Laboratory (2 credits)
(Prerequisites: ES 309, CH 238)
Instrumental methods in environmental analysis: electroanalytical methods (ion selective electrodes potentiometry and amperometry), molecular spectroscopic methods (UV/Vis and IR), atomic spectroscopic methods (absorption and emission techniques), chromatographic methods (Gas-Liquid, Ion exchange and HPLC); Field work related to purification of drinking water and industrial effluent treatment; Water quality analysis including both biological and chemical analysis.

Recommended Texts:

ES 407 Ecotourism and Nature Conservation (3 credits)
(similar to ZL 405)
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:

ES 408 Biodiversity and Conservation Biology (3 credits)
(Similar to ZL 412)
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:

**ES 409 Oceanography and Coastal Geomorphology (3 credits)**
(similar to GL 406)
Sea flow spreading and tectonic history of the Indian Ocean; Physical properties of sea water, distribution of temperature, salinity and density in space and time, light in the sea, oceanic water circulation, major and minor elements in sea water, geochemical balance of the oceans, residence times, dissolved gasses in sea water, sea as a biological environment, effects of temperature, salinity, pressure and light on marine organisms. Distribution and composition of marine sediments; Formative processes and classification of coastal land forms with emphasis on coastal geomorphology of Sri Lanka. Coastal process and environments. Coastal and marine pollution.

Recommended Texts:

**ES 410 Environmental Biotechnology (2 credits)**
(similar to MB 416)
Living organisms as pollution indicators; biodegradation; waste management; pollution treatment; bio-mining; biogas production; microbes in environmental management.

Recommended Texts:

**ES 411 Medical Geology & Environmental Toxicology (2 credits)**
Definitions and terminology of medical geology/geochemistry; Classification of elements; Major, minor and trace elements in geological and biological materials; Geochemical classifications; Elemental link between geosphere and biosphere; Essential and non-essential elements with reference to human health; Trace element speciation in human health; Tropical environmental geochemistry; Case studies- (fluoride, iodine, water hardness, arsenic, selenium etc.); Geophagy; Natural radioactivity and health; Environmental toxicology of natural dust; Analytical methods; Health benefits of rocks and minerals. Toxic chemicals in the environment, persistent organic pollutants, heavy metal toxicity, carcinogenic and Mutagenic effects of industrial chemicals, pesticides and their problems, Improper use of pesticides and laws relating to use of pesticides; Integrated Pest Management (IPM); Good Agricultural practices (GAP); Alternatives to
synthetic pesticides; Bioaccumulation and biomagnifications; Chronic toxicity; Mixture of poisons; Sub lethal effects; Environmental factors affecting toxicity. Biochemical assays in environmental toxicology; Environmental Risk assessment.

Recommended Texts:

ES 412 Nanotechnology and the Environment (2 credits)
Introduction to nanoparticles: Structure, aggregation and characterization of nanoparticles, thermodynamics and kinetics of nano particles; Fate of engineered nanoparticles; Environmental toxicology of nanoparticles; Nanotechnology for environmental remediation; Nanoparticle based water treatment systems; Nanoparticles in natural water systems.

Recommended Texts:

ES 413 Environmental Economics (2 credits)
Concept of the externality, the Coase theorem and the importance of property rights as a determinant of market failure. Alternative revelation methods for determining the value of public goods; Pigouvian tax based solutions and other regulatory methods of pollution control including tradable permits, environmental subsidies; Implementation of these measures within the context of imperfect competition, imperfect mixing and with imperfect monitoring; Uncertainty and tax interaction effects; The monitoring and enforcement of environmental regulations; The ex-post regulation of environmental hazards using strict and negligence based liability versus ex-ante standards.

Recommended Texts:

ES 414 Applied Microbiology (2 credits)
(similar to BT 412; Prerequisites: 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; Water microbiology; Waste water treatment and utilization; Setting up a microbiological laboratory; Selected titles from the above course content will be offered each year.
Recommended Texts:

ES 415 Research Methodology and Scientific writing (2 credits)
(similar to AS 402)
Literature survey and quantitative research method; 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.

ES 416 Seminar (1 credit)
Seminars on assigned topics in Environmental Science should be presented after due preparation and literature survey by the students.

ES 417 Research Project (6-8 credits)
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.

GEOLOGY

100 LEVEL COURSES

GL 101 Earth Processes (3 credits)

Recommended Texts:
2. Summerfield, M.A. Global Geomorphology
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)
Common crystal forms, habits and twinning, their Point Group symmetry and classification into crystal systems and classes, Bravais lattices, Introduction to common rock-forming minerals, their composition, physico-chemical properties, classification and identification. Economic minerals, their composition, physico-chemical properties and identification. Introduction to igneous, sedimentary and metamorphic rocks, their classification, mineralogy and texture, and identification. Introduction to rocks of Sri Lanka. Introduction to fossils. Fossils, their preservation and interpretation. Study of common fossil forms in the Precambrian and Phanerozoic, their identification and biostratigraphy.

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; Cosmogeochemistry; 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)
Phase rule and equilibrium in metamorphic rocks. Equilibrium mineral assemblages and their graphical representation using ACF, AKF, AFM diagrams. Disequilibrium, textures
of disequilibrium, and metamorphic reactions. Spatial distribution of equilibrium mineral assemblages. Depth zones to facies concept. Facies series of metamorphism, granulite facies. Schreinemeker’s Method of graphical representation. Laboratory study of hand-specimens and thin-sections of rocks of various facies subfacies and facies series. Laboratory exercises on Schreinemeker’s method.

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 Text:

GL 314 Igneous Petrology (3 credits)
(Prerequisites: GL 201, GL 205)
Principles of partial melting, crystallization, intrusion and eruption, Magmatic processes: fractionation, magma mixing and assimilation, Kinetics of crystallization, Rock associations. Hand-specimen and thin-section study of igneous rocks

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:
2. Carbonate Sedimentology by MM.E.Tucker and V.P.Wright Blackwell 1992
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:

**HR 301 Human Resource Management (2 credits)**

Recommended Text:

**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)*

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)

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 Text:

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 Text:

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 (6-8 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

SI 401 Industrial training (2 credits)
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.
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 Texts:
   1. Mathematics for Biological Sciences, J.C. Arya and R.W. Lardner

MT 101  Vector Methods (2 credits)
Vector algebra: Introduction to vectors, Linear combinations, Linear dependence and
independence. Bases and
Solutions of vector
equations involving products.
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 formulac in Spherical Trigonometry.
Vector Functions of a Single Scalar Variable: Differentiation, Integration, Space
curves, Tangent and normals.

Recommended Texts:
   1. Elementary Vector Analysis, C.E. Weatherbum
   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 fist 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 Texts:
   1. A First Course in Differential Equations, D.G. Zill
   2. Differential Equations, H.T.H. Piaggio

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 he 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 disjoin 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 Texts:**
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 fame, Use of poplar 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 race.

**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 abut 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 Texts:**
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, epimorphism, Homomorphism, Isomorphism Theorems, Permutation Groups, Cayley’s Theorem, Isomorphism between Dihedral and Symmetric Groups, Conjugacy 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.

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

Recommended Text:
2. F.R. Giordano and M.D. Weir

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

Recommended Text:

**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:

**MT 209 Graph Theory (2 credits)**

Recommended Texts:
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)

**Vector Spaces:** The abstract definition using the definition of vectors in $\mathbb{R}^3$, $\mathbb{R}^n$, $\mathbb{C}^n$.


**Inner Product Spaces:** Abstract Inner Products and Norms, Distance and angle between two vectors, Cauchy-Schwarz Theorem, The Gram-Schmidt orthogonalisation Process, Linear Operator in Inner Product Spaces, Positive definite linear operators.

Recommended Texts:

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:

MT 303 Differential Geometry (2 credits)

*Curves in space:* Serret-Frenet formulae, Osculating plane, Osculating circle and osculating sphere, Involutes and evolutes, Helices.

*Surfaces:* Envelopes, Developable surfaces, Fundamental forms, Lines of curvature and Asymptotic curves, Ruled surfaces, Geodesics.
Recommended Texts:
2. CE. Weatherburn (1927), *Differential Geometry*, Cambridge University Press,

**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 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 Text:

**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 Text:
2. K.J. Haradam, Hadamand Matrics and it’s Applications, Princeton University Press.

**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 Text:
2. 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:

**HR 301 Human Resource Management (2 credits)**

Recommended Text:

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

**MT 401 Galois Theory (3 credits)**
(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
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:

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:

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 Text:
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:

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 Text:

MT 408 Independent Study/Project Work (6-8 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.

SI 401 Industrial training (2 credits)
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.
MOLECULAR BIOLOGY AND BIOTECHNOLOGY

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 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, exogernic and endogernic 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.
**BL 120 Introduction to Biotechnology and its Applications (2 credits)**

Introduction to Molecular Biology and Biotechnology, historical development, landmark discoveries and pioneering scientists, diverse applications of Biotechnology in medicine, food production and environmental protection. World Wide Web Resources on Biotechnology and their reliability, the fraudulent nature of bioterrorism and how to circumvent it through proper and safe use of Biotechnology. In the contexts of humanitarian and environmental catastrophes, the use of Biotechnology as a developmental tool to face the challenges in the present and future.

Recommended Text:
4. International Service for the Acquisition of Agri-biotech Applications (ISAAA), Operated in USA, Kenya and Philippines. Website: http://www.isaaa.org/.
5. GMO Compass, the task of GMO Compass is to collect objective, science-based information on the use of genetic engineering in the agri-food industry and present it to the public in a way that is easy to understand and readily accessible. Maintained at Genius GmbH, Robert-Bosch-Str. 7, 64293 Darmstadt, Germany. Website: http://www.gmo-compass.org/eng/.

**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)
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-dimentional 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
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 Text:

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 322 Molecular Biotechnology (2 credits)**
(Prerequisites: MB 226, MB 306)
Genetically modified organisms, and their applications; Emergence of Molecular Biotechnology, microbial biotechnology, agricultural biotechnology, medical biotechnology, germplasm assessment and conservation, aquatic biotechnology, bioremediation, effective microorganisms, bioprospecting, regulation of Biotechnology, Biotechnology as a business, career prospects in Biotechnology.

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 Fermentation Technology (2 credits)**
(Prerequisites: CH 101, CH 102)
Microorganisms used in industrial fermentation; isolation and preservation of pure cultures; mutants, factors influencing rate of mutation; bioreactor design and operation; fermentation kinetics; culture media; sterilization; control of different parameters; process monitoring; isolation of products; current applications, synthesis of secondary metabolites, strain improvement applications of functional genomics in fermentation technology.

Recommended References:

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**MB 333 Molecular Phylogenetics (2 credits)**
(Prerequisites: MB 206, MB 226)
Introduction to evolution and systematics; molecular basis of heredity and evolution; genetic maps; general principle of systematics; phylogenetic variations in plant and animal taxa (cladistics and phonetics etc.); molecular phylogenies; speciation and hybridization; applications of molecular methods in biodiversity assessment; in vitro germplasm conservation.

Recommended References:

**MB 335 Molecular Virology (3 credits)**
(Prerequisite: MB 226)
History of virology and general characteristics of viruses; virus classification; structure and genomes; virological methods; virus infection cycle; virus receptors and mechanism of virus entry; replication and transcription of RNA viruses; reverse transcription and integration of DNA viruses; replication and transcription of DNA viruses; viral protein synthesis; virus assembly and exit; virus pathogenesis; oncogenic transformation; host resistance to viral infection; antiviral treatment; HIV and AIDS; exploitation of viruses in gene therapy.

Recommended References:

**MB 337 DNA and Forensic Medicine Laboratory (2 credits)**
(Prerequisite: MB 226)
Principles and methods of DNA profiling; recent examples; biological evidences and serology, distribution and spattering of blood and other useful biological samples, isolation of DNA from forensic samples, techniques in DNA analysis; forensic DNA databases; STR population data analysis, forensic genetics, challenges and case studies, accreditation and quality control, applications such as criminal investigations and paternity analysis, implications in law enforcements, future trends.

Recommended References:
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)
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 Text:

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

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 prevntion 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 Text:

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

HR 301 Human Resource Management (2 credits)

Recommended Text:

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 412 Biotechnology Industry (2 credits)
(Prerequisite: MB 322)
Pharmacogenomics for personalized medicine, concept of White Biotechnology, industrial production process according to Kyoto objective applications, economic potential and implications for the society, biopharmaceuticals, food and feed, paper and pulp, bio-energy and high-tech food production with GM, Bio-refineries.

Recommended References:


**MB 416 Environmental Biotechnology (2 credits)**
(Prerequisites: MB 226, MB 322)
Living organisms as pollution indicators; biodegradation; waste management; pollution treatment; bio-mining; biogas production; microbes in environmental management.

**Recommended Texts:**

**MB 441 Special Topics in Cell and Molecular Biology (3 credits)**
(Prerequisite: MB 311)
Cancer as a micro-evolutionary process; The preventable causes of cancer, Finding the cancer critical genes; The molecular basis of cancer cell behavior; Cancer treatment: present and future. Epidermis and its renewal by stem cells, Renewal by multi-potent stem cells: Blood cell formation; Fibroblasts and their transformations, stem cell engineering. Primordial germ cells and sex determination in mammals; Eggs; Sperm; Fertilization

**Recommended Texts:**

**MB 472 Scientific Writing and Research Methodology (3 credits)**
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; research philosophy, responsible conduct of research, monitoring project progress, thesis writing, avoidance of plagiarism, indices to measure productivity of scientists and research organizations.

**Recommended References:**
MB 488 Biosafety Issues in Biotechnology (2 credits)
(Prerequisite: MB 322)
Status of molecular biotechnology in the world, use of genetically modified organisms in food industry and medicine, international treaties on biosafety such as Cartagena protocol, potential risks and their assessment, transgene introgression from genetically modified crops to their wild relatives (gene flow issues), the international guidelines for research involving recombinant DNA molecules, the release of genetically modified crops into the environment, food safety, biosafety framework for a country, the role of science in making informed decisions through transparent dialogues, globalization and the international governance of modern biotechnology for safe use.

Recommended Texts:

MB 489 Quantitative Genomics and Molecular Breeding (3 credits)
Advanced quantitative genetics and genomics, parametrical and non-parametrical statistical methods and related software, genome mapping and molecular markers, QTL theory, haplotype analysis, marker assisted selection as the basis of molecular breeding, association mapping, SNP platforms and GBS data, assessment and estimation of genomic diversity in germplasm conservation and management, definition of core-collections.

Recommended Texts:

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 491 Molecular Developmental Biology (3 credits)
Plant development; Arabidopsis as a model plant for plant molecular genetics, basic strategy and molecular mechanisms of sexual reproduction in flowering plants, germination, involvement of environmental and hormonal signals in coordinating developmental events of the seedlings, switch from meristematic growth to flower formation and cell signaling. Animal development; Basic anatomical features of animals, proteins mediating cell interactions and gene regulation, regulatory DNA, interactions between cells of embryo, inductive signals, asymmetric cell division, positive feedback, signaling pathways controlling developmental patterning, Caernorhabditis elegans as a model for the study of development, Drosophila and the molecular genetics of pattern formation, homeotic selector genes and the patterning of the anteroposterior axis.
organogenesis and the patterning of appendages, cell movements and the shaping of the vertebrate body, mammalian development and neural development.

Recommended Texts:

MB 492 Applications of Nanobiotechnology (3 credits)
(Prerequisite: MB 322)
Nanobiotechnological applications in environment and food, applications in health and disease, lab on a chip concept, protein biomolecular motors, molecular nanosystems, nanobiosensors and their applications, nanoparticle based molecular labels, engineering gene circuits, nanopore methods for DNA detection and sequencing, nanodiamonds and its applications, nanomaterials for cell detection, nanomembranes, nanoparticles as non-viral transfection agents, nanoparticles for electrochemical bioassays, microbial nanoparticle production, Nanobiotechnologies in adult stem cell research, nanotechnology in tissue engineering, enzyme reactors based on nano-structured materials, nanotoxicity, recent advances in Nanobiotechnology research and development.

Recommended Texts:

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

MB 499 Research Project (6-8 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.

SI 401 Industrial training (2 credits)
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.
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), Addison-Wesley

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; 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; 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:

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.
PH 333 Introductory Nuclear Physics (2 credits)
Compulsory for Special Degree

Distribution of Nuclear matter: α -particle scattering: Rutherford's formula, differential cross-section; 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, isomeric 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 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 characterization 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_{diff}, 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-Poiseuill’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 Astrophysics (2 credit)
(Prerequisite: PH 263)
Basic Theoretical ideas and observational data on star formation; Nucleosynthesis inside stars; end states of stellar evolution, a brief discussion on extragalactic astronomy, the space time dynamics of the universe; thermal history of the universe.

PH 365 Modern Particle Physics (2 credits)

PH 366 Physics of Atmosphere, Weather and Climate (2 credits)

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, Laguerrere and Special functions; Fourier series ; Integral transformations: Laplace and Fourier transformations; Green's function; Calculus of variations, Tensors.

PH 373 Computational Physics (2 credits)
Basic mathematical operations, ordinary differential equations, boundary value and eigan value problems, special functions of Gaussian quadrature, partial differential equations, Monte Carlo methods.
Recommended Text:
2. 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 375  Nanoscience (2 Credits)**
(Prerequisites: CH 231 or PH 230)

Recommended Texts:
2. Fundamentals of Nanoelectronics, George Hanson, Pearson, 2008

**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)

HR 301  Human Resource Management (2 credits)  

Recommended Text:

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 Langrangram 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; Einstein and Debye theories of  
heat capacity; phonons; point defects; Imperfect gases: Virial equation, Special Topics:  
Brownian motion; correlation functions; transport phenomena.  
Recommended Texts:  
    Publishing  

**PH 414  Lasers (1 credit)**  
Introduction: Properties of lasers, Stimulated emission, Population inversion,  
Amplification in a medium, Einstein coefficients; Laser Oscillation: Optical resonators,  
Concave mirrors and Brewster’s windows, Resonant cavities, Coherence length,  
Frequency doubling; Types of Lasers: Gas lasers, He-Ne laser, Argon laser, Molecular  
laser, CO₂ laser, Solid state laser, Ruby laser, Nd-glass laser and other lasers; Laser  
Applications and Laser safety.  
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:  
    college publishing  
    publishing com  

**PH 423  Electromagnetic Theory (2 credits)**  
(Prerequisite: PH 323)  
Electrostatics, Magnetostatics, Maxwell's Equations, Wave equation for Ø and A,  
Lorentz condition and gauge transformations; Poynting's theorem and Poynting's vector;  
electromagnetic momentum, Plane Electromagnetic Waves and Wave Propagation, Wave  
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 Text:

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:

**PH 455  Polymer Physics (2 credits)**
History of the development of synthetic polymers; chemical nature of polymers; Classification of polymers: Thermoplastic versus thermoset polymers, amorphous versus crystalline polymers molecular sizes and shapes and ordered structures; Distributions of molar mass and their determination, Bonding and the shapes of molecules, Conformations and chain statistics, The single freely joined chain more realistic chains, the excluded-volume effect, Chain flexibility and the persistence length. Evidence for ordered structures in solid polymers, Morphology: crystallinity, orientation; Mechanical Properties: strength, modulus, elongation, hardness; Thermal properties: glass transition temperature, heat capacity, thermal conductivity, thermal expansion coefficient Optical properties: light transmission, refractive index; Electrical properties: surface and volume resistivity, dielectric constant, electronic conductivity, ionic conductivity, piezoelectric. Differential scanning calorimetry (DSC) and differential thermal analysis (DTA), Density measurement, Light scattering, X-ray scattering, Infrared and Raman spectroscopy, NMR technique, Optical and electron microscopy. Applications of polymers, processing, environmental issues and recycling.

Recommended Texts:

**PH 456  Nuclear Magnetic Resonance (NMR) (2 Credits)**
Shimming, Phase Cycling, 1-D Hydrogen Spectra, Integration, SNR Improvement, Variable Temperature, Troubleshooting, Cryogen Fills **Carbon-13 NMR**: Introduction, Decoupling, Population Inversion, NOE, 1-D Spectra  

**2-D Techniques**: Introduction, J-resolved, COSY, Examples  

**Advanced Spectroscopic Techniques**: Introduction, Diffusion, Spin Relaxation Time, Solid State, Microscopy, Solvent Suppression, Field Cycling NMR

Recommended Texts:  
2. Basic One- and Two-Dimensional NMR Spectroscopy, Horst Friebolin, Wiley-VCH, Weinheim, 2005  

**PH 457 Advanced Nanoscience (2 credits)**  
(Prerequisites: PH 375)  

Recommended Text:  
2. Fundamentals of Nanoelectronics, George Hanson, Pearson, 2008

**PH 458 General Relativity (2 credits)**  
(Prerequisites: PH 370)  
Tensor calculus on manifolds; the equivalence principle and space time curvature; The gravitational field equations and their structure; The Schwarzschild geometry and experimental tests of general relativity; Linearized gravity and gravitational waves; The Friedman-Robertson-Walker Geometry and cosmological models.

Recommended texts:  

**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 (6-8 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.

**SI 401 Industrial training (2 credits)**
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.

**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:

ST 102  Introduction to Probability Theory  (3 credits)
Approximation to Binomial using Poisson, Binomial using Normal, and Poisson using Normal.
Recommended Texts:

ST 103  Statistics Applications I (1 Credit)
(Prerequisite : ST 101 or any other Basic Statistics course)
Introduction to statistical packages, Data management: Editing, summarizing, Transforming and Manipulating Data, Graphical methods for describing data, Numerical methods for describing data, Distributions and Random data. Applications of statistical packages
Recommended Texts:
1.  MINITAB Reference manual
2.  Introductory statistics with R, Dalgaard P.
3.  Data manipulation with R, Spector P.

ST 104  Statistics Applications II (1 Credit)
(Prerequisite: ST 101 or any other Basic Statistics course)
Introduction to statistical software for Data analysis and Statistical Computing, Obtaining numerical and graphical summaries, Model fitting, Basics of statistical programming
Recommended Text:
1.  Introductory statistics with R, Dalgaard P.
2.  SAS Reference manual

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

**ST 105/MT 107  Mathematics for Statistics (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:

**200 LEVEL COURSES**

**ST 201  Probability Theory (3 credits)**
(Prerequisites : 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 Xᵢ, MAX Xᵢ, etc., Distributions of sample mean and sample variance; t, F and χ² distributions and their properties, Laws of large numbers, Central limit theorem.

Recommended Texts:

**ST 202  Applied Statistics (3 credits)**
(For students who do not offer Statistics as a major subject. Equivalent to BT 209 offered by the Department of Botany and ZL 205 offered by Department of Zoology.)

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)
(Prerequisites: ST 201)
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.
Some practical assignments will be given for this course

Recommended Texts:

ST 204 Sampling Techniques (2 credits)
(Prerequisites: ST 203)
Some practical assignments will be given for this course

Recommended Texts:

ST 205 Statistical Simulation (2 credits)
(Prerequisites: ST203)
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:
MT 202 Real Analysis II (3 credits)
(Prerequisites: MT105)
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 integral 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)
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: 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:
2. M.D. Raisinghania (1997), Vector Analysis, S. Chand & Comp. Ltd.

MT 207 Numerical Analysis I (2 credits)

Recommended Text:
MT 209  **Graph Theory (2 credits)**  

**Recommended Texts:**

**300 LEVEL COURSES**

**ST 301 Regression Analysis (3 credits)**  
(Prerequisite: 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. Some practical assignments will be given for this course.

**Recommended Texts:**

**ST 302 Quality Control (2 credits)**  
(Prerequisites: 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. Some practical assignments will be given for this course.

**Recommended Texts:**

**ST 303 Design and Analysis of experiments (3 credits)**  
(Prerequisites: ST 203)
Comparison of two samples (independent, dependent), One-way ANOVA: Assumptions, Normal theory, F-tests. Multiple comparisons: LSD method, Tuckey's method, Bonferroni method, Scheffe’s method, Duncan’s multiple range method.

202
Two-way ANOVA: Normal theory, Randomized block design, The two factor factorial, Multifactor Factorials, Confounding, Introduction to Analysis of covariance, Latin square. Some practical assignments will be given for this course.

Recommended Texts:

**ST 305  Multivariate Methods I (2 credits)**
(Prerequisites: ST 105, ST 203)
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 Analysis (2 Credits)**
(Prerequisites: ST203, 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:
ST 308 Bayesian Statistics I (2 credits)
(Prerequisites: ST203)
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 309 Non-Parametric & Categorical Data Analysis (3 Credits)
(Prerequisites: ST203)
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 and Goodness of fit tests, The Kolmogorov-Smirnov test, Inference on two-dimensional contingency tables, Models for binary response variables and generalized linear models: Logistic regression, logit models, probit models, Model diagnostics Log-linear models: Log-linear models for two or more dimensions, testing goodness of fit, estimation model parameters, Strategies in model selection, Analysis of deviance, Log-linear models for ordinal variables, Some practical assignments will be given for this course

Recommended Texts:
1. *Nonparametric Statistical Inference*, Gibbons J.D. & Chakrabortic S.,
2. *Categorical Data Analysis*, Alan Agresti
3. *Generalised Linear Models*, McCullagh and Nelder

ST 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.

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:
MT 304  Partial Differential Equations (2 credits)
(Prerequisites: ST 105)
First order partial differential equations: Linear equations, Non-linear equations, Characteristics.
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 Text:
2. [Other recommended texts]

HR 301  Human Resource Management (2 credits)
Recommended Text:

400 LEVEL COURSES

ST 401  Actuarial Statistics (2 credits)
(Prerequisites: ST 203)
Economics of uncertainty. Risk theory and utility. Jensen's inequality. Sums of random variables and convolutions. Applications to individual risk models. Failure rates and the

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: CS 409)

Some practical assignments will be given for this course

Recommended Texts:

**ST 403  Statistics for Bioinformatics (2 credits)**
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: ST201, 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)**
(Prerequisites: 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)**
(Prerequisites: 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:

**ST 407 Linear Models (3 Credits)**
(Prerequisites: ST 105, ST 203)

Recommended Texts:
1. *Matrices with Applications in Statistics*, F.A.Graybrill, Wadsworth
2. *Theory and Applications of the Linear Model*, F.A.Graybrill, Wadsworth

**ST 408 Reliability Theory and survival analysis (3 Credits)**
(Prerequisites: ST 203)
Survival analysis: Introduction, Survival curves, Parametric modeling, Cox’s proportional hazards model, Extensions.

Recommended Texts:

**CS 401 Artificial Intelligence and Expert Systems: (3 credits)**
(Prerequisite: CS 311)

Recommended Texts:

**CS 409 Neural networks and Fuzzy logics (3 Credits)**
(Prerequisites: 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. Parallel and distributed processing, Neuron, Connectivity, Activation function, propagation rule, Learning rules, pattern Preparation, Perceptron, Multilayer perceptron, Associative memory, Hopfield neural networks, Self organizing map (SOM), Adaptive Resonance theory, topologies, Training methods, supervised and unsupervised learning

Recommended Texts:

**ST 423 Industrial Training (3 Credits)**
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained 'Daily Diary' and 'Students Record Book' which should be submitted to the Head of the Department within two weeks after completion of training. In addition, the students are expected to write a report and make presentation on the work carried out by them.

**ST 426 Research Project (6-8 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. At the completion of the project students are expected to write a report and make a presentation.

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

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ST 103</td>
<td>Statistics Applications I</td>
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<td>ST 204</td>
<td>Sampling Techniques</td>
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<td>ST 303</td>
<td>Design and Analysis of experiments</td>
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<td>ST 304</td>
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<td>ST 301</td>
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<td>GL316</td>
<td>Remote Sensing and GIS</td>
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<td>MT311</td>
<td>Linear Programming</td>
</tr>
<tr>
<td>MT407</td>
<td>Optimization Theory</td>
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</tbody>
</table>

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

GL316 (2 credits) Remote Sensing and GIS
MT311 (3 credits) Linear Programming
MT407 (3 credits) Optimization Theory

**ZOOGY**

**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:


**BL 102 Plant and Animal Form & Function (2 Credits)**

*Plant Form & Function*: Tissue types; Internal structure of plants and organs; Photosynthesis; Transport systems; Plant nutrition.

*Animal Form & Function*: Levels of body organization, body form and symmetry; Major animal groups and their basic needs for survival; How different animal groups solve problems of survival and challenges of
the environment through form and function; Functional adaptations of animals under extreme environmental conditions.
Practicals based on above.

Recommended Texts:

**BL 103 Basic Ecology (2 Credits)**
Ecological levels (individuals, populations, communities, habitats, ecosystems, biomes, biosphere); Components of the physical environment (energy, water, atmospheric gases, wind, fire, gravity, topography, geologic substratum and soil); Energy flow in ecosystems (trophic levels, food webs, productivity); Cycles of materials (hydrological cycle, carbon cycle, biogeochemical cycles).
Practicals based on above.

Recommended Texts:

**BL 107 Basic Microbiology (2 credits)**
Laboratory exercises based on the above topics.

Recommended Texts:
BL 115 Biomolecules (2 Credits)
Essential classes of biomolecules - nucleic acids, proteins, fatty acids & lipids and carbohydrates; structure and function; chemistry, properties and interactions of biomolecules; applications of biomolecules in agriculture, medicine, forensics and industry (15 L).
Laboratory exercises based on above topics (30 P).
Recommended Texts:

BL 116 Introductory Environmental Biology (2 Credits)
Basic concepts in environmental biology; Hydrosphere; Lithosphere; Atmosphere; Biosphere; renewable & nonrenewable resources and cycling of energy & matter; Climate & life; human population growth & problems of overpopulation; Atmospheric pollution and global changes: impacts of atmospheric pollution on biota- plants, animals, humans, carbon footprint; World food resources & green revolution; Effect of agriculture on environment; Water resources: pollution and treatment methods; Solid and hazardous wastes; Environmental health & toxicology; Sustaining terrestrial biodiversity and urban biodiversity. Global resources and associated problems.
Practicals based on above.
Recommended Texts:

BL 117 Biotic Interactions (2 Credits)
Neutralism verses interactions among plants, animals and microbes; kinds of biotic interactions with examples, interspecific interactions and intraspecific interactions – symbiotic relationships, protection and defense, competition & allelopathy. The role of trophic interactions in community initiation, maintenance and degradation. Biotic interactions affecting the sizes of species populations and diversity. Community consequences of biotic interactions and co-evolutionary dynamics. Biotic interactions in human dominated landscapes. Application aspects of biotic interactions (15 L).
Laboratory exercises based on above topics (30 P).
Recommended Texts:


**BL 118 Introductory Evolutionary Biology (2 Credits)**

Introduction; Evidence for evolution; Mechanisms of evolution; Micro and macroevolution; Speciation; Co-evolution; Adaptation; Adaptive radiation; Phylogenetics; Phenotypic plasticity; Kin selection; Parent offspring conflict; Human evolution; Health and evolution; Evolution of photosynthesis, angiosperms and crop plants.

Practicals based on above.

Recommended Texts:


**BL 120 Introduction to Biotechnology and its Applications (2 credits)**

Introduction to Molecular Biology and Biotechnology, historical development, land mark discoveries and pioneering scientists, diverse applications of Biotechnology in medicine, food production and environmental protection. World Wide Web Resources on Biotechnology and their reliability, the fraudulent nature of bioterrorism and how to circumvent it through proper and safe use of Biotechnology. In the contexts of humanitarian and environmental catastrophes, the use of Biotechnology as a developmental tool to face the challenges in the present and future.

Recommended Text:

4. International Service for the Acquisition of Agri-biotech Applications (ISAAA), Operated in USA, Kenya and Philippines. Website: http://www.isaaa.org/.
5. GMO Compass, the task of GMO Compass is to collect objective, science-based information on the use of genetic engineering in the agri-food industry and present it to the public in a way that is easy to understand and readily accessible. Maintained at Genius GmbH, Robert-Bosch-Str. 7, 64293 Darmstadt, Germany. Website: http://www.gmo-compass.org/eng/.
200 LEVEL COURSES

ZL 201 Animal Embryology (2 Credits)
Historical development of embryology; Gametogenesis, structure and function of gametes; Process of fertilization; Principles and concepts of different embryonic stages and processes: cleavage, blastula, gastrulation, gastrula, neurulation, neurula and organogenesis; Early embryonic development of Amphioxus, frog, chick, human and selected invertebrates.
Practicals based on above.
Recommended Texts:

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.
(Equivalent to BT 209 and 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 206 Invertebrate Diversity (3 Credits)
Classification and life history of Protozoa; Introduction to Metazoa; Characteristic features, diversity, ecology, life history and phylogenetic relationships of the following invertebrate phyla: Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda, Annelida, Onychophora, Arthropoda, Mollusca, Echinodermata, Hemichordata, Tardigrada, Bryozoa, Brachiopoda.
Practicals based on above.
Recommended Texts:
ZL 215 Zoogeography and Sri Lankan Fauna (2 Credits)
Theories of Continental Drift and Plate Tectonics; Earth’s mantle and core; Tectonic plates and their motion; Supercontinent cycle; Geological time scale; History of zoogeography; Patterns of zoogeography; Biological processes in zoogeography; Ecological zoogeography: dispersal of animals, barriers for dispersal; Zoogeographic regions: terrestrial and oceanic regions and inland waters; Centers of origin and divergence of species; Island biogeography; Sri Lankan fauna.
Practicals based on above.
Recommended Texts:

ZL 216 Vertebrate Diversity (3 Credits)
Origin and evolution of protochordates and vertebrates; Diversity, distribution, and classification of protochordates (urochordates and cephalochordates) and vertebrates: jawless fishes, cartilaginous fishes, bony fishes; amphibians, reptiles (including major extinct groups), birds and mammals.
Practicals based on above.
Recommended Texts:

ZL 217 Coastal Ecosystems and Coral Reefs (2 credits)
Introduction to the coastal environment; Biology and ecology of communities in rocky intertidal zone, estuaries, salt marshes, mangroves, coral reefs, sea grass beds; Human impact on the coastal zone; Disturbances and restoration; Coastal zone management; Regulations and laws.
Recommended Texts:

ZL 218 Histological and Museum Techniques (1 credit)
Tissue processing and microtomy; Slide mounting and staining of whole specimens, tissues and embryos; Histochemistry; Taxidermy and preparation of skeletons; Curation of vertebrate and invertebrate specimens.
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:  

**300 LEVEL COURSES**

**ZL 302 Comparative Anatomy And Animal Physiology (2 Credits)**  
Comparative anatomy and physiology of digestive, respiratory, excretory, circulatory, nervous, musculoskeletal, reproductive and endocrine systems in selected invertebrates and vertebrates; Homeostasis in vertebrates.  
Practicals based on above. 

Recommended Texts:  

**ZL 307 Fish Biology (2 Credits)**  
Morphological, physiological and ecological diversity of fishes; Behavior, growth, life history strategies; Composition of major fish assemblages; Fishes and their habitats; Fish community structure, food webs and pollution dynamics.  
Practicals based on above. 

Recommended Texts:  

**ZL 314 Evolutionary Biology and Systematics (2 Credits)**  
Conceptual and philosophic issues in evolutionary theory; Molecular evolution; Phylogenetics; Evolution and development; Limits on adaptation; Life history evolution; Phenotypic plasticity; Assessing the factors that affect rates of speciation and extinction; Causes of geographic variation in genetic diseases; Evolutionary applications in biomedicine, disease biology, biotechnology, climate change, conservation biology, aquaculture fisheries and wildlife management, forestry and agriculture. Course will consist of interactive lectures and discussions of scientific papers.  
Practicals based on above.
Recommended Texts:

**ZL 322 Insect Pest Management (2 credits)**

Introduction to insect pests; Insect population dynamics and pest status; Insect pests of agriculture, stored products, plantation crops, forestry, horticultural and export crops; household insect pests; Insect pest control; physical, biological, chemical and integrated pest management. Insecticide resistance and mechanisms of resistance. Success stories of pest control.

Recommended Texts:

**ZL 323 Vector Borne Diseases (2 credits)**

Taxonomy, morphology, distribution and life cycle of medically and veterinary important vector borne pathogens; Emergence and resurgence of vector borne diseases; Dynamics of transmission; Detection and control; Integrated strategies to address vector borne diseases; Environmental and ecological relations, Outbreaks and geographic spread of vectors and pathogens; Vectors of medically and veterinary importance, and their control; Case study on currently important vector borne disease in Sri Lanka.

Recommended Texts:

**ZL 324 Inland Fisheries and Aquaculture (2 credits)**

Island fisheries of Sri Lanka, its importance and potential: species involved, fishing gear and methods, techniques of natural stock enhancements in inland fisheries: fishery regulation and management.

Recommended Texts:

ZL 326 Animal Behaviour (2 credits)
An evolutionary approach to animal behaviour; Proximate and ultimate causes of behaviour; Development of behavior; Heredity and environment; Economic decisions; Evolutionary arms race; Competition for resources; Living in groups; Fighting and assessment; Sexual conflict; Parental care and mating systems; Selfishness and altruism.

Recommended Texts:

ZL 327 Animal Genetics and Molecular Biological Techniques (2 credits)
(Equivalent to MB 226/ BT 307)
Genetic variation; Chromosomal and extra-chromosomal inheritance; Variation in chromosome number and structure; Organization of prokaryotic and eukaryotic genomes; DNA replication, transcription and translation; Genetic code; Regulation of gene expression; DNA and RNA extraction; Genomic DNA and Complimentary DNA, Agarose and Polyacrylamide gel electrophoresis; DNA manipulative enzymes; Polymerase Chain Reaction and Gene Cloning; Repetitive DNA sequences; DNA fingerprinting and barcoding; DNA microarrays and RNA interference (gene silencing); DNA sequencing; Genetic disorders and gene therapy.

Recommended Texts:

ZL 328 Herpetology (3 credits)
Transition from water to land; Evolution and adaptive radiation of amphibians and reptiles; Biology of herpetofauna; Communication and behavior of amphibians and reptiles; Parental care and reproductive strategies; Herpetofauna as bio-indicators; Global and local threats to herpetofauna; Conservation and management of amphibians and reptiles; K/T extinction of dinosaurs.
Recommended Texts:


**ZL 329 Avian & Mammalian Biology (3 credits)**

Origin and evolution of birds; Form & function: feathers and dynamics of bird flight; Vocalizations; Social behavior; Annual cycles of birds; Migration and navigation; Avian life histories: mates, breeding systems, nests and incubation; Population dynamics; Adaptive radiation of birds: Darwin’s finches and Hawaiian honeycreepers; Origin and evolution of mammals; Mammalian characteristics; Biology of prototherians (egg-laying mammals), metatherians (marsupials), and eutherians (selected groups including elephants, primates, rodents, bats, carnivores, artiodactyls, and cetaceans).

Recommended Texts:


**ZL 330 Ecotourism and Nature Conservation (2 credits)**

Historical perspective of ecotourism; Ecotourism vs mass tourism; Socio-cultural impacts; Regional economic development; Zoos, wildlife parks and other ecotour attractions; Ecotourism resorts and tour companies; International and domestic ecotourism; National and international policies and accreditation programs; Future trends; Constraints and pitfalls; Ethics in ecotourism; Case study analysis.

Recommended Text:


**ZL 331 Limnology and Wetland Ecology (2 credits)**

Physics, chemistry and biology of freshwater systems; Emphasis on: morphometry; Light and temperature; Water chemistry in relation to nutrients; Physiological requirements;
Composition and interaction of algal and invertebrate populations; Eutrophication; Pollution; Environmental change of freshwater systems.

Recommended Text:

ZL 332 Quantitative Ecology (2 credits)
Ecological data; Hypothesis testing in ecology; Estimating abundance in animal populations; Line transects, quadrat counts, mark-recapture techniques; Population growth and carrying capacity; Population regulation; Age structure; Life history strategies; Survivorship curves and life tables; Interspecific interactions: Investigating food habits of terrestrial vertebrates; Niche overlap and diet analysis; Species diversity measures.

Recommended Texts:

400 LEVEL COURSES

ZL 404 Applied Parasitology (3 Credits)
Epidemiology of parasitic diseases with special reference to Sri Lanka; Drug resistance of parasites; Zoonoses; Emerging and re-emerging infectious diseases; Epidemiology and control of helminthes in livestock; Parasite behaviours; Parasite-induced alterations in host behavior, reproduction and survival; Evolution of parasitism; Impact of parasites on wild animal health and population declines; Medically and veterinary important arthropods and vector borne diseases; Diagnostic techniques of parasitic diseases; Assignments and discussions on current research articles. Practicals based on above.

Recommended Texts:

ZL 406 Environmental Biology (3 Credits)
Adaptation to environment and adapting 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; Agrochemicals 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:

**ZL 407 Immunobiology (3 Credits)**
Adaptive and innate immunity; cells and soluble mediators of immune system; Antigens and antigen presentation; inflammation; Antibodies; T-cell receptors; Major histocompatibility complex; Cytokines and cytokine receptors; Evolution of immunity; Vaccination; Tumor immunology; Immunodeficiency; Transplantation and rejection; Autoimmunity and autoimmune diseases; Hypersensitivity; immunological techniques. Practical and discussions 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; Inshore and offshore fishery; Fishing gear; Marine fishery resources of Sri Lanka; Mariculture of shellfish. Practical based on above.

Recommended Texts:
1. *The Effects of Fishing on Marine Ecosystems and Communities*. S.J. Hall.
ZL 411 Wildlife Management (3 Credits)
Wildlife Census Techniques; Population: Growth and Regulation; Carrying capacity; Sustainable Yield Harvesting; Effective Population Size (EPS); Minimum Viable Population (MVP); In-situ and Ex-situ conservation; Extinction; Vertebrate pest control; Management of Threatened Wildlife; Island Biogeography and Principles of Reserve Design; Categories of Protected Areas; Protected Areas of Sri Lanka; Wildlife and Society; International Conventions.
Field studies and assignments.
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 421 Scientific Writing and Presentation (2 Credits)
History and origin of scientific writing; Types of scientific journals and articles and their characteristics; Scientific method; Information retrieval methods (Print & electronic); Format and content of a research paper; Guidelines for making an effective scientific presentation (oral and poster); Guidelines for writing a project proposal, research report and thesis; Ethics in research and scientific writing; Plagiarism; Critical examination and presentation of a scientific paper; Interactive discussions of scientific papers.
Assignments based on above.
Recommended Texts:
ZL 491 Research Project (6-8 credits)
A research project on a given zoological topic shall be carried out under the supervision of staff members. 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.

SI 401 Industrial training (2 credits)
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained ‘Daily Diary’ which should be submitted to the Head of the Department within two weeks after completion of the training. In addition, the students are expected to write a report and make a presentation on the work carried out by them.

ZL 424 Research Methods and Data Analysis (2 credits)
Designing and conducting research; Data collection; Concepts of probability and probability distributions and how they are applied in statistical testing; developing and testing hypothesis; Errors in hypothesis testing; Parametric and nonparametric statistics; Univariate and multivariate data analysis; Applications of statistical packages.

Recommended Texts:

ZL 425 Entomology (2 credits)
Insect systematics; Anatomy and physiology of insect organ systems; Development and growth; Sensory perception; Communication and behavior of insects; Insect adaptations to live in different environments, Social insects; Apiculture; Insect pollination; Predatory and parasitic insects; Insects of forensic importance.

Recommended Texts:
**ZL 426 Developmental Biology (2 credits)**

Fate, potency, cell specification and differentiation, morphogenesis, cell adhesion in embryonic development; Genome equivalency and differential gene expression; Stem cells, regeneration, animal cloning, maternal and zygotic control of gene expression; Cell-cell communication during development: inductive events, signal transduction cascades, cell death pathways; Patterning the embryonic body plan: embryonic axes and germ layers, tetrapod limb development.

Recommended Texts:


**ZL 428 Independent Study & Seminar (2 credits)**

Make a presentation of an assigned topic after literature survey and produce a written article on the topic critically analyzing primary literature. Write two essays in the class on given topics after due preparation and literature survey.

Recommended Texts:

1. Primary Literature relevant to the topic.
SUPPLEMENTARY COURSES
ECONOMICS

EC 201 Introductory Economic Theory (3 credits)

Recommended Texts:

EC 301 The Sri Lankan Economy (2 credits)
(Prerequisite EC 201)

Recommended texts:

MANAGEMENT STUDIES

MG 201 Management Studies I (2 credits)

Recommended Texts:

MG 301 Management Studies II (2 credits)

Recommended Texts:

SCIENCE EDUCATION

SE 101 Science and Society (3 credits)
(Only for the students who follow the Computational Management programe)
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 Texts:

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

Recommended Text:

**SE 202 Educational Philosophy and Educational Management (2 credits)**
(Prerequisite: SE 201)

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

**SE 301 Methodology in Teaching Science (2 credits)**
(Prerequisite: SE 201)
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)*
(Prerequisite: SE 201)
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:

**SE 303 Assessing students in the learning process (2 credits)**
(Prerequisite: SE 201)

Recommended Texts:

**SE 310 Introduction to Scientific Writing (1 credit)**

Identification of different subtopics in a scientific report. Type of information presented under different subtopics. Avoiding plagiarism. Methods of quoting references in the text. Methods of referencing in different bibliographic styles. Deciding on information to be included in the abstract.

Recommended Texts:

APPLIED SCIENCES SUBJECT AREA

An additional 30 credits at 400 level from the course units in the Applied Sciences subject area, as stated below.

- All the compulsory courses, which are of multidisciplinary in nature (11 Credits)
- Industrial training component (8 Credits)
- At least 11 credits of optional courses selected from at least three subject categories among six subject categories based on biology, chemistry, geology, mathematics, physics and statistics & computer science.

AS 400 Industrial Management (2 credits - Compulsory)
Approaches to Management: Introduction to Management; Organizations and importance towards effective work; The scientific, the human relation, the quantitative and the systems approach.
Group Dynamics: Formal and informal organizations, teamwork & teambuilding; self managing teams; Motivation; motivational drives, models of motivation, behaviour modification, contemporary motivational approaches; Productivity and worker satisfaction.
Communication in Organizations: The Two-Way communication process, communication barriers, upward, downward and lateral communication. public speaking.
Managing Conflicts Stress and Counseling: Nature and level of conflict, sources of conflict, effects of conflict, conflict resolution, change management; Work change, resistance to change, implementing change successfully; Stress and job performance, approaches to stress management, employee counseling; Effect of culture on organizational behavior and its impact on management.

Recommended Texts:

AS 401 Industrial Placement (8 credits)
Train students with work experience in an industrial environment and to produce a model science graduate to be competent to work in the industrial sector through variety of activities as specified by Sri Lankan industries. Students will specifically gain knowledge in the following areas during this period: Type of raw materials; Industrial process; Problems associated with the process; Quality control; Research & Development aspects; Management aspects.
This course will be graded based on evaluation by industries, report

AS 402 Research methodology and scientific writing (2 credits)
Methods of Research: To provide skills of survey and quantitative research methods.
Scientific Writing: Literature survey – traditional and modern methods; Improve scientific report writing skills: writing abstracts, summary of research papers, proposal writing, etc.
Recommended Texts:

**AS 403 Seminar (1 credit)**
Under this course undergraduate students will give oral presentations and listen to presentations by various people in Departments and by other speakers. Each student enrolled in the course will give one oral presentation which will be evaluated by a team of members of the Faculty. Learning from and with each other is one important aspect of this course. Participation includes punctual attendance, engagement with topics being discussed, answering the posed relevant questions etc. **20-minute Student Seminar:** Students are encouraged to choose a topic with the guidance of a faculty member assigned. After preparation of a 20-minute presentation based on material in the published literature (journal articles or websites), it should be then submitted to the lecturer assigned by the coordinator for approval. This will be then presented to a selected audience according to a roster. *These seminars will be graded based on continuous attendance, performance/speaking ability, grasp of material, use of appropriate visual aids, answers to questions, and an overall presentation.*

**AS 404 Data Integrity Management & Data Analysis (2 credits-Compulsory)**
*Data Integrity Management:* Good laboratory practice (GLP); Facilities and equipment (including computer systems); Use of equipment; Managing test and reference items and reagents; Design of experiments to obtain variable data; Record keeping; Storage and retention of records and materials; Maintenance and calibration of equipment; Standard operation procedures; Multi-site and multi-laboratory studies.
*Errors of Measurements:* Concept of significant figures; Uncertainty of measurements; Statistical averages and deviations such as mean, median, standard deviation, relative deviation; Statistical tests such as Q test, Z test, t test, F test, and confidence intervals; propagation of errors; Errors in instrumental methods; Linearization and graphical analysis; Method of least squares.
*Data analysis:* Data preparation and applications of statistical techniques using statistical software.

Recommended Texts:

**AS 409 Industry and the Environment (2 credits-Compulsory)**
*Chemical Aspects:* Effect of industrial activities on the environment; Guidelines for discharge of industrial effluents; Water quality and air quality: chemical aspects, classical and instrumental methods for determination of water quality and air quality parameters, analytical aspects; Treatment of water and waste water: chemical and biological methods, low-cost and modern methods.
**Sound Pollution**: Sound pollution due to various industrial activities in Sri Lanka; Pollution parameters of sound and measurements of sound pollution.

**Air Pollution**: Air pollution and climate change; Biomonitoring of environmental pollution: concepts, active and passive monitoring, bioindicator parameters, control of air pollution by plants, green belt design.

**Field Visits**: Industrial /Field visits to various industries.

Recommended Texts:

**AS 410 Industrial Applications Laboratory (2 credits)**

**Analysis of Industrial Effluents**: Determination of parameters, such as DO, BOD, COD, TDS, SS, floatables, conductivity, hardness, anions, etc.

**Analysis and quality control of industrial materials**: Operation of modern instrumentation used in the industrial sector such as X-ray fluorescence spectrometer, X-ray diffractometer, atomic absorption spectrophotometer, gas chromatograph, thermogravimetric apparatus & differential thermal apparatus, etc; Selected experiments using above instruments as applied to quality control processes of industries; Analysis of industrial raw materials and products such as cement clinker, ceramics, clay, dolomite, apatite, mineral sands, etc.

Recommended Texts:

**AS 414 Industrial Microbiology (2 credits)**

Microorganisms with industrial and environmental use and their products; Growth and product formation in industrial processes; Large scale fermentations: proteins, antibiotics, organic acids, amino acids, enzymes, vitamins, food, alcoholic beverages, fuel and energy, microbial quality of water; Setting up a microbiological laboratory.

[Selected titles from the above course content will be offered each year]

Recommended Texts:

**AS 415 Biodiversity Conservation and Sustainable Development (2 credits)**

**Impart Knowledge and Develop Skills on Biodiversity Conservation and Management**: Changes of biodiversity over space and time; Assessing and Monitoring biodiversity; Conservation of biodiversity; Managing species and habitats

**Sustainable Use of Biodiversity**: Timber and non timber forest products; Medicinal plants and lesser known timber species in Sri Lanka, Indigenous knowledge; Ecotourism
Production Forestry and Biodiversity Conservation: Forest management; Impacts of forestry practices in the conservation of biodiversity, Sustainable forestry practices; Soil fertility management for the conservation of biodiversity; 

Computer Aided Data Analysis and Management of Biodiversity: Identification and classification of vegetation types/habitats using the computer programmes PC ORD, XL stat, Estimates.

Laboratory and Field Work: Assessing and monitoring biodiversity, Estimating the plant species diversity in a forest, data analyses and identifying different vegetation types

Recommended Texts:
2. Primack, R.B. A, Primer of Conservation Biology

AS 416 Fisheries and Aquaculture (2 credits)

Inland Fisheries in Sri Lanka: Brief history and the recent developments in the industry, species involved and the gear used. Fishery regulation, sustainable utilization and potential for future developments.

Aquaculture: General principles and economics of aquaculture, culturable fish and shellfish species, design and construction of aquafarms, fish nutrition and feeding, farm management, integration of aquaculture with crop and livestock farming, marketing of aquaculture products and aquarium fish trade.

Laboratory studies: Identification of fish species, fish parasites and diseases, preparation of aquarium tanks

Field visits: visits to brackish water prawn farm, cage culture facility, fish processing unit, freshwater aquarium fish farm, reservoir with well organized fishery.

Recommended Texts:

AS 417 Food and Fresh Produce Technology (2 credits)

Training on research & development and quality control aspects of fresh produce handling; food processing and safety; packaging and analysis; floriculture.

Recommended Texts:

AS 418 Ecotourism (2 credits)

Impart knowledge and develop awareness on non-detrimental tourism; develop skills as ecotourism guides and operators.

Recommended Texts:
1. Fennell, D.A. Ecotourism: An Introduction

**AS 431 Chemical Technology (2 credits)**

**Introduction:** Chemical engineering stoichiometry; Chemical plant technology: safety, services, storage, etc; fluid flow; Industrial chemical engineering equipments: reactors (batch, flow, semi batch);

Chemical engineering economics and planticides: cost, investments, fixed charges etc.

**Chemical Technology:** Raw materials, raw materials for the chemical industry; New development in chemical technology; Automation and some selected examples.

**Chemical Kinetics:** Chemical kinetics in plant design for isothermal, constant volume batch reactions, isothermal variable volume batch reactions, plug flow reactions continuous stirred tank reactants (Industrial reactants).

**Catalysis:** Homogenous, heterogeneous catalysis, pack bed reactors, fluid dye pack reactors; Electrochemical industries.

Recommended Text:

**AS 432 Cleaner Production for Industry (2 credits)**

**Introduction:** Introduction to cleaner production, cleaner production tools; Assessment and audits; Introduction of cleaner production in an enterprise and cleaner production methodology; Prerequisite for success of cleaner production.

**Industrial Aspects:** Cleaner production assessment, cleaner production team, process mapping and process flow diagram, data sources, material balance, energy balance, costing of waste; alternating option generations; Better process control, equipment and product modification, technology change, onsite recovery/reuse; Implementation of cleaner production options and pay back period.

**ISO Standards:** ISO standards in industrial processes.

**Case Studies and Group Exercises:**

Recommended Texts:
1. National Cleaner Production Centre (2006) *Proceedings: Seminar on Introduction to Cleaner Production into University Curriculum,* Colombo
2. National Cleaner Production Centre (2005) *Cleaner Production: A Way to Improve Your Enterprise*

**AS 433 Industrial Waste Management (2 credits)**

**Characterization of Industrial Waste:** Types of waste; Toxic substances in different types of waste; Chemical and physical methods of determining pollution parameters of industrial waste.

**Minimization of Waste and Management of Waste:** Traditional and modern concepts, advantages and disadvantages of different waste management strategies.

**Development of Industries Using Waste as a Resource:** Value addition methods for waste for reuse.

Recommended Text:
AS 434 Industrial Organic Chemistry (2 credits)

Industries Which Use Organic Materials: To impart a theoretical and practical knowledge of industries in Sri Lanka which use fats & oils, phospholipids and waxes with emphasis on soap making and surface active compounds, manufacture of biodiesel and the food industry.

Essential Oils in Sri Lanka: Overview of the essential oil industry in Sri Lanka, including the methods of extraction, analysis and quality standards utilized.

Tea Industry in Sri Lanka: Tea industry and the processing technology and the importance of tea flavours.

Recommended Texts:
2. Textbook of chemical Technology Vol. 11 Shukla SD and Pandey GN
3. Food Chemistry L.H. Meyer
4. Industrial Chemistry E.R Riegel.

AS 444 Industrial and Economic Minerals (2 credits)

Introduction to Gemmology: Introduction to gems and gemstones, basic physical properties of gem minerals-crystallography, colour, hardness (durability), lustre, cleavage, general optical properties-reflection, refractive index, pleochroism, special properties-special optical properties, luminescence, fluorescence, dispersion, Introduction to fashioning.

Industrial Minerals: Mechanisms of formation and distribution of metallic and non-metallic ore deposits; Classification of industrial minerals and rocks; Geology and origin of industrial minerals and rocks; Deposits of industrial minerals and rocks (quartz, feldspars, carbonates, asbestos, clay, phosphates).

Exploration and Mining Techniques: Introduction to mine planning, mining methods, mine plant design and mineral processing

Recommended Texts:

AS 445 Remote Sensing and Geographic Information Systems (2 credits)

Remote Sensing: Overview and concepts of Remote Sensing technology, basics of photogrametry, practical uses of aerial photographs in various disciplines, fundamental characteristics of electromagnetic radiation, remote sensing platforms, satellite system and sensors, active and passive sensing systems, concepts of spatial, spectral, radiometric and temporal resolution, overview of RS applications.

GIS (Geographic Information System): Introduction to GIS, definition, concepts of GIS, scope and application areas, purpose and benefits of GIS, functional elements of GIS, required hardware and software for GIS, installation of GIS, map projection, data structures [WINDOWS-1252?]— raster and vector data structures, input of geospatial data, sources of data and input devices, spatial database data acquisition and management techniques, data manipulation and analysis, map output generation.
Laboratory Sessions: Visual interpretation of aerial photographs for land use, land pattern analysis, hands-on practical sessions on GIS, data input, linking non-spatial and spatial database, database editing and updating, GPS data integration in GIS, data manipulation and pre-processing, spatial analysis, map generation, mini-project for GIS application.

Recommended Texts:

AS 451 Industrial Mathematics (2 credits)
Mathematical Modelling: Linear programming, integer programming and non-linear programming models.
Network Modelling: The transshipment problem, the shortest path problem, the equipment replacement problem, transportation/assignment problems, generalized network flow problems, maximal flow problems, special modeling considerations and minimal spanning tree problems.
Project Management: Introduction, creating the project network, critical path method, project crashing, project evaluation and review technique, simulating project networks and Microsoft project.

Recommended Texts:
3. Simulation Modeling using @RISK, Wayne L. Winston, Duxbury Press

AS 452 Financial Mathematics (2 credits)
Introduction to mathematical models that comes under finance. Introduction of MATHEMATICA software package at an advanced level and prepares students to use software to solve mathematical problems related to finance through practical sessions.

AS 461 Semiconductor Device Technology and Application (2 credits)
To provide knowledge on the physics behind semiconductor devices and the fabrication of semiconductor devices and IC circuits.

Recommended Texts:

AS 462 Science and Technology of Ceramic Materials (2 credits)
Introduction: Traditional and modern ceramics (Technical ceramics), ceramic industry in Sri Lanka,
Raw Materials: Clays, talc, refractories, fluxes, enamels, glazes. purification of clays, value addition to the raw materials.
Power Processing: Crushing, grinding, sizing, chemical methods
Shape Forming: Pressing, isostatic pressing, casting, mould preparation, tape casting, extrusion, injection molding, binders.
Densification: Theory of sintering, Control of sintering parameters, firing and kilns, hot pressing (HP), hot isostatic pressing (HIP), sintering problems, densification by chemical processes.
Glass and Glass Ceramics (5L): structure of glass materials, concept of glass-ceramics, properties and application of glass-ceramics, glass ceramic composites
Quality assurance (2L): non destructive testing, environmental issues related to ceramic industry;
Practical Classes and industrial visits
Recommended Texts:

AS 463 Energy; Sources, Use and Conservation (2 credits)
Energy resources:
a. Fossil Fuels; Coal (electricity generation from coal, coal for industry), petroleum (refining, different products and their usage)
b. Alternative energy resources; nuclear energy (nuclear energy from fission, nuclear power plants, advantages and problems, nuclear energy from fusion), solar energy (direct use of solar energy; Solar collectors, solar chimneys)(indirect use of solar energy; PV cells; Efficiencies, limitations), wind energy (wind blow, power dependence, efficiency with wind speed), tidal energy (origin, tidal fences, tidal turbines/offshore turbines), geothermal energy (high temperature resources, moderate/low temperature resources), biomass energy (direct use, through conversion; biofuel; ethanol, bio-diesel), batteries (fuel cells)
Energy Picture of Sri Lanka: Main sources available, Energy consumption pattern, Use of biomass, Petroleum requirement, Electricity generation, Alternative sources, New power projects
Conservation of Energy: Different methods to conserve energy; Advantages and disadvantages of different methods

AS 464 Workshop Practice (2 credits)
Introduction: Introduce technical drawing methods, measuring instruments, handling of basic hand tools and portable machines used in sheet metal works.
Use of a Machines: machines of lath, milling and drilling machines, etc
Wood and Plastic Machining: Practice basic wood and plastic working methods in wood and plastic machines of portable bench types
Glass Work: Practice glass cutting methods and blowing methods

AS 465 Industrial Applications (Electronics/Hardware) Laboratory (2 credit)
Digital Electronics: Logic gates, combinational and sequential logics, flip flops; counters, 7-segment display and driver circuits; Stepper motors, sensors, DAC and ADC, interfacing exercises.
Analogue Electronics: Power supplies and amplifier circuits, opamps.
Repair of instruments: Repair of simple instruments such as colorimeters, ph meters, uv-vis spectrophotometers, etc.
Recommended Text:

AS 471 Design and Development of Software Systems (2 credits)
Software process and advantages of software process; Feasibility study; Requirement analysis ; Requirement specification; Software design; Implementation; Testing and maintenance.

Recommended Text:

AS 472 Management of Computers and Computer Networks (2 credits)
PC management; PC trouble shooting; Computer networks; Network configuration; Device interfacing; Data acquisition and data processing; Micro – controllers; Instrument control.

Recommended Text:

AS 473 Visualizing Statistical Concepts using Java and Software Development (2 credits)
To provide experience to undergraduates in development of statistical software.

Recommended Texts:

AS 474 Statistical Applications in Industry and Project Presentation (2 credits).
To provide experience in handling statistical problems in industry and to improve project presentation skills and report writing.

Online PowerPoint Tutorials:
http://www.actden.com/pp/,
http://presentationism.com/

AS 481 Enzymes in Industry (2 credits)
Proteins and Protein Purification: Amino acids and proteins, protein structure and function, protein purification and characterization, chromatography and electrophoresis.
Enzyme; The Agents of Life: Enzymes as catalysts in biological systems, enzyme classification, enzyme kinetics, enzyme assay methods, regulatory enzymes.
Application of Enzymes Technology in Industry: Bakery industry, food and dairy industry, textile industry, enzymes as detergents, enzymes in biotechnology.
Laboratory work: Laboratory experiments relevant to above aspects.

Recommended Texts:

**AS 482 Biochemistry and Molecular Laboratory Instrumentation (1 credits)**
Introduction, preparation of biochemical laboratory solutions, pH and buffers; Absorption spectroscopic methods in biochemical applications; Chromatography methods; Electrophoresis; DNA isolation and analysis; Immunochemical methods (immunoblotting and ELISA); DNA isolation and analysis; Polymerase chain reaction.

Recommended Texts:

**AS 483 Bioinformatics (2 credits)**
Introduction to Bioinformatics; Structure and function of DNA; Collecting and storing sequence data; Biological databases and retrieval of information; Sequence alignment; Database searching for similar sequences; Phylogenetic analysis; Prediction of genes and regulatory sequences; Protein structure prediction.

Recommended Texts:
## COMPUTATION AND MANAGEMENT SUBJECT AREA

### Year One

**All students:** EN 100 - Basic English (2 credits), CS 100 – Computer Applications (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 114 – Law and Ethics (2 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>CS 101</td>
<td>Introduction to Computer Science (3 credits)</td>
</tr>
<tr>
<td>CS 102</td>
<td>Programming Techniques (3 credits)</td>
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<tr>
<td>CS 104</td>
<td>Structured oriented Programming practical (1 credit)</td>
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<tr>
<td>CS 105</td>
<td>Object oriented Programming practical (1 credit)</td>
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<tr>
<td>ECN 101</td>
<td>Introductory Microeconomics I (3 credits)</td>
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<tr>
<td>MT 105</td>
<td>Real Analysis I (3 credits)</td>
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<tr>
<td>MGT 101</td>
<td>Principles of Management (3 credits)</td>
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<tr>
<td>ECN 102</td>
<td>Introductory Macroeconomics II (3 credits)</td>
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<td>Arts and Biological Science Stream:</td>
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<tr>
<td>MGT 103</td>
<td>Introduction to Business Accounting (3 credits)</td>
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<tr>
<td>MT 121</td>
<td>Mathematics for Arts/Commerce I (3 credits)</td>
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<td>Commerce Stream:</td>
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<tr>
<td>MT 121</td>
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<td>MT 122</td>
<td>Mathematics for Arts/Commerce students II (3 credits)</td>
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<tr>
<td>Physical Science Stream:</td>
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<tr>
<td>FNA102</td>
<td>Introduction to Art History and Aesthetics (3 credits)</td>
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### Year Two

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<tbody>
<tr>
<td>CS 201</td>
<td>Data structures (2 credits)</td>
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<tr>
<td>CS 202</td>
<td>Data Structures Practical (1 credits)</td>
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<tr>
<td>CS 203</td>
<td>Database Management Systems (2 credits)</td>
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<tr>
<td>CS 204</td>
<td>Programming using DMS Packages (1 credit)</td>
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<tr>
<td>ECN 201</td>
<td>Intermediate Microeconomics I (3 credits)</td>
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<tr>
<td>ECN 205</td>
<td>Intermediate Macroeconomics II (3 credits)</td>
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<tr>
<td>MGT 206</td>
<td>Human Resource Management (3 credits)</td>
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<td>MGT 207</td>
<td>Operations Management (3 credits)</td>
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<td>MGT 208</td>
<td>Business Statistics (3 credits)</td>
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<td>MGT 209</td>
<td>Project Management (3 credits)</td>
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<td>MGT 211</td>
<td>Business Accounting for Decision Making (3 credits)</td>
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<tr>
<td>MT 221</td>
<td>Mathematics for Management Studies I (3 credits)</td>
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<tbody>
<tr>
<td>CS 303</td>
<td>Operating Systems Concept (3 credits)</td>
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<td>CS 305</td>
<td>Computer Networks (2 credits)</td>
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<tr>
<td>CS 309</td>
<td>Object Oriented Analysis and Design (3 credits)</td>
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<td>CS 310</td>
<td>Server side web programming</td>
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<td>CS 311</td>
<td>Software Engineering (2 credits)</td>
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<tr>
<td>CS 315</td>
<td>Design and Analysis of Algorithms (2 credits)</td>
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<tr>
<td>ECN 304</td>
<td>Econometrics I (3 credits)</td>
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<tbody>
<tr>
<td>MGT 301</td>
<td>Marketing (3 credits)</td>
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<tr>
<td>MGT 304</td>
<td>Entrepreneurship (3 credits)</td>
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<tr>
<td>MGT 305</td>
<td>Cost and Management Accounting (3 credits)</td>
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<tr>
<td>MGT 307</td>
<td>Business Law (3 credits)</td>
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<tr>
<td>MT 321</td>
<td>Mathematics for Management Studies II (3 credits)</td>
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<th>Course Code</th>
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<tbody>
<tr>
<td>MGT 421</td>
<td>Project involving Internship (6 credits)</td>
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<tr>
<td>MGT 423</td>
<td>Seminar (1 credit)</td>
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<tr>
<td>MGT 424</td>
<td>Strategic Management (3 credits)</td>
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<tr>
<td>MGT 438</td>
<td>Management Information Systems (3 credits)</td>
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3 more credits from CS 4xx and 2 from MGT 4xx

9 credits chosen from CS4xx or MGT 4xx of which at least 3 must be from CS4xx and 3 from MGT4xx

### 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 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 Texts:
4. *Analysis*, S.R. Lay

**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

**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 104 Structured oriented Programming practical (1 credit)
(Prerequisites: CS101, CS102 which shall be taken concurrently)
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

Recommended Text:

CS105 Object oriented Programming practical (1 credit)
(Prerequisites: CS101, CS102)
Implementation of programs with object oriented language constructs: classes, objects, inheritance, aggregation, composition and polymorphism.

Recommended Texts:
2. Java Programming: From the Beginning, K. N. King, Georgia State University

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.
Queueing Theory: Characteristics of queues, Simple queues, Queuing costs, Multiple-server queues.

**CS 201 Data Structures (2 credits)**
(Prerequisites: CS 101, CS 104, CS 105)
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 104, CS 105)
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 104, CS 105, 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.


**ECN 202 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 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 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:

CS 311 Software Engineering (2 Credits)
(Prerequisites: CS 201)
Overview of software engineering; software process; classic life cycle model, iterative models, incremental model. Project planning; Fundamentals of project and system planning. Requirements analysis, Software design fundamentals; Stepwise refinement, bottom-up approach, modularity, Design techniques; Use of UML and design patterns. 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 Texts:

CS 315 Design and Analysis of Algorithms (2 Credits)
(Prerequisites: CS 202, CS 301)

Recommended Texts:

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 (6-8 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.

Recommended Texts:
# STATISTICS & OPERATIONS RESEARCH SUBJECT AREA

## Year One

**All students:** BL100 – Basic Life Sciences (2 credits), CS 100 – Computer Applications (2 Credits), EN 100 - Basic English (2 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title &amp; Credits</th>
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<tbody>
<tr>
<td>ST 101</td>
<td>Introduction to Statistics (3 credits)*</td>
<td>CS 104 Structured oriented Programming practical (1 credit)*</td>
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<tr>
<td>ST 102</td>
<td>Introduction to Probability Theory (3 credits)*</td>
<td>CS 105 Object oriented Programming practical (1 credit)*</td>
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<tr>
<td>ST 103</td>
<td>Statistics Applications I (1 credit)#*</td>
<td>MT105 Real Analysis I (3 credits)*</td>
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<tr>
<td>ST 104</td>
<td>Statistics Applications II (1 credit)#*</td>
<td>MT 107 Mathematics for Operations Research (3 credits)*</td>
</tr>
<tr>
<td>CS 101</td>
<td>Introduction to Computer Science (3 credits)*</td>
<td>MT 108 Operations Research I (2 credits)*</td>
</tr>
<tr>
<td>CS 102</td>
<td>Programming Techniques (3 credits)*</td>
<td>MT 109 Linear Programming (3 credits) #*</td>
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## Year Two

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<tbody>
<tr>
<td>ST 201</td>
<td>Probability Theory (3 credits)*</td>
<td>CS 204 Programming using Database Management Systems (1 credit)*</td>
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<tr>
<td>ST 203</td>
<td>Theory of Statistics (3 credits) #*</td>
<td>MT 202 Real Analysis II (3 credits)</td>
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<tr>
<td>ST 204</td>
<td>Sampling Techniques (2 credits) #*</td>
<td>MT 204 Mathematical Methods (3 credits)</td>
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<td>ST 205</td>
<td>Statistical Simulation (2 credits) #*</td>
<td>MT 209 Graph Theory (2 credits)</td>
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<tr>
<td>CS 201</td>
<td>Data Structures (2 credits)*</td>
<td>MT 210 Advanced Linear Programming (3 credits) #*</td>
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<tr>
<td>CS 202</td>
<td>Data Structures Practicals (1 credit)*</td>
<td>MT211 Integer Programming (3 credits) #*</td>
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<tr>
<td>CS 203</td>
<td>Database Management Systems (2 credits)*</td>
<td>MT 212 Operations Research II (2 credits)*</td>
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## Year Three

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<tbody>
<tr>
<td>ST 301</td>
<td>Regression Analysis (3 credits) #*</td>
<td>ST 325 /MT325 Seminar (1 credit) #*</td>
</tr>
<tr>
<td>ST 302</td>
<td>Statistical Quality Control (2 credits) #*</td>
<td>CS 315 Design and Analysis of Algorithms (2 credits)#*</td>
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<tr>
<td>ST 303</td>
<td>Design and Analysis of Experiments (3 credits)#*</td>
<td>MT 304 Partial Differential Equations (2 credits)</td>
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<tr>
<td>ST 305</td>
<td>Multivariate Methods I (2 credits) #*</td>
<td>MT 313 Convex Analysis (2 credits)</td>
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<tr>
<td>ST 306</td>
<td>Data Analysis &amp; Preparation of Reports ( 1 credit) #*</td>
<td>MT 314 Network Optimization Theory (3 credits) *</td>
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<td>ST 307</td>
<td>Time Series Analysis (2 credits) #</td>
<td>MT 315 Operations Research III (2 credits)*</td>
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<td>ST 308</td>
<td>Bayesian Statistics I (2 credits)*</td>
<td>MT 316 Non-Linear Programming (3 credits) *</td>
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<tr>
<td>ST 309</td>
<td>Non Parametrics &amp; Categorical Data Analysis (3 credits) #*</td>
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## Year four

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<th>Course Code</th>
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<tbody>
<tr>
<td>ST 401</td>
<td>Actuarial Statistics</td>
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<tr>
<td>CS 409</td>
<td>Neural networks and Fuzzy logics</td>
<td>3</td>
<td>#</td>
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<tr>
<td>ST 402</td>
<td>Statistical Data Mining</td>
<td>3</td>
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<tr>
<td>ST 403</td>
<td>Statistics for Bioinformatics</td>
<td>2</td>
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<tr>
<td>ST 404</td>
<td>Stochastic Processes</td>
<td>2</td>
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<tr>
<td>ST 405</td>
<td>Multivariate Methods II</td>
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<td>ST 406</td>
<td>Bayesian Statistics II</td>
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<tr>
<td>MT 409</td>
<td>Selected Topics in Applied Operations Research</td>
<td>2</td>
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<tr>
<td>ST 402/MT 425</td>
<td>Project work /Industrial training</td>
<td>3</td>
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<td>ST 409</td>
<td>Neural networks and Fuzzy logics</td>
<td>3</td>
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<tr>
<td>MT 410</td>
<td>Optimization for Engineering Design</td>
<td>3</td>
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<tr>
<td>MT 411</td>
<td>Optimization Modeling</td>
<td>2</td>
<td>*</td>
</tr>
<tr>
<td>MT 412</td>
<td>Financial Mathematics</td>
<td>3</td>
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</tr>
</tbody>
</table>

† Equivalent to AS 451
* : 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 104 Structured oriented Programming practical (1 credit)**
(Prerequisites: CS101, CS102)
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

Recommended Text:

**CS105 Object oriented Programming practical (1 credit)**
(Prerequisites: CS101, CS102)
Implementation of programs with object oriented language constructs: classes, objects, inheritance, aggregation, composition and polymorphism.

Recommended Texts:
2. *Java Programming: From the Beginning*, K. N. King, Georgia State University
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 Texts:
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:

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 Texts:
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 χ^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. (Prerequisite: 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. (Prerequisite: ST 203)

Recommended Texts:
ST 205 Statistical Simulation (2 credits)
(Prerequisites: CS 102, CS 104, CS 105, 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:

CS 201 Data Structures (2 credits)
(Prerequisites: CS 101, CS 104, CS 105)
Data Structures: linear and non linear data structures. Arrays, lists: linked list, ordered linked list, and doubly linked list; push down stacks; queues: FIFO queue and deque. Tree structures – trees in general, binary search tree (BST), root insertion to BST, splay tree, 2-3-4 trees, radix tree and red-black tree; Graphs; Implementation of depth first search, breadth first search; Hashing: initial hash, collisions, separate chaining.
Recommended Texts:
2. Standish T. A.; Data Structures in Java; Addison-Wesley; 1998
3. Gregory L., Heilemen; Data Structures, Algorithms, & Object-Oriented programming; McGraw-Hill

CS 202 Data Structures Practicals (1 credits)
(Prerequisites: CS 104, CS105, CS 201)
Implementation of data structures studied in CS 201 using C, C++ and Java.
Recommended Texts:
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 104, CS 105)
Overview: What is a database? Data and metadata. Conceptual Modeling: Entities, attributes, associations, functional determination, 3-level structure, graphical representation. Relational Databases: Relational algebra, Relational databases and tables, Query languages. The entity-relationship model, Logical organization of databases; Physical organization of databases; Characteristics of disks and disk blocks, Storage of relations, Query processing and optimization, Concurrency control; Transactions, Serializability, Locking, Recovery. Functional dependencies and forms, Introduction to Distributed DBMS, OO DBMS, ORDBMS.
Recommended Texts:

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3. Date, C. J.; *An Introduction to Database Systems*; Addison-Wesley; 2000

**CS 204 Programming using Database Management Systems (1 credits)**
(Prerequisites: CS 104, CS 105, 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:

**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 204 Mathematical Methods (3 credits)**
(Prerequisite: MT 107)
**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:** 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 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-Wolf
Decomposition algorithm, Interior point algorithms, Bounded variable Simplex
algorithm.
Some practical assignments will be given for this course.

Recommended Text:
1. Linear programming and Network Flows, Mokhtar S. Bazaraa, Operations
   Research, Kanti Swarup, (1997)
   University Press.

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:

MT 212 Operations Research II (2 credits)
(Prerequisite: MT 109)
Theory of games, Queuing theory, Inventory management.

Recommended Text:
4. Schaum’s Outline of Theory and Problems, Richard Bronson
5. Operation Research, S.K. Jain and D.M. Mehta

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300 LEVEL COURSE

ST 301 Regression Analysis (3 credits)
Some practical assignments will be given for this course. (Prerequisite: 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:
1. Myers R.H. (1990) Classical and Modern Regression with Applications,
   Duxbury Press
   Irwin Inc.
   Chapman & Hall/CRC

ST 302 Quality Control (2 credits)
Some practical assignments will be given for this course. (Prerequisite: 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:
1. Hansen B.L. (1987) & Ghare P.M., Quality Control and Application, Prentice
   Hall
   Wiley & Sons.

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, Tuckey's method, Bon- feroni
method, Scheffé’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:
   Experimental Design, Springer
   Irwin Inc.
   Series.
ST 305 Multivariate Methods I (2 credits)
(Prerequisite: ST 203)
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:
   1. Statistical Decision Theory and Bayesian Analysis, J.O. Berger (1985)
ST309  Non-Parametric & Categorical Data Analysis (3 Credits)
Prerequisites: ST203
Log-linear models: Log-linear models for two or more dimensions, testing goodness of fit, estimation model parameters, Strategies in model selection, Analysis of deviance, Log-linear models for ordinal variables. Some practical assignments will be given for this course.
Recommended Texts:
1. Nonparametric Statistical Inference, Gibbons J.D. & Chakrabortic S.,
2. Categorical Data Analysis, Alan Agresti
3. Generalised Linear Models, McCullagh and Nelder

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 315  Design and Analysis of Algorithms (2 Credits)
(Prerequisites: CS 201, CS 202)
Recommended Texts:

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 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:
1. *Linear and Nonlinear Programming*, David G. Luenberger

**400 LEVEL COURSES**

**ST 401 Actuarial Statistics (2 credits)**
(Prerequisite: ST 203)

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 Data Mining Techniques (3 credits)**
(Prerequisites: CS 409)
Some practical assignments will be given for this course

Recommended Texts:

**ST 403 Statistics for Bioinformatics (2 credits)**
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:

**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 409 Neural networks and Fuzzy logics (3 Credits)**
(Prerequisites: 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. Parallel and distributed processing, Neuron, Connectivity, Activation function, propagation rule, Learning rules, pattern Preparation, Perceptron, Multilayer perceptron, Associative memory, Hopfield neural networks, Self organizing map (SOM), Adaptive Resonance theory, topologies, Training methods, supervised and unsupervised learning

Recommended Texts:
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:  

ST 425 / MT 425 (6-8 Credits) Project Work / Industrial Training
Each student will undergo full time training in the industry for the prescribed period on projects assigned by the industry. Students are required to have a duly maintained 'Daily Diary' and 'Students Record Book' which should be submitted to the Head of the Department within two weeks after completion of training. In addition, the students are expected to write a report and make presentation on the work carried out by them.
ENGLISH FOR ACADEMIC PURPOSES

Intensive course (Duration: 4-6 weeks)
The intensive course is designed to achieve UTEL level 4.

Grammar & Writing - Parts of speech, sentence structures, simple descriptions
Reading - Identify the main idea, supporting details of a short text, read for gist and details to answer questions, use contextual, structural and morphological clues to deduce meanings of unfamiliar words, understand the function of basic punctuations in a text.
Speech - Communicate information of personal / familiar topics
Use question forms to elicit information of familiar topics.
Listening - Familiarize students with basic techniques of grasping information from a spoken text. Identify key ideas in a short academic text and take down notes

EN 100 (compulsory foundation course, 2 credits)
The EN 100 course is designed to achieve UTEL levels 5 and 6.
Reading - Consolidates reading skills. Reading complex texts for gist and details, reading and note taking: Presenting given information using illustrations, graphs, charts, symbols and abbreviations.
Speech- Express opinions on topics guided by prompts. Deliver a short speech on a given topic using limited range of cohesive devices. Use simple present / present continues to talk about situations depicted in visuals.
Listening -Listening for comprehension, specific and general information and note taking based on texts dealing with general and academic contexts.

EN 200 (compulsory certificate course)
The EN 200 course is designed to achieve UTEL level 7.
Reading - Reading comprehension, Reading and summarizing
Speech - Group presentations (focus on presentation skills, slide preparation and report based on the presentation). Functional language
Listening - Listen to authentic spoken texts from a range of contexts, including variety of accents, both academic and social and draw inferences, understand opinions, extract specific and general information.