VAVUNIYA CAMPUS

UNIVERSITY OF JAFFNA, SRI LANKA

FACULTY OF APPLIED SCIENCE

HANDBOOK

2016/17

Foreword

On my behalf, as the Rector of the Vavuniya Campus of the University of Jaffna, on behalf of the staff, I warmly welcome all of you joining the Faculty of Applied Science as fresh internal students for the academic year 2016/2017. I am sure that most of you would feel the fascination of a community full of diverse ideas and perspectives, and the prospect of boundless opportunities at your fingertips. I encourage you all to take advantage of the facilities available at the Campus.

At Vauniya Campus, you will be surrounded by dedicated faculty and staff members who facilitate your growth. They are well prepared for the task and eager to teach you from a biblical worldview about the academic discipline you are pursuing. In addition, our faculty and staff induce you to realize your potential for achievements well beyond your academic studies. As such, take advantage of the expertise you encounter, and create your own experience.

This Student Handbook is one tool that can assist you during your collegiate years. On these pages, you would find the information, rules and regulations required to plan your academic stay at the Vavuniya Campus in a fruitful manner from the inception. I urge you to read it, understand it by referring to it during your ongoing orientation.

Once again, I welcome you to Vauniya Campus of the University of Jaffna.

Finally, I wish to appreciate the Dean and the staff of Faculty of Applied Science who devoted their time and effort in the preparation of this Handbook.

Dr. T. Mangaleswaran
Rector
Vavuniya Campus of the University of Jaffna

Preface

It is my privilege to introduce this handbook to the stakeholders of the Faculty of Applied Science, Vavuniya Campus of the University of Jaffna.

This handbook is updated with all the relevant information of the Faculty of Applied Science. Further, this handbook is made with the approval of the university authority and the suggestions highlighted by the Standing Committee on Science of the University Grants Commission to maintain uniformity across the Science Faculties.

I am sure that our students can obtain all the relevant information through this handbook and it also serves as a guide for them when they newly enter the Faculty. I kindly request all the fresh students to read this handbook thoroughly for you successful academic career at our faculty.

I am thankful to the staff of the Faculty of Applied Science and all who were helpful in bringing out this handbook for the year 2016/2017.

Mr. S. Kuhanesan,
Dean
Faculty of Applied Science

Contents

1 General Information

1.1 Introduction

The University of Jaffna was first established in 1974 as the Jaffna Campus of the University of Sri Lanka, offering courses in Science and Humanities. In 1979 with the implementation of university Act No 16 of 1978, it became an independent and autonomous university as the University of Jaffna. Today the University of Jaffna has expanded its activities with eight faculties and a campus in Vavuniya with two faculties.

Faculty of Applied Science was established with the upgrading of the Northern Province Affiliated University College (NPAUC established in 1991) as the Vavuniya Campus of the University of Jaffna in 1997.

The Faculty of Applied Science is situated in Kurumankadu and Inner Circular Road about a kilometer from the picturesque Vavuniya town at present, and Applied Mathematics and Computing degree programme was shifted to Pampaimadu where the whole of the Vavuniya Campus is to be established. Vavuniya in the southern part of the Northern Province is a melting pot of cultures of the Vanni region and the north central region of Sri Lanka. A culture that has been influenced and shaped by the Vanniyas (of whom the King Pandaravanniyan is a prominent example) this district has ties even with the Paduvankarai regions that extend to the Southernmost part of the North Eastern Province - an indication of how the Vanniya people have contributed to the rich culture of the Tamil speaking societies of Sri Lanka.

Often compared with the Kovai region of South India, Vavuniya is renowned for its mild climate which provides a pleasant change from the usual arid conditions of the coastal regions of the northeast. As such, it provides an ideal setting for the Faculty of Applied Science, and, provides with the students with a pleasant environment to indulge in educational and extra-curricular activities. Further, as per present conditions, Vavuniya provides a strategic location that acts as a

transit point for the movement of people as well as various financial and industrial activities/processes. Thus, Vavuniya is expected to grow into a prominent financial and cultural hub in Sri Lanka.

The Faculty of Applied Science of the Vavuniya Campus consists of two Departments, namely Department of Physical Science and Department of Bio- science.

Department of Physical Science

The Department of Physical Science of the Vavuniya Campus of the University of Jaffna came into existence with the commencement of the Faculty of Applied Science in 1997. Since then the department has developed the academic programs in Applied Mathematics & Computing, and Information and Communication Technology, with the revisions of the syllabi in regular intervals, and improvements of the laboratory facilities. Department has five disciplines namely Mathematics, Computer Science, Statistics, Physics and Information Technology. The major commitment of the department is to provide up to date knowledge in Mathematics, Computer Science, Information Technology, Physics and Statistics to undergraduate students through course work, practical classes and research projects. The department offers B.Sc. in Applied Mathematics and Computing (General), B.Sc. in Computer Science (Special), BICT (General) and B.Sc. in Information and Communication Technology degrees to undergraduates. In addition to teaching, staff members are actively involved in a number of research projects in their respective field of study.

Department of Bio-science

The Department of Bio-science is one of the Departments in faculty of Applied Science of Vavuniya Campus of the University of Jaffna, commenced in 1997. The academic program has been developed in Environmental Science. The Syllabi has been drafted with different courses in Environmental Science and Bio Science with emphasis on fields of technological importance. The major objective of the Department is to train the undergraduates to suit the latest trends in industry, research and development of national economy through course work, practical sessions and research projects pertaining to Environmental Science. The department has facilities to offer B. Sc Environmental Science (three year -General) and B. Sc in Environmental Science (four year) special to undergraduates. The staff members also do the research work in their respective fields.

Vision and Mission

As in the case of any institution, the Faculty has developed a clear-cut vision as an academic entity to actively compete in the dynamic market of higher educational service providers in the local, national and international arenas.

The **Vision** of the Faculty of Applied Science is:

> 'To be the centre of excellence in the provision of technologically advanced and appropriate applied science education'.

As per the vision stated above, the Faculty of Applied Science has developed its own unique **motto** or **slogan** which states:

> 'State of the art technological education for applied thinkers, and, dynamic personalities - which provides a cutting-edge advantage to survive and excel in the dynamic and competitive job market'.

The **Mission** of the Faculty of Applied Science is:

> 'To become the leader in advancing knowledge and skills in applied science and in evolving into a good academic-corporate citizen contributing to the sustainable development of the region and country'

Goals of the Faculty of Applied Science are:

(1) Ensuring and enhancing high academic standards.

(2) Strengthening and enhancing institutional capacity to cater to present and future needs.

(3) Production of marketable graduates with high academic and practical skills.

(4) Promote pure and applied research of high standards.

(5) Enhancing the projection of a good corporate citizen's image.

As such, the Faculty of Applied Science strives to provide the best possible means of education to its students to enable them to develop with both academic and professional skills so that they can be successful individuals in their personal and professional lives.

1.2 Officers of the University of Jaffna

Chancellor	Prof. S. Pathmanathan
Vice Chancellor	Prof. R. Vigneswaran
Rector, Vavuniya Campus	Dr. T. Mangaleswaran
Dean, Faculty of Agriculture	Prof. (Ms) T. Mikunthan
Dean, Faculty of Applied Science	Mr. S. Kuhanesan
Dean, Faculty of Arts	Dr. K. Suthakar
Dean, Faculty of Business Studies	Dr. A. Pushpanathan
Dean, Management Studies and Commerce	Prof. T. Velnamby
Dean, Faculty of Medicine	Dr. S. Raviraj
Dean, Faculty of Science	Prof. J. P. Jeyadevan
Dean, Faculty of Graduate Studies	Prof. G. Mikunthan
Dean, Faculty of Engineering	Dr. A. Atputharajah
Dean, Faculty of Technology	Dr. (Mrs.) S. Sivachandran
Registrar	Mr. V. Kandeepan
Bursar(Acting)	Mr. A. Sivanadarajah
Librarian	Ms. S. Arulanandam

1.3 Officers of the Vavuniya Campus

Rector, Vavuniya Campus	Dr. T. Mangaleswaran
Dean, Faculty of Applied Science	Mr. S. Kuhanesan
Dean, Faculty of Business Studies	Dr. A. Pushpanathan
Deputy Registrar, Establishments	Mr. T. Vijeyakumar
Senior Asst. Librarian	Mr. S. Shanmugathasan
SAR, Examinations and Admission	Mr. R. Jeyakumar
AR, Student and Staff Services	Mr. P. Krishnanathan
AB, Payments and Accounts	Mr. A. E. M. Venesious
AB, Supplies	Mr. B. Balathas
SAR, Faculty of Applied Science	Mr. M. Nanthakumaar
AR, Faculty of Business Studies	Ms. D. Sooriyakumar

1.4 Faculty of Applied Science

The Faculty of Applied Science as an academic organization has a flexible, friendly and conducive internal environment that allows for effective teaching, learning and research. This is due to the fact that the faculty has a unique signatured culture where the student and staff interactions are at an optimum sustainable high, where one-to-one attention is administered to the students by the teachers. Further, the Faculty has very strong ties with the community of Vavuniya and, it is seen as a key and prominent player in the advisory capacities of all development endeavors taking place in the locality.

1.4.1 Office of the Dean

Dean	**Mr. S. Kuhanesan** B.Sc. (Hons)(Physics) (Peradeniya), M.Phil.(Peradeniya)
Senior Assistant Registrar	**Mr. M. Nanthakumaar**
Computer Application Assistant	**Mr. V. Prasathkumar**
	Ms. T. Tharani
Stenographer	**Ms. B. Suvarneya**
Labourer	**Mr. V. Subakar**

1.4.2 Department of Bio-science

Department of Bio-science offers course units in Botany, Zoology, Chemistry and Environmental Science. The course units cover necessary topics in Environmental Science, and, are designed to give a firm background in the field of Environmental Science.

Head

Dr. (Ms). J. Nimalan
B.Sc.(Hons) (Agriculture) (Jaffna),M.Sc (Thailand),
PhD (Peradeniya)

Academic Staff

Dr. (Ms). A. Nanthakumaran
B.Sc.(Hons) (Agriculture) (EUSL),M.Sc (Norway), PhD (India)

Dr. (Ms). J. Nimalan
B.Sc.(Hons) (Agriculture) (Jaffna),M.Sc (Thailand),
PhD (Peradeniya)

Mr. A. E. S. Patrick
B.Sc.(Hons)(Zoology) (Jaffna), M.Phil.(Peradeniya)

Dr. S. Wijeyamohan
B.Sc.(Hons)(Zoology)(Peradeniya), PhD (Peradeniya)

Dr.(Ms). S. Devaisy
B.Sc.(Hons)(Environmental Sc.)(Vavuniya Campus, Jaffna),
M.Sc.(Peradeniya),PhD(Australia)

Ms. S. Malathy
B.Sc.(Hons)(Chemistry) (Jaffna)

Mr. G. Naveendrakumar
B.Sc.(Hons)(Environmental Sc.)(Vavuniya Campus, Jaffna)

Ms. K. Sobana
B.Sc.(Hons)(Environmental Sc.)(Vavuniya Campus, Jaffna)

Mr. K. Arjunan
B.Sc.(Hons)(Environmental Sc.)(Vavuniya Campus, Jaffna)

Ms. H. K. N. Sanjeewani
B.Sc.(Hons)(Environmental Sc. and Natural Resource Mgt.) (Sabaragamuwa), PG.Dip. (Oxford,UK)

Ms. V. Sharaniya
B.Sc.(Hons)(Environmental Sc.)(Vavuniya Campus, Jaffna)

Non Academic Staff

Clerk	**Mr. M. Pirapuram**
Technical Officer	**Mr. M. Muhundhakumar**
	Mr. S. Poongkannan
Laboratory Attendant	**Mr. A. Suntharalingham**
	Mr. A. Kamilash
	Mr. R. Sajith
Labourer	**Mr. A. Danushanth**

1.4.3 Department of Physical Science

Department of Physical Science offers course units in Pure Mathematics, Applied Mathematics, Statistics, Computer Science and Information Technology. The course units cover wide range of Mathematical and Statistical topics. Also it covers wide spectrum of Information Technology aspects. The course units are designed in such a way to impart theoretical as well as practical knowledge.

Head

Mr. S. Thirukumaran
B.Sc. (Hons)(Computer Science)(Jaffna),
PG.Dip. (Colombo), M.Eng.Sc. (Malaysia)

Academic Staff

Mr. S. Kuhanesan
B.Sc. (Hons)(Physics)(Peradeniya), M.Phil.(Peradeniya)

Mr. B. Yogarajah
B.Sc. (Hons)(Mathematics)(Jaffna), PG.Dip.(Peradeniya)
M.Phil.(Jaffna)

Mr. S. Thirukumaran
B.Sc. (Hons)(Computer Science)(Jaffna),
PG.Dip. (Colombo), M.Eng.Sc. (Malaysia)

Dr. R. Nagulan
B.Sc. (Jaffna), M.Sc. (Peradeniya),
PhD (Kent, UK)

Mr. S .S. Suthaharan
B.Sc. (Hons)(Computer Science)(India), M.Sc. (India)
M.Phil.(Peradeniya)

Mr. U. Priyatharsan
B.Sc. (Hons)(AMC)(Vavuniya Campus, Jaffna)
M.Sc. (IT)

Mr. T. Jeyamugan
B.Sc. (Hons)(AMC)(Vavuniya Campus, Jaffna)

Mr. N. Edwin Linosh
B.Sc. (Hons)(AMC)(Vavuniya Campus, Jaffna)

Mr. T. Kokul
B.Sc. (Hons)(Computer Science) (Jaffna)

Ms. S. Nishanthy
B.Sc. (Hons)(ICT)(Vavuniya Campus, Jaffna)

Mr. S. Kirushanth
B.Sc. (Hons)(ICT)(Vavuniya Campus, Jaffna),
M.Sc. (Peradeniya)

Mr. M. Kayanan
B.Sc. (Hons)(AMC)(Vavuniya Campus, Jaffna)

Ms. V. Subaramya
B.Sc. (Hons)(Computer Science)(Vavuniya Campus, Jaffna)

Ms. A. Ann Sinthusha
B.Sc. (Hons)(Computer Science) (Jaffna)

Mr. T. Kartheeswaran
B.Sc. (Hons)(ICT)(Vavuniya Campus, Jaffna)

Instructors

Mr. S. Selvarajan
B.Sc. (Jaffna), M.Sc. (Colombo)
M.Phil.(Colombo)

Mr. K. Santhanakrishnan
B.Sc. (Hons) (Computer Science) (Jaffna)

Mr. S. Gopinath
B.Sc. (Hons)(ICT)(Vavuniya Campus, Jaffna),

System Engineer

Mr. K. Pratheepan
B.Sc. (Peradeniya), M.Sc. (Peradeniya)

System Analyst

Mr. S. Nithiyanandam
B.Sc. (Jaffna) M.Sc (UCSC)

Non Academic Staff

Technical Officers	**Mr. K. Jeyakhoban**
	Mr. N. Thevarajah
	Mr. M. Sutharshan
Laboratory Attendants	**Mr. S. Vinayagamoorthy**
	Mr. S .L. Reginold
	Mr. S. Kodeeswaran
Labourer	**Mr. J . Lajeepan**

1.4.4 Department of English Language Teaching (DELT)

The ELTU has been functioning from its inception in 1992 (earlier it was called as English Unit). On 18th December 2017, it became the Department of English Language Teaching. There are two permanent academic staff, one senior lecturer grade I and one senior lecturer grade II. There are six instructor cadres available and recruited on temporary basis until they are filled with permanent instructors. Its services for the last fifteen years have been well-acknowledged and recorded. It provides English Language Teaching services at the undergraduate level and in English Language research. According to the Standing Committee on Teaching English as a Second Language (TESL) of the University Grants Commission (UGC), though it is part of the Faculty of Business Studies (FBS), it has the mandate to serve the students of the Faculty of Applied Sciences (FAS) and the whole Campus. Thus it serves the students of the Information Communication Technological Stream as well.

Academic Staff	**Dr. J. Gnanaseelan** BA (Hons)(Jaffna), PGD (COL), MA (KLN), MA & MPhil (India), Msc(USJP), PhD(India)
	Ms. S. Jeyaseelan BA (Hons)(Vavuniya Campus, Jaffna), MA (KLN)
Non Academic Staff	
Computer Application Assistant	**Ms. S. Shinthuja**
Labourer	**Mr. R. A. Raveendran**

1.4.5 Internal Quality Assurance Cell (IQAC)

The purpose of this cell is to monitor and to ensure the best practices for quality principles at the faculty level. Best practices are amenable to documentation and have the potential for replication; they are transparent, accountable, affordable and accessible to both staff and students, and add value to an institution. They are contextual and influenced by many factors. Best practices show the path to success through continuous improvement leading to the benchmark of excellence.

Chairperson	**Mr. S. Kuhanesan**
Coordinator	**Dr. (Ms). A. Nanthakumaran**
Members	**Mr. S. Thirukumaran**
	Mr. B. Yogarajah

2 Course Structure

The degree program is based on the bi-modal semester system. As such, each academic year will be considered as level 1, 2, 3 and 4 respectively. Each level of study is divided into 2 semesters. One semester consists of a 15 weeks term of academic work.

The Faculty of Applied Science offers following B.Sc. degree programmes.

(a) Three year degree programme (6 semesters)

B.Sc. (Applied Mathematics and Computing)
B.Sc. (Environmental Science)
Bachelor of Information and Communication Technology

(b) Four year degree programme (8 semesters)

B.Sc.(Special) in Computer Science
B.Sc.(Special) in Environmental Science
B.Sc. in Information and Communication Technology

The curriculum of all degree programmes of the faculty are being revised by adopting the Sri Lankan Qualification Framework (SLQF), respective ACM/ IEEE guidelines, respective subject benchmark statements and other relevant UGC circulars.

2.1 Credit Units

For a theory course, 15 hours of lectures are equivalent to one credit and for a practical course, 30 - 45 hours work is considered as one credit. Industrial Training required for the programme shall be equivalent to 1 credit. Each student has to complete 30 credit units during each year of study with a total of 90 credit units during three years of study (General Degree) and 120 credit units during four years of study (Special/Extended Fourth year Degree programmes).

Further, a research project in special degree of 15 weeks duration shall be equivalent to 5 credits for B.Sc.(Special) in Computer Science whereas a research project in special degree of one semester duration shall be equivalent to 6 credits for B.Sc.(Special)in Environmental Science.

2.2 Code Numbers

Each course unit is denoted by the subject area abbreviation and 4 digit number. First digit denotes the level/year of study. Second digit indicates the semester. Third digit indicates the serial number of the course unit in the specific semester and the fourth digit indicates the number of credit assigned to the course unit.

2.3 Auxiliary Course Unit

The Auxiliary Course units are designed to provide basic knowledge on a wide-range of disciplines that an undergraduate should possess in the present era.

The credits of the Auxiliary Course Units are not taken for the computation of the GPA. However, All the auxiliary course units shall be evaluated and considered for the award of degrees.

Auxiliary Courses
English Language I & English Language II
Sri Lankan studies, Social Harmony and Natural Resources of Sri Lanka
Communication skills
General Biology(Only for Applied Mathematics and Computing)
Career Guidance
Management and Entrepreneurial skills

2.4 General Degree Programme

Each student has to complete 30 credit units during each year of study with a total of 90 credit units during three years of study (General Degree). In addition, all the students are required to complete the Auxiliary courses offered in each semester in the following manner.

Credit passes (Grade C) or above in the English Language I & II of Auxiliary course units and a pass (Grade D) or above in the other Auxiliary course units are the prerequisite to complete the degree programme.

2.5 Special degree programme

2.5.1 Bachelor of Science (Special) in Computer Science

Students who are interested to read special degree programme are advised to apply at the end of the second year of study. Students may apply to follow a special degree programme in Computer Science.

The minimum requirements for selection to the special degree programme are as follows:

(i) Should complete the first and second year of study.

(ii) A candidate should obtain a GPA of not less than 2.70 in the subject of specialization in the first and second years of study and obtain grades of C or better in all course units.

Each student selected to follow special degree programme has to complete 120 credit course units during four years of study. In addition, all the students are required to complete the auxiliary courses offered in each semester in the following manner.

Credit passes (Grade C) or above in the English Language I & II of Auxiliary course units and a pass (Grade D) or above in the other Auxiliary course units are the prerequisite to complete the degree programme.

The courses for the special degree programme will be commenced from level 3 semester II. Students selected to follow special degree programme in Computer Science are expected to take their respective specialization courses. The remaining credit courses should be taken from the other courses offered in the general degree in level 3 semester II.

During the fourth year, students specializing in Computer Science are required to carry out a research project of 15 weeks duration on a given topic under the supervision of a senior member of the academic staff in a university or senior research staff in a reputed research institute.

Option for General Degree
During the fourth year of study, a student following a special degree course may opt for a general degree before sitting for the final (fourth) year examination with valid reason. The final acceptance to opt for the general degree will be subject to the recommendation of the Faculty Board of Applied Science, Campus Board and approval of the Senate.

2.5.2 Bachelor of Science (Special) in Environmental Science

Students who are interested to follow special Degree programme are advised to apply at the end of the second semester of level II. The minimum requirements for selection to the special Degree programme for a student are as follows:

(i) Should successfully complete the first and second year of study

(ii) A student should obtain a GPA of not less than 3.0 calculating the grade points for grades obtained in courses of level 1 and 2 and obtain grades of D or better in all the course units of level 1 and 2.

Each student selected to follow the special Degree programme has to complete minimum of 120 credit units during four years of study. In addition, all the students are required to pass the auxiliary courses offered during the three year period.

Credit passes (Grade C) or above in the English Language I & II of Auxiliary course units and a pass (Grade D) or above in the other Auxiliary course units are the prerequisite to complete the degree programme.

During the fourth year second semester, students shall be required to carry out a research project for one semester duration on a given topic under the supervision of a senior member of the academic staff in a university or senior research staff from a reputed research institute. Students have to undergo an industrial training equivalent to one credit.

Option for General Degree

During the fourth year of study, a student following a special degree course may opt for a general degree before the submission of thesis of the research project with valid reason. The final acceptance to opt for the general degree will be subjected to the recommendation of the Faculty Board of Applied Science and the Campus Board.

2.6 Extended Fourth Year Degree Programme

2.6.1 Bachelor of Science in Information and Communication Technology (B.Sc. in ICT)

Based on their performance and preference, a selected number will be able to offer an extra (fourth) year leading to Bachelor of Science in Information and

Communication Technology (B.Sc. in ICT) Degree.

The minimum requirements for selection for the above extended fourth year degree programme are as follows:

(i) Should complete the first, second and third year of study

(ii) A student should obtain a GPA of not less than 2.70

The courses for extended fourth year degree will be commenced from level 4 semester I. Each student selected to follow the extended fourth year degree has to complete 120 credit units during their four years of study. In addition, all the students are required to complete the auxiliary courses offered in each semester in the following manner.

Credit passes (Grade C) or above in the auxiliary course units English I & II and a pass (Grade D) or above in the other auxiliary course units are the prerequisite to complete the degree programme.

Option for General Degree
During the extended fourth year of study, a student following a extended fourth year degree programme may opt for a general degree before sitting for the final (fourth) year examination with valid reason. The final acceptance to opt for the general degree will be subject to the recommendation of the Faculty Board of Applied Science, Campus Board and approval of the Senate.

2.7 Examination Structure

2.7.1 Department of Physical Science

The final examination for each course in General and Special Degree Programmes are held as per the semester schedule at the end of each semester in which the course is completed. Each theory paper will be of one to three hours duration based on the credit hours. Duration for each practical examination will be based on the credit value assigned to the particular practical module (eg. one credit value will have two hours examination two credit value will have three hours examination). Number of questions for the theory paper will be based on the number of contact hours. The 15 hours lectures will have one hour examination, 30 hours lectures will have two hours examination and 45/60 hours lectures will have three hours examination. Students will be given choice to select questions in the examination. (e.g. for one, two and three hours examinations, choices will be two out of three, four out of five and five out of six respectively). The

continuous assessments in the form of assignments, presentations, quiz etc. will also be conducted during the course and the marks will also be considered for evaluation.

2.7.2 Department of Bio-science

The end semester examination for each course unit is held at the end of each semester in which the courses are completed. Each theory paper will be of two / three hours duration based on the credit hours and the duration for each practical examination may be decided by the Head of the Department in consultation with respective lecturer-in-charge. Number of questions for the theory paper will be based on the number of contact hours. Usually, the 15hrs or more hours practical will have end semester practical exam during examination period and the duration of practical examination can be decided by the Head of the Department in consultation with respective lecturer-in-charge of the module. The continuous assessments will be assessed in the form of assignments (both in-class and field based), term papers, presentations, tutorials, quizzes etc., conducted during the course and the marks will be considered for evaluation.

2.8 Attendance

All registered students are required to attend all lectures, tutorials and practical. 80 % attendance is compulsory for both theory and laboratory courses. Any student who has less than 80 % attendance in a course, both in theory and laboratory work will not be allowed to sit for the examination of that course.

2.9 Medium of instruction

English will be the medium of instruction.

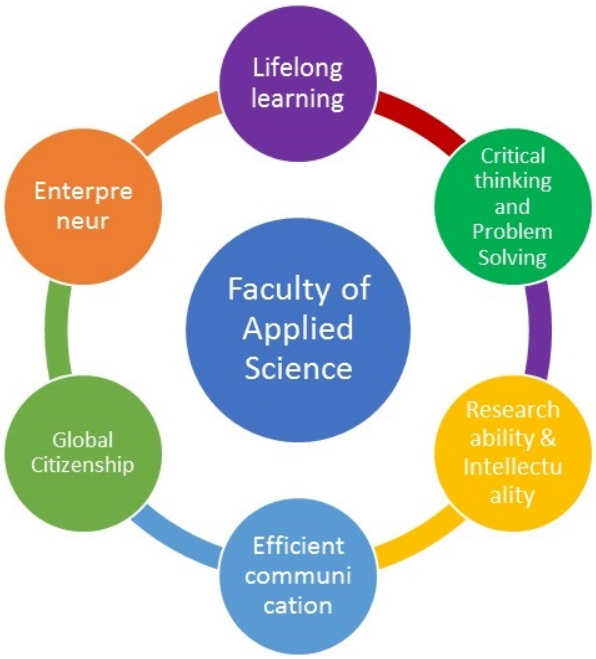
2.10 Career Prospects

The passed out graduates of the Faculty of Applied Sciences from both the Biological and Physical sciences backgrounds have proven their caliber as professionals in the fields of planning, socio-economic development (in the international non governmental sectors), scientific research, IT, and even in non-traditional fields such as insurance, marketing and banking. This shows that the Faculty of Applied Science not only provides its students with training in their respective academic fields but also nurtures them to develop their interpersonal and management skills so that they can compete (without difficulty) in the job markets. At present with the advent of the special degree programmes students have

the additional advantage of further specialization in a selective field (of their choice). For example, Bio-science students have the opportunities to hone and develop their skills as environmental planners and analysts by carefully mixing and matching the wide array of module options provided.

2.11 Graduate Profile

The Faculty of Applied Science will produce the graduates with a strong sense of commitment to the acquisition of updated knowledge, skills, and an ability to apply these to a dynamic environment. They can critically evaluate science in a real world context through exposure to industries and act with integrity and fluency across cultures and perspectives for the betterment of society. They will have intellectual openings to engage in research and be innovative through independent learning to meet the necessary requirements. They will possess team work sprit, positive attitude and the ability of effective communication and leadership quality.



The graduates in the discipline of Applied Mathematics and Computing should be;

- able to analyse complex problems and design, develop and evaluate solutions using the knowledge and understanding of their subjects.
- able to apply mathematical and computer science algorithms and tools to solve problems using their intellectual abilities.

- self-motivated, enthusiastic and to undertake lifelong learning to continue professional development.
- independence of mind, with intellectual integrity possessing professional ethical behaviour.

Graduates in the discipline of Environmental Science should be;

- able to apply academically gained knowledge in solving environmental issues scientifically.
- skilled in writing, research activities, problem-solving and communication.
- committed to improving the sustainability of the environment.
- a socially and environmentally responsible citizen.

Graduates in the discipline of Information and Communication Technology should be;

- able to demonstrate the in-depth knowledge and skill in Information and Communication Technology.
- participating in team work to plan projects and implement successfully for a sustainable system.
- efficiently communicate to work out and solve the computing problem in organizations.
- able to maintain the updated IT knowledge by critically analysing the system and to carry out research.

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3 Course Details

3.1 B.Sc. (Applied Mathematics and Computing)

LEVEL 1	**For General Degree course**			
Course Number		**Title**	**Number of Credits**	
Semester I	AMA 1113	Differential Equations	03	**16**
	PMA 1113	Foundation of Mathematics	03	
	STA 1113	Statistical Theory	03	
	COS 1112	Fundamental Concepts in Information Technology	02	
	COS 1122	Practical for Fundamental Concepts in Information Technology	02	
	COS 1132	Introduction to Programming Using C++	02	
	COS 1141	Practical for Introduction to Programming Using C++	01	
	*ACU 1110	English Language I	00	
	*ACU 1120	General Biology	00	
Semester II	AMA1213	Mechanics	03	**14**
	PMA 1213	Analysis and Number Theory	03	
	COS 1212	Numerical Computing I	02	
	COS 1221	Practical for Numerical Computing I	01	
	COS 1233	Advanced Programming Using Java and C++	03	
	COS 1242	Practical for Advanced Programming Using Java and C++	02	
	*ACU 1210	Communication Skills	00	
	*ACU 1220	Sri Lankan studies, Social Harmony and Natural Resources of Sri Lanka	00	
* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees .				

LEVEL 2	**For General Degree course**			
Course Number		**Title**	**Number of Credits**	
Semester I	PMA 2112	Liner Algebra with applications	02	**15**
	PMA 2121	Practical for Liner Algebra with applications	01	
	AMA 2113	Methods of Applied Mathematics	03	
	AMA 2123	Vector Calculus& Field Theory	03	
	STA 2113	Statistical Analysis	03	
	COS 2112	Data Structures and Algorithms	02	
	COS 2121	Practical for Data Structures and Algorithms	01	
	*ACU 2110	English Language II	00	
Semester II	AMA 2212	Fundamentals of Optimization	02	**15**
	AMA 2223	Elementary Fluid Dynamics	03	
	AMA 2231	Practical for Fundamentals of Optimization	01	
	STA 2212	Design of Experiments	02	
	STA 2221	Practical in Statistical systems	01	
	COS 2212	Numerical Computing II	02	
	COS 2222	Data Base System	02	
	COS 2231	Practical for Data Base System	01	
	COS 2241	Practical for Numerical Computing II	01	
	*ACU 2210	Career Guidance	00	
* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.				

LEVEL 3	**For General Degree course**			
Course Number		**Title**	**Number of Credits**	
Semester I	AMA 3113	Modelling	03	**15**
	AMA 3123	Mathematical Programming	03	
	STA 3112	Regression Analysis & Time Series	02	
	STA 3121	Practical for Regression Analysis & Time Series	01	
	COS 3113	Software Engineering	03	
	COS 3122	Operating Systems	02	
	COS 3131	Practical for Operating Systems	01	
	*ACU 3110	Management and Entrepreneurial skills	00	
Semester II	PMA 3213	Algebraic Structures and Complex Variables	03	**15**
	AMA 3213	Analytical Dynamics	03	
	STA 3213	Applied Statistics	03	
	COS 3213	Internet Programming	03	
	COS 3222	Computer Systems	02	
	COS 3231	Practical for Computer Systems	01	
* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.				

LEVEL 3	**For Special Degree in Computer Science**			
Course Number		**Title**	**Number of Credits**	
Semester II	SCOS 3213	Knowledge Based System (KBS) and Logic Programming	03	**09**
	SCOS 3223	Parallel Computing	03	
	SCOS 3232	Practical for Knowledge Based System (KBS) and Logic Programming	02	
	SCOS 3241	Practical for Parallel Computing	01	
Those who are following special degree course in Computer Science should take all the Computer Science courses offered in general degree level 3 semester II and the special Computer Science courses offered in level 3 semester II (i.e should take - COS 3213, COS 3222, COS 3231, and SCOS 3213, SCOS 3223, SCOS 3232, SCOS 3241).				

LEVEL 4	**For Special Degree in Computer Science**

Course Number		**Title**	**Number of Credits**	
Semester I	SCOS 4113	Advanced Numerical Analysis	03	**15**
	SCOS 4123	Combinatorial Mathematics and Graph Theory	03	
	SCOS 4133	Networking Basics	03	
	SCOS 4143	Object Oriented Analysis and Design	03	
	SCOS 4153	Computer Graphics and Image processing	03	
Semester II	SCOS 4213	Compiler Design	03	**15**
	SCOS 4223	Theory of Computation	03	
	SCOS 4232	Numerical Solution of Partial Differential Equations-Finite Element Method	02	
	SCOS 4241	Practical for Numerical Solution of Partial Differential Equations-Finite Element Method	01	
	RPRO4215	Project and Seminar	05	
	INTR 4211	Industrial Training (3 weeks)	01	

3.2 BICT

LEVEL 1				
Course Number		**Title**	**Number of Credits**	
Semester I	ICT1113	Discrete Structures	03	**15**
	ICT1122	Fundamentals of Computer Systems	02	
	ICT1132	Introduction to Program Design and Programming	02	
	ICT1142	Object Oriented Program Design	02	
	ICT1152	Practical for Fundamentals of Computer Systems	02	
	ICT1162	Practical for Introduction to Program Design and Programming	02	
	ICT1172	Practical for Object Oriented Program Design	02	
	*ACU 1110	English Language I	00	
Semester II	ICT1213	Data Structures	03	**15**
	ICT1223	Basic Electronics and Digital Logic Design	03	
	ICT1233	Operating Systems	03	
	ICT1242	Practical for Data Structures	02	
	ICT1252	Practical for Basic Electronics and Digital Logic Design	02	
	ICT1262	Practical for Operating Systems	02	
	*ACU 1210	Communication skills	00	
	*ACU 1220	Sri Lankan studies, Social Harmony and Natural Resources of Sri Lanka	00	
* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.				

LEVEL 2				
Course Number		**Title**	**Number of Credits**	
Semester I	ICT2113	Mathematics for Computing	03	**15**
	ICT2122	Design and Analysis of Algorithms	02	
	ICT2133	Software Engineering	03	
	ICT2142	Visual Computing (Rapid Application Development)	02	
	ICT2152	Practical for Design and Analysis of Algorithms	02	
	ICT2161	Practical for Software Engineering	01	
	ICT2172	Practical for Visual Computing (Rapid Application Development)	02	
	*ACU 2110	English Language II	00	
Semester II	ICT2212	Operational Research	02	**15**
	ICT2222	Database Design	02	
	ICT2232	Computer Networks	02	
	ICT2243	Computer Graphics	03	
	ICT2252	Management Information Systems	02	
	ICT2262	Practical for Database Design	02	
	ICT2272	Practical for Computer Graphics	02	
	*ACU 2210	Career Guidance	00	
* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.				

LEVEL 3				
Course Number		**Title**	**Number of Credits**	
Semester I	ICT3113	Advanced Database Management Systems	03	**15**
	ICT3122	Project Management	02	
	ICT3133	Project	03	
	ICT3142	Human Computer Interaction	02	
	ICT3152	Server Management	02	
	ICT3162	Practical for Advanced Database Management Systems	02	
	ICT3171	Practical for Human Computer Interaction	01	
	*ACU 3110	Management and Entrepreneurial skills	00	
Semester II	ICT3213	Knowledge Based System (KBS) and Logic Programming	03	**15**
	ICT3222	Internet Security	02	
	ICT3232	Multimedia and Web development	02	
	ICT3242	Internet Computing	02	
	ICT3252	Practical for Knowledge Based System (KBS) and Logic Programming	02	
	ICT3262	Practical for Multimedia and Web development	02	
	ICT3272	Practical for Internet Computing	02	
* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.				

LEVEL 4				
Course Number		**Title**	**Number of Credits**	
Semester I	ICT4113	Computer Architecture and Assembly Language Programming	03	**15**
	ICT4122	Bio Informatics and Computational Biology	02	
	ICT4132	Mobile Computing	02	
	ICT4142	Advanced Computer Networks	02	
	ICT4152	E-Commerce	02	
	ICT4161	Practical for Computer Architecture and Assembly Language Programming	01	
	ICT4171	Practical for Bio Informatics and Computational Biology	01	
	ICT4181	Practical for Mobile Computing	01	
	ICT4191	Practical for E-Commerce	01	
Semester II	ICT4213	Parallel and Cluster Computing	03	**15**
	ICT4222	Advanced Networking Technologies I (Routing)	02	
	ICT4232	Advanced Networking Technologies II (Switching)	02	
	ICT4242	Agent Technology	02	
	ICT4252	Seminar/Presentation	02	
	ICT4261	Practical for Parallel and Cluster Computing	01	
	ICT4271	Practical for Advanced Networking Technologies I (Routing)	01	
	ICT4281	Practical for Advanced Networking Technologies II (Switching)	01	
	ICT4291	Practical for Agent Technology	01	

3.3 B.Sc. (Environmental Science)

LEVEL 1	**For General Degree course**			
Course Number		**Title**	**Number of Credits**	
Semester I	ASB 1113	Plant diversity and Taxonomy	03	**15**
	ASB 1122	General and Inorganic Chemistry and Chemical Thermodynamics	02	
	ASB 1131	Practical Unit-Inorganic Chemistry	01	
	ASB 1143	Cell and Molecular Biology	03	
	ASB 1153	Basic Mathematics and statistics	03	
	CCCU 1113	Fundamental concepts in information Technology	03	
	ACU 1112*	English Language I	02	
Semester II	ASB 1212	Plant Anatomy and Physiology	02	**15**
	ASB 1223	Organic Chemistry	03	
	ASB 1231	Practical Unit-Organic Chemistry	01	
	ASB 1242	Vertebrate Diversity	02	
	ASB 1252	Invertebrate Diversity	02	
	ASB 1262	Development Physiology and Post Harvest Technology	02	
	ASB 1273	Basic Microbiology	03	
	ACU 1211*	Communication skills	01	
	ACU 1222*	Sri Lankan studies, Social Harmony and Natural Resources of Sri Lanka	02	

* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.

LEVEL 2	**For General Degree course**			
Course Number		**Title**	**Number of Credits**	
Semester I	ENS 2112	Biodiversity and Conservation	02	**15**
	ENS 2123	Environmental Pollution and Pollution Control	03	
	ENS 2132	Environment and Agriculture	02	
	ENS 2143	Earth and Atmospheric sciences	03	
	ENS 2153	Food nutrition and Environment	03	
	ENS 2162	Environmental sanitation and legal aspects	02	
	ACU 2113*	English Language-II	03	
Semester II	ENS 2213	Analytical Chemistry	03	**15**
	ENS 2222	Animal Behaviour & Population Dynamics	02	
	ENS 2232	Applied ecology and community environment	02	
	ENS 2242	Resource and Environmental Economics	02	
	ENS 2253	Environmental Disaster Management	03	
	ENS 2263	Soil Science and Fertility Management	03	
	*ACU 2212	Career Guidance	02	

* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.

LEVEL 3		**Course Title**	**General Degree**	**Special Degree**
Course Number		**Title**	**Number of Credits**	
Semester I	ENS 3113	Applied Hydrology and Water resource Management	03	**15**
	ENS 3122	Application of Geographic Information Systems (GIS) in Natural Resource Management (NRM)	02	
	ENS 3132	Forest Environmental Biology and Management	02	
	ENS 3142	Wild life Biology and Management	02	
	ENS 3153	Solid and Hazardous Waste Management	03	
	ENS 3163	Applied Statistics and Experimental design	03	
	SENS 3173	Environmental Biotechnology	-	**03**
	ACU 3112	Management and Entrepreneurial Skills	02	
			15	**18**
Semester II	ENS 3212	Research Methods for Environmental and Resource Management	02	**14**
	ENS 3222	Marine Environment and Management	02	
	ENS 3231	Environmental Law	01	
	ENS 3243	Industrial chemistry and pollution monitoring methods	03	
	ENS 3252	Environmental Impact Assessment (EIA) and Environmental Audit	02	
	ENS 3262	Sustainable Development and Environmental Policy	02	
	ENS 3272	Environmental System/s Modelling (ESM)	02	
	ENS 3281	Seminar	01	
	SENS 3283	Pesticide Chemistry and Environmental Toxicology	-	**03**
			15	**17**

* Auxiliary Course Units are treated as non-credit valued course units as they are not taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degrees.
Seminar for general students only and student has to pass the seminar to obtain degree.
Special degree students have to follow SENS 3173, SENS 3283, in addition to general degree course in semester I & II.

LEVEL 4	**Special Course in Environmental Science**			
Course Number		**Title**	**Number of Credits**	
Compulsory courses				
Semester I	SENS 4113	Ground and Surface Water Management	03	**12**
	SENS 4123	Soil∼Plant∼Water System	03	
	SENS 4132	Limnology and Wetland Management	02	
	SENS 4142	Domestic and Industrial Wastewater Treatment technologies	02	
	SENS 4152	Project Management	02	
	Optional Courses			**06**
	SENS 4163	Food Microbiology and Toxicology	03	
	SENS 4173	Ecotourism	03	
	SENS 4182	Environmental Remote Sensing (ERS)	02	
	SENS 4193	Advanced Spectroscopic methods	03	
	SENS 41(10)2	Plantation Forestry and Environment	02	
	SENS 41(11)2	Integrated Approaches in Pest and Weed Management	02	
	SENS 41(12)3	Introduction to Science/ Environment communication	03	
	SENS 41(13)2	Global Environmental Change (GEC)	02	
	SENS 41(14)1	Cleaner Production	01	
				18
Semester II	SENS 4211	Industrial Training	01	**07**
	SENS 4226	Research Project	06	

Optional Courses will be selected according to the (teaching) resources available to get the 15 credits with compulsory courses. Special degree students have to obtain an industrial training from any industry related to these course modules for 2 months during the vacation after semester I. At the end of the industrial training each students has to submit a report and present his/her experience for evaluation.

4 Evaluation System

4.1 B.Sc. (Applied Mathematics and Computing)

The evaluation of a course shall be based on in-course assessment namely continuous assessments/assignments, presentations, quiz etc. and the end semester examination.

In the case of theory course unit, the final evaluation will be evaluated by giving 20% to the in-course assessment and 80% for the end semester examination.

For example, the final marks M_1 for the theory course unit will be evaluated in the following:

$$M_1 = \frac{8T + 2A_1}{10}$$

where T is the marks obtained in the final theory examination and A_1 is the marks obtained in the in-course assessment during the course.

In the case of practical course unit, the final evaluation will be evaluated by giving 60% to in-course assessment and 40% for the end semester examination. For example, the final marks M_2 for the practical course unit will be evaluated in the following:

$$M_2 = \frac{4P + 6A_2}{10}$$

where P is the marks obtained in the final practical examination and A_2 is the marks obtained in the in-course assessment during the practical course.

Each of the marks A_1 and A_2 will be the average of the best $\frac{2}{3}$ of the in-course assessment. However, in the case of stand alone one credit course, minimum of two in-course assessment will be taken for evaluation.

4.2 BICT

The evaluation of a course shall be based on in-course assessment namely continuous assessments/assignments, presentations, quiz etc. and the end semester examination.

In the case of theory course unit, the final evaluation will be evaluated by giving 20% to the in-course assessment and 80% for the end semester examination.

For example, the final marks M_1 for the theory course unit will be evaluated in the following:

$$M_1 = \frac{8T + 2A_1}{10}$$

where T is the marks obtained in the final theory examination and A_1 is the marks obtained in the in-course assessment during the course.

In the case of practical course unit, the final evaluation will be evaluated by giving 60% to in-course assessment and 40% for the end semester examination. For example, the final marks M_2 for the practical course unit will be evaluated in the following:

$$M_1 = \frac{4P + 6A_2}{10}$$

where P is the marks obtained in the final practical examination and A_2 is the marks obtained in the in-course assessment during the practical course.

Each of the marks A_1 and A_2 will be the average of the best $\frac{2}{3}$ of the in-course assessment. However, in the case of stand alone one credit course, minimum of two in-course assessment will be taken for evaluation.

4.3 B.Sc. (Environmental Science)

The evaluation of a course unit shall be based on in-course assessment and end semester examination. In-course assessment consists of assignments, presentations, quizzes, tutorials etc.

(i) In case of theory course unit, the final evaluation will be evaluated by giving 20% for continuous assessment and 80% for the end course examination.

Tutorials	05%
Two written quizzes	15%
End semester examination	80%

(ii) In the case of practical course unit, the final evaluation will be evaluated by giving 20% for continuous assessment and 80% for the end course examination.

(iii) In the case of course unit with practical component, the practical component of the courses will be assessed by continuous assessments and by end course examinations. For courses in which practical are assessed, student obtaining less than 30% marks in either theory or practical will obtain a 'E grade even if the average is greater than 30. When the practical hours change, the calculation of marks should be done accordingly.

For example, ASB 1113 (3:35/30)

This is a 3 credit unit and the practical component having the 35 hours of lecture and 30 hours of practicals. The weightage of the practicals and the theory is allocated based on the credit hours. Marks given for the theory component and practical component are as follows.

$$\frac{100}{45} \times 35 = 77.78$$
$$\frac{100}{45} \times 10 = 22.22$$

4.4 Grading System and Grade Point Average

Based on the scheme of evaluation mentioned above, marks obtained in respect of a course unit will be graded as follows

Range of Marks	Grade	Grade Point Value
80 - 100	A^+	4.0
75 - 79	A	4.0
70 - 74	A^-	3.7
65 - 69	B^+	3.3
60 - 64	B	3.0
55 - 59	B^-	2.7
50 - 54	C^+	2.3
45 - 49	C	2.0
40 - 44	C^-	1.7
35 - 39	D^+	1.3
30 - 34	D	1.0
00 - 29	E	0.0

Grading will be given for each credit (e.g. A in a 2 credit course would be considered as 2A) and the minimum grade to pass a course unit will be D.

Grade Point Average (GPA) is the credit-weighted arithmetic mean of the Grade Points which is formulated as

$$\text{GPA} = \frac{\text{Sum of (credits} \times \text{grade points)}}{\text{Total credits}} = \frac{\sum c_i g_i}{\sum c_i} = G_j$$

where c_i is the number of credits for the i^{th} course and g_i is the grade point for the i^{th} course.

The Final GPA (FGPA) for **all the degree programmes** would be **the credit weighted mean giving equal weight for all levels**, computed to **two decimals**.

4.5 End Course Examination of the Faculty

An end course examination shall be conducted for each course unit at the end of the course or at the end of the semester in which the teaching of the course is completed. The end course examinations shall be conducted by the Examination Branch of the Vavuniya Campus as per the academic calendar of the Faculty approved by the Senate. An Examination Board of the Faculty constituted for each course unit shall finalise the results of that course unit.

The grades obtained by the students in the end course examination and the overall grades obtained by the students for that particular course shall be displayed by the Head of the Department concerned after ratification by the Examination Board of the Faculty. The Dean shall send Grades list to the Examination Branch of the Vavuniya Campus.

When the results of the examinations on all the course units of a particular semester of an academic year are received by the Examination Branch of the Vavuniya Campus, the Examination Branch will summon a meeting of the Examination Board chaired by the Rector. The Board will release the overall performance of the students in that semester of that academic year.

The Examination Board chaired by the Rector will also release the GPA in each level, overall GPA and the Class of Honours obtained by the students who have completed that course of study in that academic year.

4.6 Provision for Re-scrutinization

The Commission Circular No: 978 dated 9th April, 2012 on "*Provision for re-scrutinization of marks and grades of undergraduates*" has been adopted by the

Faculty with effect from 06th February 2013.

However, the candidates who apply for re-scrutiny should accept the final grade which may be higher, lower or no change after the re-scrutinization.

4.7 Repeat/Re-Sit Examination

(a) Those who fail to obtain the requisite number of credit passes or fail to appear for an end semester examination are required to appear for such an examination when it is held next.

(b) A course unit mark with a grade less than "D" must be repeated.

(c) For repeat candidates, the marks at the end course examinations and the marks at his/her previous continuous assessments will be taken for computation and the maximum grade awarded will be 'C'.

(d) Repeat examination of a candidate supported by a Medical Certificate either by the Campus Medical Officer (CMO) or certified by the CMO will be considered as that of his/her first attempt. The said candidate's previous continuous assessments will be considered for computation.
such Medical Certificate should be submitted with the appropriate certification of CMO within two weeks from the date of the said examination held.

(e) Candidates who failed to obtain the requisite number of credit passes may proceed to the following year of study and may repeat the failed courses at a subsequent end semester examination.

(f) Examination can be repeated not more than three times. A grace chance is permitted with the approval of the senate.

(g) Candidates who obtain C^- / D^+ / D grade, will be given option to repeat the course unit in order to improve the grade up to C.

(h) In the event of (g), a candidate obtains a lower grade while attempting to improve his/her grade, he/she will be entitled to his/her previous grade.

(i) Candidates obtain a grade less than 'C' in course unit Seminar of Environmental Science degree programme must repeat the unit.

4.8 Award of Certificate

A candidate who wishes to leave the course after completing the level 1 of the degree programme will be awarded a 'Certificate' if he/she has;

(a) Grade C or above in the Auxiliary Course Units English Language I and Grade D or above in the other Auxiliary course units.

(b) Taken all 30 credits available for the general degree programme in level 1.

(c) Obtained a minimum GPA of 2.00 in level 1.

Students of Applied Mathematics and Computing, and Environmental Science will be awarded a certificate in "Applied Science" where as students of ICT will be awarded a certificate in "Information and Communication Technology".

4.9 Award of Diploma

A candidate who wishes to leave the course after completing the level 1 and level 2 of the degree programme will be awarded a 'Diploma' if he/she has

(a) Grade C or above in the Auxiliary Course Units English Language I & II and Grade D or above in the other Auxiliary course units.

(b) Taken all 60 credits available for the general degree programme in level 1 and level 2.

(c) Obtained a minimum GPA of 2.00 in level 1 and level 2.

Students of Applied Mathematics and Computing, and Environmental Science will be awarded a diploma in "Applied Science" where as students of ICT will be awarded a diploma in "Information and Communication Technology".

4.10 Award of General Degree

4.10.1 Department of Bio-science

To eligible for the B.Sc in Environmental Science degree a candidate should;

(a) Have obtained Grade C or above in the Auxiliary Course Units English Language I & II and Grade D or above in the other Auxiliary course units.

(b) Have taken all 90 credits available for the general degree programme in level 1, level 2 and level 3.

(c) Have obtained a minimum FGPA of 2.00 in level 1, level 2 and level 3.

(d) Complete the relevant requirements within a period of five academic years from the registration.

4.10.2 Department of Physical Science

To eligible for the B.Sc (General)/BICT degree a candidate should;

(a) Have obtained Grade C or above in the Auxiliary Course Units English Language I & II and Grade D or above in the other Auxiliary course units.

(b) Have taken all 90 credits available for the general degree programme in level 1, level 2 and level 3.

(c) Have obtained a minimum FGPA of 2.00 in level 1, level 2 and level 3.

(d) Complete the relevant requirements within a period of five academic years.

4.11 Award of Classes (General Degree)

4.11.1 Department of Bio-science

A candidate may be awarded a class if he/she has completed the minimum 90 credit units and fulfil the requirement of the general degree within the period of three academic years from the registration. Award of classes for the General Degree will be decided by the Board of Examiners using the following following Final Grade Point Average (FGPA) values shown below.

FGPA	Class /Pass
$\geq$3.7	First class
3.30-3.69	Second Upper
3.0-3.29	Second Lower
2.00-2.99	Pass

4.11.2 Department of Physical Science

A candidate may be awarded a class if he/she has completed the 90 credit units within the period of three academic years. If a candidate fails one or more course units and still completes these units within three academic years, he/ she is eligible for a class but the maximum grade given for the repeated units will be C. Award of classes for the General Degree will be decided by the Board of Examiners using the following criteria as guidelines.

1. **First Class**
   A candidate shall be awarded First Class if he/she
   (a) is eligible for B.Sc. (General)/BICT Degree,
   (b) obtains minimum FGPA of 3.70, and,
   (c) completes the relevant requirements within three academic years.

2. **Second Class (Upper Division)**
   A candidate shall be awarded Second Class (Upper Division) if he/she
   (a) is eligible for B.Sc. (General)/BICT Degree,
   (b) obtains minimum FGPA of 3.30, and,
   (c) completes the relevant requirements within three academic years.
3. **Second Class (Lower Division)**
   A candidate shall be awarded Second Class (Lower Division) if he/she
   (a) is eligible for B.Sc. (General)/BICT Degree,
   (b) obtains minimum FGPA of 3.00, and,
   (c) completes the relevant requirements within three academic years.

4.12 Award of (Special) Degree

4.12.1 Award of B.Sc.(Special)in Environmental Science

To eligible for the B.Sc. (Special)in Environmental Science degree a candidate should;

(a) have obtained Grade C or above in the Auxiliary Course Units English Language I & II and Grade D or above in the other Auxiliary course units.

(b) have taken minimum 120 credits available for the general and special degree programme in level 1, level 2, level 3 and level 4.

(c) have obtained a minimum FGPA of 2.00 in level 1, level 2, level 3 and level 4.

(d) Complete the relevant requirements within a period of six academic years.

(e) Obtain D or better in all course units.

4.12.2 Award of B.Sc.(Special)/B.Sc.in ICT Degree

To eligible for the B.Sc. (Special)/B.Sc. in ICT degree a candidate should;

(a) Have obtained Grade C or above in the Auxiliary Course Units English Language I & II and Grade D or above in the other Auxiliary course units.

(b) Have taken all 120 credits available for the general and special degree programme in level 1, level 2, level 3 and level 4.

(c) Have obtained a minimum FGPA of 2.00 in level 1, level 2, level 3 and level 4.

(d) Complete the relevant requirements within a period of six academic years.

B.Sc.(Special) in Computer Science degree will be the award of Special Degree. B.Sc. in Information and Communication Technology (B.Sc.in ICT).

4.13 Award of Classes (Special Degree)/(Extended Fourth Year Degree)

Department of Bio-science

A candidate may be awarded a class if he/she has completed minimum of 120 credit units within the period of four academic years from the registration. Award of classes for the Special Degree will be decided by the Board of Examiners using the following Final Grade Point Average (FGPA) values shown below.

FGPA	Class /Pass
$\geq$3.7	First class
3.30-3.69	Second Upper
3.0-3.29	Second Lower
2.00-2.99	Pass

4.13.1 Department of Physical Science

A candidate may be awarded a class if he/she has completed the 120 credit units within the period of four academic years. If a candidate fails one or more course units and still completes these units within four academic years, he/ she is eligible for a class but the maximum grade given for the repeated units will be C. Award of classes for the Special Degree/Extended Fourth Year Degree will be decided by the Board of Examiners using the following criteria as guidelines.

1. **First Class**
   A candidate shall be awarded First Class if he/she
   (a) is eligible for B.Sc.Special) in Computer Science /B.Sc.in ICT,
   (b) obtains grades of A for at least half of the level 3 and level 4 special course units (Only for B.Sc. (Special) in Computer Science and, not required for B.Sc. in ICT),
   (c) obtains minimum FGPA of 3.70, and,
   (d) completes the relevant requirements within four academic years.
2. **Second Class (Upper Division)**
   A candidate shall be awarded Second Class (Upper Division) if he/she
   (a) is eligible for B.Sc.(Special) in Computer Science /B.Sc.in ICT,

(b) obtains grades of B^+ or better for at least half of the level 3 and level 4 special course units and at least grade C for the remaining level 3 and level 4 course units (Only for B.Sc. (Special) in Computer Science and, not required for B.Sc. in ICT),

(c) obtains minimum FGPA of 3.30, and,

(d) completes the relevant requirements within four academic years.

3. **Second Class (Lower Division)**
   A candidate shall be awarded Second Class (Lower Division) if he/she

   (a) is eligible for B.Sc.(Special) in Computer Science /B.Sc.in ICT,

   (b) obtains grades of B or better for at least half the level 3 and level 4 special course units (Only for B.Sc.(Special) in Computer Science and , not required for B.Sc. in ICT),

   (c) obtains minimum FGPA of 3.00, and,

   (d) completes the relevant requirements within four academic years.

4.14 Effective date of the degree

The effective date of the degree shall be the last date of the examination.

4.15 Official Transcript

The credit values of all the course units and the grades obtained in each course unit including the auxiliary course units shall appear in the transcript.

The transcript shall also give the Final GPA (FGPA), the class (if any) obtained and the Grade Point Value of each Grade.

5 Examination Rules

5.1 Attendance

Candidates shall be in attendance outside the examination hall at least 15 minutes before the commencement of each paper, but shall not enter the hall until they are requested to do so by the Supervisor.

5.2 Seating

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

5.3 Admission to Hall

No candidate shall be admitted to the examination hall for any reason whatsoever after the expiry of half an hour from the commencement of the examination. Nor shall a candidate be allowed to leave the hall until half an hour has lapsed from the commencement of the examination or during the last 15 minutes of the paper.

5.4 Record Book as Identity

A candidate shall have his/her student Record Book and the 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 Record Book. If he/she fail to bring his/her Record Book on any occasion, he/she shall sign a declaration in the form provided for it, and produce the Record Book in the next occasion when he/she appears for the examination. If it is the last paper or the only paper he/she is sitting, he/she shall produce the Record Book/Identity Card to the Senior Assistant Registrar/Examination on the following day. If a candidate loses his/her Record

Book in the course of the day or if a candidate loses his/her Record Book in the course of the Examination, he/she shall obtain a duplicate Record Book, Identity Card from the Senior Assistant Registrar/Examination, for production at the examination hall.

5.5 Documents which candidates should not bring

No candidate is allowed to have any written documents in his or her possession.

5.6 Declaration of Articles in Possession

If a supervisor so requires every candidate shall declare everything he/she has in his/her possession

5.7 Copying

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. No shall any candidate either help another candidate or person whomsoever. No shall any candidate conduct himself so negligently that an opportunity is given to any other candidate to read anything written by him/her or to watch any practical experiment conducted by him/her. No shall any candidate use any other unfair means or obtain or render improper assistance at the examination.

5.8 Cheating

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

5.9 Articles that candidate may bring

Candidates shall bring their own pens, ink, mathematical instruments, erasers, pencils or any other equipment or stationary which the candidates have been instructed to bring.

5.10 Examination Stationery

Examination stationery (i.e. writing paper, graph paper, drawing paper, ledger paper, precise paper etc.) will be supplied as and when necessary. No sheet of

paper or answer book supplied to candidate may be torn, crumpled, folded or otherwise mutilated. No other papers shall be used by candidates. Log tables or any other materials provided by the University shall be used with care and left behind on the desk. Such material supplied whether used or unused, shall be left behind on the desk and not removed from the examination halls.

5.11 Index Number

Every candidate shall enter his/her Index Number on the answer book and on every continuation paper. He/She also enter all necessary particulars as indicated in the cover of the answer book. A candidate who inserts on his/her own script an index number other than his/her is liable to be considered as having cheated. A script that bears no Index Number or an Index 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.

5.12 Rough work to be cancelled

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 admission cards, time tables, question papers, record books or on any other paper. Any candidate who disregards these instructions will be considered as having written notes or outline of answers with the intension of copying.

5.13 Unwanted parts of Answers to be crossed out

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

5.14 Under Supervisors Authority

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

5.15 Conduct

Every candidate shall conduct himself/herself in the Examination Hall and its precincts so as not to cause disturbance or inconvenience to the Supervisor or his/her staff or to other candidates. In entering and leaving the hall, shall conduct him/her as quietly as possible. A candidate is liable to be executed from the examination hall for disorderly conduct.

5.16 Stopping work

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

5.17 Maintenance of Silence

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

5.18 Leaving

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

5.19 Impersonation

No person shall impersonate a candidate whether in the examination hall or before or after the examination, nor shall any candidate allow himself to be impersonated by any other person.

5.20 Prior knowledge

No candidate shall obtain or attempt to obtain prior knowledge of questions.

5.21 Dishonesty

Serious notice will be taken of any dishonest assistance given to candidate, by any person.

5.22 Cancellation/Postponement

If circumstances arise which in the opinion of the Supervisor render the cancellation or postpone of the examination necessary, he/she shall stop the examination, collect the scripts already written and then report the matters as soon as possible to the Rector/Senior Assistant Registrar/Examination.

5.23 Making of statements

The Supervisor/Invigilator is empowered to request 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.

5.24 Whom to contact in Examination Matters

No candidate shall contact any person other than the Rector/Dean or Senior Assistant Registrar/Examinations regarding any matter concerning the examinations.

5.25 Handing over of Answer scripts

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

5.26 Withdrawal

Every candidate who registers for an examination shall be deemed to have sat an examination within the specified period unless he/she submits a medical certificate prior to the commencement of the examination. The medical certificate shall be from the Campus Medical Officer. If this is not possible the medical certificate should be obtained from a Government Medical Practitioner and should be submitted to the Campus Medical Officer for certification at the earliest possible time.

5.27 Absence from Examination

When a candidate is unable to present himself/herself for any part or section of an examination, he/she shall notify the cause to the Senior Assistant Registrar /Examinations immediately. This should be confirmed with supporting documents within 48 hours by registered post.

5.28 Plagiarism

The Faculty operates on a **zero tolerance** policy when it deals with acts of plagiarism. The students are advised to ensure that all their course work, reports and other reportive work are referenced properly when quoting or citing from another person's work. Of particular importance is the common tendency to 'copy and paste' from the internet that is practiced voraciously at present. This, in the case of the Faculty of Applied Science **will not be tolerated** even to the very minor levels.

6 Services and Facilities

The office of the Senior Assistant Registrar(Examinations and Admission) is located in the Main Campus Building at Park Road. This office carries out Students Registration, Issuing Identity Card, Admission Card for end semester examination, Result Sheets, Official Transcript, Statements and, Degree Certificates.
The office of the student councilors and Assistant Registrar (Welfare) is located in Pampaimadhu premisses. All the needs of the students outside their study courses such as loan facilities, grants, scholarships, hostel facilities, cafeteria are opened through the Welfare Branch.

6.1 Financial Assistance

Financial Assistances available are as follows:

- Mahapola Scheme
- Bursary Scheme
- Vice Chancellor welfare fund
- Rector's fund
- Late Mrs. Puvaneswary Loganathan Memorial fund

6.2 Awards and Prizes

The Faculty of Applied Science students are eligible to apply for the following awards. However, the students must satisfy the minimum requirements to apply for these awards.

- Late Mrs. Puvaneswary Loganathan Memorial Gold Medal
  (Only for Environmental Science Students)
- Prof. Alagaiah Thurairajah Gold Medal

- Prof. Kanthia Kunaratnam Gold Medal
- University Prize (Thambiah Mudhaliyar Chatram Trust)

6.3 IT Facilities

The Campus has a well established Computer Laboratory with networking facilities. Wireless network has been set up for teaching WiFi Technology. Cisco laboratory has been set up to teach advanced network technology. Multimedia laboratory also has been set up. All the students have access to internet facilities.

6.4 Laboratory Facilities

The Faculty has well equipped Chemistry and Bio Science Laboratories to Environmental Studies. Arrangements are underway to set up a fully fledged Physics Laboratory. At present the department of Bio Science has began establishing a computer laboratory for hosting GIS and Environmental Modelling facilities to the Environmental Science students.

6.5 Self Access Learning Centre

There is a Self Access Learning Centre with 25 computers and internet facilities at Kurumankadu premises of the Faculty of Applied Science. During the free time, students can utilize this learning centre. This is to encourage self learning skills of the students.

6.6 IT Centre

The IT Centre of the Vavuniya Campus is located in hostel premises at Pampaimadhu. There are 50 computers available with internet facilities for teaching, learning and training purposes. Further, the centre supports to train the state and non-state employees and school leavers in IT and other aspects. The students of the Faculty of Applied Science also can enjoy the facilities of this centre.

6.7 Library Services

The Campus possesses a well established library to support the teaching, learning and research in all disciplines. It is situated in the main campus. Further, the library also provides facilities that enable students to access scientific information through selected online journal venues.

6.8 Physical Education

Students are encouraged to participate and utilize the facilities available for sports in the campus.

6.9 Accommodation and Lodging

At present Vavuniya Campus has four hostels in order to accommodate 1000 students both male and female.

6.10 Facilities for the differently abled students

The Faculty has the ramp facility in the laboratories to support the dierently abled students. In addition to that lecture halls are equipped with left-handed arm chairs. Further, Faculty is taking initiative to construct washrooms and elevators for the dierently abled students.

6.11 Health Facilities

The Campus Medical Officers (CMO) will be available from 12.00 Noon to 1.00 PM at Health centres of the Main Campus at Park Road and Pampaimadhu Premises. when necessity arises the students will be channeled to the Vavuniya General Hospital.

6.12 Students Union

Students who register to follow a degree program at the Faculty shall be the members of the Campus Students Union and Faculty of Applied Science Students Union.

6.13 Staff and Students Interaction

A committee has been set up to promote staff and students interaction. This committee arranges various programmes to enhance togetherness and social harmony.

6.14 Students Counselors

Students counselors are in service in the Faculty. Students can obtain any assistance and can clarify any problem with the students counselors.

6.15 Academic Counselors

Academic counselors are available for students of each level of the Faculty of Applied Science to guide them through successful academic career.

7 Schedules and Contacts

7.1 Semester Schedules

First Semester	
First Semester First Half	8 weeks
Mid Semester Vacation	1 week
First Semester Second Half	7 weeks
End Semester Examinations and Vacation	10 weeks

Second Semester	
Second Semester First Half	8 weeks
Mid Semester vacation	1 week
Second Semester Second Half	7 weeks
End Semester Examinations and Vacation	10 weeks

7.2 How to Contact

Rector	024 2222264
Dean, Faculty of Applied Science	024 2220179
Senior Assistant Registrar, Faculty of Applied Science	024 2228401
Head, Dept. of Physical Science	024 2220269
Head, Dept. of Bio Science	024 3248189
Dean, Faculty of Business Studies	024 2228231
Deputy Registrar, Establishment	024 2225143
Senior Assistant Registrar,Examinations and Admission	024 2223317
Assistant Registrar, Administration	024 2223316
Assistant Registrar, Student and Staff Services	024 2228238
Asst. Bursar , Payments and Accounts	024 2220299
Asst. Bursar , Supplies	024 2224017
Senior Assistant Librarian	024 2220279
DELT	024 2228235

↬ **Website address of the Vavuniya Campus:** www.vau.jfn.ac.lk
↬ **LMS address of the Vavuniya Campus:** lms.vau.jfn.ac.lk

Appendix A

Detailed Syllabus

BSc (Applied Mathematics and Computing)

LEVEL 1

Module Code	AMA 1113	**Title**	Differential Equations	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students should be able to gain knowledge in solving differential equation and its basic applications

Outline Syllabus:

Origins of Differential Equations. Equations of First Order and First Degree. Separable Variables and Reduction to Separable Variables, Linear Equations and those Reducible to Linear Forms. Geometric Applications. Equations of First Order and Higher Degree. Linear Equations with Constant Coefficients and Variable Coefficients. System of Linear Equations. Equations of the Second Order. Miscellaneous Types. Total Differential Equations. Conditions for Integrability, Exactness. Solving integrable total Differential Equations. Solution by Series of First Order Equation.

Module Code	PMA 1113	**Title**	Foundation of Mathematics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students should develop a strong foundation on mathematics to follow the remaining courses in applied mathematics and computing.

Outline Syllabus:

Mathematical Logic, Set Theory, Relation and Function. Finite and Infinite Sets, Number System, Boolean Algebra and its Applications. Matrix Algebra: Matrices, Equal matrices, sums of matrices, products of matrices. Algebraic Structures: Groups, Rings, Fields. Polynomials over Fields.

Module Code	STA 1113	**Title**	Statistical Theory	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn how to summarize, interpret and presenting statistical information.

Outline Syllabus:

Collection, Classification and Tabulation of Data. Graphs and Diagrams, their use in Analysis and Presentation. Measures of Central Tendency, Dispersion, Skewness and Kurtosis Concept, Axioms of Probability, Baye's Theorem and Applications, Random Variable. Moment Generating Functions, Probability Generating Functions. Probability Distributions, Binomial, Poisson, Normal, Exponential and Geometric Distributions, Joint Distributions. Conditional Expectation.

Module Code	COS 1112	**Title**	Fundamental concepts in Information Technology	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn the basic concepts in IT and learn about various basic software packages.

Outline Syllabus:
Introduction: Early history of computing, The computer generation, Characterization/ Classification of computers, Basic components and organization of a computer, Representation of information in a computer, Number Systems, Computer logic, Concept of programming and programming languages, Introduction to Matlab.**Application software:** Basic features of application software, tools for work and study - Desktop Accessories, word processing, spreadsheets, Database Management system, Graphics, Communications, Software suites, etc. Operating system and its functions. Utility programs, Utility packages.**Introduction to operating systems:** The need for an operating system, The types of operating systems, The features of the MS-DOS/Windows X operating system, Linux.**Introduction to word processing :** Word processors and its advantages. Ms Word, LateX. **Introduction to spreadsheets packages:** Training in the usage of spreadsheet such as Excel;**Introduction to computer presentation techniques:** Ms power point.**Introduction to Database management system packages:** Ms Access. **Statistical packages:** A brief introduction to statistical packages, usage of packages such as Minitab/SAS. **Introduction to IT & Computer and communication:** Revolution in Computers and communications. The digital future: Role of IT in society, Distinguish between data and information. properties of Information and basis IT tools., Input devices and its functions, output devices and its functions, processing and memory hardware, Secondary storage and communication devices.**Development of communication / computer Technology:** Type of network: WAN, MAN, & LAN, Types of LAN and its components, Topology of LAN, Transmission Media: Twisted-pair, co axial and fibre optics cables, Circuit switching and packet switching, Basics of Protocol, VoIP (IP telephony). **Web design Tools**: Introduction to HTML and Macromedia Flash MX.

Module Code	COS 1122	**Title**	Practical for Fundamental concepts in Information Technology	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 1112

Outline Syllabus:

Practical for Fundamental concepts in Information Technology (COS 1112)

Module Code	COS 1132	**Title**	Introduction to programming using C++	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn to design and program in C++

Outline Syllabus:

Introduction, Programming languages: Machine languages, Assembly languages and High level languages, Techniques of problem solving: Algorithm, Flowchart and Pseudo codes. Introduction of C++ programming, Fundamental of C++ programming, Structure of a C++ program, Input/Output streams, Variable declaration, Arithmetic operations, Relational operations, Logical operations,Control structures: If/Else, While repetition, For repetition, Switch multiple selection, Do/While,Break and Continue, Functions, Scope of variables and parameters, Recursion, Arrays. **Object Oriented Concepts** :Classes and objects, Inheritance, Encapsulation, Polymorphism, Linked list class, string class, etc.

Module Code	COS 1141	**Title**	Practical for Introduction to Programming using C++	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 1212

Outline Syllabus:

Practical for Introduction to Programming using C++ (COS 1212)

Module Code	ACU 1110	**Title**	English Language I	
Credits	0	**Hours**	**Lectures**	15
			Laboratory	**30**

Learning Objectives:

The students should be able to gain necessary skill to read, understand and communicate in English.

Outline Syllabus:

Reading: Basic Reading skills, Skimming, Scanning, Identifying main points, Understanding vocabulary, Understanding sequencing, Reading for comprehension. Writing: Introducing the Mechanics of writing, Introducing vocabulary in and around the University environment, Transferring graphic, statistical, pictorial Information into writing, Sequencing, Form filling, Writing notes, Preparing to write a project. Speaking: Introducing, Describing/ people/events/pictures, Interviewing at an elementary stage, Giving instructions/directions, Making short speeches on a previously prepared topic. Listening: Listening to discriminate sounds, Listening to discriminate sounds. Listening for specific information, Listening for the gist, Listening and responding to telephone conversion, Listening & comprehending Communicative grammar: Introducing basic structures, Word-order Tense, Negation, Question formation, Articles, Preposition, Pronouns, Quantifier, Word class, Active/passive, Conjunctions/ relativization Project: Topics to be selected from student's field of interest, Submission of individual projects to be before the end of the semester.

Module Code	ACU 1120	**Title**	General Biology	
Credits	0	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

This course is designed to provide basic understanding on the characteristics of living organism; biodiversity, genetics and evolution to non-bio science students.

Outline Syllabus:

Scope and nature of Biology, Origin of life and compossitition of living matter, Branches of biology, Applied Biology, Biomes to microhabitats, Communities and ecosystems, Classification of organism, Chemistry of life, The cell as a basic unit, tissues, organs and individuals, the release of energy, Nutrition in plants and animals, transport in plant and animals, co -ordination and control, Defense against diseases, Cell division, Cell cycle, Patterns of reproduction, the principles of heredity , Evidences of evolution.

Module Code	AMA 1213	**Title**	Mechanics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students should be able to understand the basic concept in dynamic and static systems.

Outline Syllabus:

Particle Dynamics: Conservative System. Non-Conservative System. Impulse, Work and Energy. Conservation Laws of Momentum and Energy. Rectilinear Motion with various Laws of Force. Central Orbits. Motion on a Curve. Particles on a Surface. Motion in a Resisting Medium, Varying Mass. Collision of Particles, Elastic Collisions and Scattering. Motion of a System of Particles. **Rigid Dynamics**: Moments and Product of Inertia, Momental Ellipsoid, Equimomental Systems. Motion of a Lamina in its own Plane. Two Dimensional Motion of Rigid Bodies. **Statics** : Theory of forces, Elastic beams, Equilibrium of Strings and Chains.

Module Code	PMA1213	**Title**	Analysis and Number Theory	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

The objective of this unit is to aid students in attaining a broad understanding of analysis techniques that are the basic stepping-stones to contemporary research. Creativity and problem solving skills will be sharpened.

Outline Syllabus:

Axioms for the Real Numbers, Sequences, Convergence, Limit Superior and Limit Inferior. Series. Limits, Continuity, Differentiability. Rolle's Theorem, Mean-Value Theorem. Taylor's Theorem. L'Hospital Rules. **Infinite Series**: Convergence of Infinite Series, Tests for absolute Convergence, Series of functions. **Elementary Number Theory**: Euclidean Property, Factorization, G. C. D., L. C. M. Linear Diophantine Equations, Congruences.

Module Code	COS 1212	**Title**	Numerical Computing I	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn basic Numerical computation algorithms and will be able to assess the errors involved in the algorithms they use.

Outline Syllabus:

Computer number system and errors: Computer number representation, round off errors, loss of significance . **Solution of equation of one variable** : The bisection method ,the method of false-position, fixed point iteration, convergence of iterative methods, Aiken's Δ^2 process, order of convergence, Newton-Raphson method, convergence of Newton-Raphson iteration, Secant method, Order of Secant method.
Roots of Polynomials : Computing with polynomials , using Newton method to compute the roots of a polynomial, Muller's method , Bairstow's method for quadratic factors.
Interpolation: Interpolation and Lagrange polynomial , Errors in Interpolation, Divided Difference, Interpolation with equally spaced points, Interpolation with cubic spline.
Numerical Differentiation and Integration : Numerical Differentiation, Derivatives from difference table, Derivation of derivative formula using Lagrange's Interpolation formula, Richardson's Extrapolation, a five points formula.
Numerical Integration : Trapezodial Rule and Simpon's Rule, Round off error in Trapezodial Rule and Simpon's Rule, adaptive quadrature method, Gaussian quadrature.

Module Code	COS 1221	**Title**	Practical for Numerical Computing I	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 1212.

Outline Syllabus:

Practical for Numerical Computing I (COS 1212)

Module Code	COS 1233	**Title**	Advanced programming using C++ and Java	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn to design programs using the advanced features of C++ and Java .

Outline Syllabus:

Pointers in C++, Implementing classes, programming Graphics, Designing classes, Interfaces, Graphical user Interfaces, Exception Handling, files and streams, Object-Oriented Design.

Module Code	COS 1242	**Title**	Practical for Advanced programming using C++ and Java	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 1233

Outline Syllabus:

Practical for Advanced programming using C++ and Java (COS 1233)

Module Code	ACU 1210	**Title**	Communication skills	
Credits	0	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student should develop skills and knowledge in broad self institutional, social and public communications and develop specialized knowledge and skills in creative, professional, organization and mass communications.

Outline Syllabus:

Introduction to Communication: The communication process, Exchange of meanings, Experience Transmission, Downward communication ,Upward communication, Horizontal communication , One-way communication, Two-way communication and Multi-directional communication. Importance of Communication: Communications for Management, Managerial time in communications and Effects of Good communication. Forms of Communication: Oral communication: Written communication, Non-verbal communication, Para-language Code, Signals, Symbols, Icons, Gestures, Freelance writing, Writing for your people and Publishing and Editing. Levels of communication: Inter personal communication, Public communication and Major components of communication. Planning and Organization: Provision of Information, Management Participation, Analytical skills, Establishment of objectives, Strategy formulation & Development, Activity Identification, Work grouping, Resource allocation, Delegation, Balancing & Timing, Activity Synchronization & Harmonization, Communication for coordination. Motivation: Legal Compliance. Instrumental Satisfaction, Self Expression, Goal Congruence and Communication in Motivation. Control: Issue of Instructions, Reporting & Recommendations, Performance Appraisal and Styles of Control. Staffing: Interview Techniques, Communication in Training & Development, Performance Evaluation & Feedback and Industrial Relations. Leadership: Supportive Leadership, Directive leadership, Achievement Oriented leadership and Participative leadership. Public Relations & Marketing Communication: Negotiating skills: Creating the climate, Opening process, Fabric of Negotiations, Conduct of Negotiation, Communication during Negotiations, Bargaining, Teamwork and Negotiating styles.

Module Code	ACU 1220	**Title**	Sri Lankan studies, Social Harmony and Natural Resources of Sri Lanka	
Credits	0	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

This course is designed to provide basic knowledge in Sri Lankan history and natural resources; social concepts; human rights and the importance of social harmony in a multicultural and multiethnic society.

Outline Syllabus:

Sri Lankan Studies: History, religion, languages, literature, arts, local wisdom and the lifestyle of Sri Lanka in the past, present and the future trend. **Social Harmony:** Concepts and Ideals: Human rights, dignity and values. Acceptance of Global and National pluralism. Acceptance and tolerance of other cultures, traditions, religions and languages. *Identification of issues relating to Social disharmony*:Discrimination, deprivation, Social injustice, Racism, Gender discrimination, Religious fundamentalism. *Historical background to social disharmony in Sri Lanka*: Denial of equal rights in language, employment, education, and economic development of the regions etc., lack of mutual understanding, criminalization of politics and politicization of social issues. *Steps to peace building*: Mutual understanding, progressive positive negotiations, dialogue instead of debate, sustainable peace process, participation of the grass root level society in the peace process, cultivating a "Culture of peace", reconciliation, conflict management. Activity based session to enhance and build social harmony. *At the political level*: Political reform and devolution of powers, good governance, cultivating a sound political culture, cohabitation among political parties and forces, effectively handling pressure groups, inclusive approach than an exclusive one. *Natural Resources of Sri Lanka*: Land aquatic-coastal and marine resources, inland aquatic resources, Renewable and Non-renewable resources.

LEVEL 2

Module Code	PMA 2112	**Title**	Linear Algebra with applications	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should be able to handle vectors, properties of matrices and its application to follow the other relevant courses.

Outline Syllabus:

Vector Spaces, Sup- Spaces, Basis, Dimension theorem; Null Space Sylvester's theorem, Matrix representation, Change of basis; products by partitioning Special types of matrices, Rank of a matrix, Non- singular and singular matrices, Elementary matrices. Determinants Laplace expansion Adjoints; Homogeneous Systems, Uniqueness, Cramers rule, Augmented matrix, consistency. Invariant sub-spaces, Characteristic Polynomials, Eigen Values and Eigen Vectors. Quadratic forms.

Module Code	PMA 2121	**Title**	Practical for Linear Algebra with application	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

Student should be able to understand the theory taught in PMA 2112

Outline Syllabus:

Practical for Linear Algebra with application (PMA 2112)

Module Code	AMA 2113	**Title**	Methods of Applied Mathematics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

To expose students to the theory and application of some of the major areas of applied mathematics; to develop skills in analytic techniques with the application, and physical principles in order to solve problems in physical science and computer science.

Outline Syllabus:

Ordinary Differential Equations: Solution (of ordinary differential equations of second order) by series methods. Legendre and Bessel functions. **Partial Differential Equations**: Partial differential equations by elimination of arbitrary constants and functions, Linear Partial differential equations of order one, Homogeneous Partial differential equations. Complementary functions and particular integrals, Non homogeneous Partial differential equations with constant coefficients, Second order Quasi linear Partial differential equations, Reduction to canonical form. **Fourier Series**: Fourier coefficients, Sine series Cosine Series, Perceval identity, Application of Fourier series to Partial differential equations. **Integral Transforms**: Lap lace transforms, Fourier transforms Z- transform, Application to differential equations.

Module Code	AMA 2123	**Title**	Vector Calculus and Field Theory	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Understand and use the concepts of vector calculus to acquire enough technical skills to use these ideas in field theory or appropriate "real world" situations. Field theory should be useful to solve problems, using general principles and techniques, in the Vector calculus.

Outline Syllabus:

Vector Calculus: Gradient, Divergence and Curl. Line, Surface and Volume integrals. The Divergence theorem, Stokes theorem, Greens theorem, Curvilinear representation of Gradient, Div and Curl. **Field Theory**: Gravitational and electrostatic fields. Governing laws, Planetary motion, Gauss theorem Line of force potential Problems.

Module Code	STA 2113	**Title**	Statistical Analysis	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Enable students to carry out significance tests and to learn decision-making abilities.

Outline Syllabus:

Point and interval estimates, Confidence limits, Standard errors of means, Proportions, Differences, significance testing. Type I and type II Errors. Use of t and of testing Use of central limit theorem. Goodness of fit tests of data to standard distributions. **Non parametric Methods**: Komogorov-Sminov test, Mann- Whitney test, Wald -Wolf Owitz runs test, Sign test Wilcoxon signed rank test, Analysis of Variance by ranks (Kruslal -Wallis test)

Module Code	COS 2112	**Title**	Data Structures and Algorithms	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn linear and non linear data structures and design algorithms for sorting and searching. They will also learn to analyse these algorithms for their complexity.

Outline Syllabus:

Efficient Algorithms for Sorting: Sorting by exchange, Insertion and selection sort Quick sort, Heap sort, Shell and radix sort. **Searching Algorithms:** Sequential Search and binary Search. **Efficiency of Algorithms:** Worst-case analysis, Average case analysis, Lower and upper bounds. **Dynamic Data Types:** Pointer Data type (implementation, operations and Application) **Static Data types:** Their Properties, Implementations operating and applications (single linked list, doubly linked list, stacks, queues). **Tree structures:** Trees, Binary trees, Tree traversal algorithms, Threaded trees, Binary search trees, Balanced trees , Applications.

Module Code	COS 2121	**Title**	Practical for Data Structures and Algorithms	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 2112

Outline Syllabus:

Practical for Data Structures and Algorithm (COS 2112)

Module Code	ACU 2110	**Title**	English Language II	
Credits	0	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

To test the students' communicative abilities and other skills such as informative, writing and comprehensive powers.

Outline Syllabus:

Exposure to significant structures of the English language as the basis of developing language abilities: Reading, Writing, listening and speaking through language skill integration with emphasis on communicative competence at a higher level. Reading: Basic reading skills, Reading for details, Understanding vocabulary in and from context, Finding main ideas, Understanding sequences, Intensive reading, Reading comprehension, Making inference, Summarizing. Writing: (a) Introducing basic structures and grammatical items - all tenses, active/passive voices, relativization, joining sentences, prepositions, adverbials, adjectives and question formation. (b) Controlled writing - Transforming graphic information into writing, picture composition, sequencing, form-filling. (c)Communicating in writing - writing notes, memos, personal/official letters, report writing. Listening: Listening for specific information; for specific details; for gist of the passages; for comprehension, for making inferences, listening and note taking; listening reproducing. Speaking: Introducing describing people/events/pictures; asking for information; giving directions/instructions, making requests/complains. Using model dialogues/improvisations/reading to stimulate conversations and small group discussion. Project: Writing an essay of not less than 600 words on a topic selected from students' fields of interest. Each student has to choose his/her topic from a list of 5 topics proposed for him/her by the examiners at the end of the first semester in the second year. The written examination on essay is conducted during the last fortnight of the first half of the second semester of the second year.

Module Code	AMA 2212	**Title**	Fundamentals of Optimization	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should be able to understand the organizational structure in operations and techniques to run the system.

Outline Syllabus:

Simplex Method - Theory and Computational Procedure : Efficient computational techniques, Revised Simplex method, Decomposition algorithm and the Bound variables algorithm, Dual problem, post optimality analysis. **Transportation Assignment and Allocation Problems :** Project and scheduling by PERT - CPM (Critical path method). Network analysis applications.

Module Code	AMA 2223	**Title**	Elementary Fluid Dynamics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn to solve 2D and 3D fluid dynamical problems.

Outline Syllabus:

The concept of continuum of a fluid, Description of flows, Eulerian and Lagrangian variables, Steam lines and particle path, Material derivatives, Kinematics and conditions, Mass conservation, Steam functions, Relative motion, Expansion, Voracity. Circulation, Uniqueness of a flow of given expansion rate and Voracity, Dynamically considerations, irrational incompressible flow, Sources, Sinks, Doublets, Spherical and axis-symmetric problems, Stress in fluid and the equation of motion of a real fluid, Conditions at a material boundary applications.

Module Code	AMA 2231	**Title**	Practical for Fundamentals of Optimization	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

Implementation of the theory taught in AMA 2212 using Microsoft Excel or any relevant software.

Outline Syllabus:

Practical for Fundamentals of Optimization (AMA 2212)

Module Code	STA 2212	**Title**	Design of Experiments	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Enable students to understand the similarities and differences between various types of analysis of varience including univariate verses multivariate studies.

Outline Syllabus:

Basic concepts, Testing different among several means, F- ratio and F-tables, One -way ANOVA, Two - way ANOVA, The randomized blocked design, Two factor randomized design. Analysis of treatment effects and factorial treatments. Latin squares and related designs.

Module Code	STA 2221	**Title**	Practical in Statistical systems	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**30**

Learning Objectives:

The main objectives of this course are to learn the statistical software Minitab and to discuss the problems of the course STA2212

Outline Syllabus:

Practical in Statistical systems (STA2212)

Module Code	COS 2212	**Title**	Numerical Computing II	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Students will learns to solve large linear systems and ordinary differential equations . They will also leave to assess the errors involved in the computation of the solution of linear systems and differential equations.

Outline Syllabus:

The numerical solution of system of linear equation
Direct method : Gaussion Elimination, pivoting strategies, operational count, Matrix factorization, compact schemes (Crouts, Choleski), Tridiagonal system, stability and Ill conditioning, Vector and matrix norms, condition number.
Indirect method : Jacobi , Gauss-seidal methods , Convergence of Iteration methods, Successive over relaxation method .
Solution of Ordinary Differential Equations Derivation of method, One step method, Runge - Kutta method, Derivation of R-K methods, Euller's method and Errors Estimation, Linear Multistep methods, Adams methods and predictor-corrector methods, Stability of Numerical methods.

Module Code	COS 2222	**Title**	Data Base System	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn the file organization method and learn the mathematical foundation of relational data bases. They will also learn about Normal forms and data modelling techniques. Students will be able to query the data base in query language such as SQL.

Outline Syllabus:

File Organization and Access Mechanisms : Sequential, Direct, Indexed, B- tree, Inverted tree. **Data models :** pre - relational, Relational, post - relation (Object oriented, Deductive, Functional ect.) **Mathematical Foundations :** Relational algebra, Calculus, Propositional and predicate calculus. **Query Language Interfaces:** QBE, QUEL, Graphical. **Advanced SQL Features :** Sup -queries, Correlated queries, Complex joins, Recursion, Triggers and events, 4GL, Embedded SQL. **Integrity Constrains:** Domain integrity, Referential integrity, Functional dependencies. **Normal Forms and Normalization.** BCZF and 3rd normal forms. **Data base Design :** ER Modelling, Mapping ER model to relational model. **Development of Data base Application.**

Module Code	COS 2231	**Title**	Practical for Data Base System	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 2222.

Outline Syllabus:

Practical for Data Base System (COS 2222)

Module Code	COS 2241	**Title**	Practical for Numerical Computing II	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 2212.

Outline Syllabus:

Practical for Numerical Computing II (COS 2212).

Module Code	ACU 2210	**Title**	Career Guidance	
Credits	0	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

To give an overall view of the career prospective and guidance.

Outline Syllabus:

The world of work: Unemployment in Sri Lanka. Recent demographic, Economic and social changes of Sri Lanka and how they effect the graduate labour market. The private sector culture - emphasis on attitudes The role of scientists in various employment sectors. The expectations of private sector employer from new graduate employees. Career guidance Employment search.
Image Projection: Social graces, Public relations, Career development and survival skills of young graduates, Personality development, Leadership, Team work, Human relations, Effective communication, Problem solving, Stress management.
Presentation Techniques: The bio-data, Facing interviews, assertiveness

LEVEL 3

Module Code	AMA 3113	**Title**	Modelling	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

The main goal of this unit is to learn how to make a creative use of some mathematical tools. Modeling is the process to gain a better understanding to develop skills in formulating, solving, and interpreting appropriate models of some problems in physical science and computing.

Outline Syllabus:

Modelling Fundamentals: Setting up differential equation from word problems, Qualitative solutions, Sketching for first order differential equations, Discrete and system model . **Some Models and Instructions :** Population growth models, Growth and decay models, Leading to partial differential equations.

Module Code	AMA 3123	**Title**	Mathematical programming	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn to solve various optimization problems.

Outline Syllabus:

Dynamic Programming : Characteristic of dynamic programming problems, Deterministic dynamic programming, probabilistic dynamic programming. **Goal programming:** Objective of goal programming, Non - pre -Emotive goal programming, pre - Emotive goal programming , Formulation of linear programming models for variables of linear functions with positive and negative component. **Non - linear programming :** Optimization fundamentals, Types of non -linear programming problems, Unconstrained optimization, Constrain optimization, the Karush - Kuhn- Tucker (K . K . T) condition for constrained optimization , Fractional programming, Quadratic programming, Separable programming, Convex programming, **Introduction to Game Theory :** Two-Person Zero -sum games, solving simple games, Dominated strategies method, Minimax criterion, Games with mixed strategies .

Module Code	STA 3112	**Title**	Regression Analysis and Time Series	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Students will learn simple and multiple regression analysis, how to use and interpret the regression results in a real world setting and variety of statistical models for time series.

Outline Syllabus:

Simple linear regression and the principle of least Squares, Matrix approach to linear regression, Multiple linear regression , Interpretation of coefficients. Inferences in regression analysis , prediction of future values, Correlation and the coefficient of determination , Analysis of aptness of the model , Model selection procedures. **Time series :** Additive and multiplicative models, Isolation of trend, Seasonal variation and cyclic variation, Moving average and centred moving average , Elementary forecasting .

Module Code	STA 3121	**Title**	Practical for Regression Analysis and Time Series	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**30**

Learning Objectives:

Student should be able to get first-hand experience in conducting and interpretating regression and time series analysis learned in STA 3112 using statistical software.

Outline Syllabus:

Practical for Regression Analysis & Time Series (STA 3112)

Module Code	COS 3113	**Title**	Software Engineering	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Student will learn how to analyze and evaluate system demands. They will study system design, project planning, system maintenance and testing. They will also learn different programming paradigms.

Outline Syllabus:

Scope of software Engineering: Software crisis , Software engineering objectives, Object - oriented paradigm. **Software Life Cycle Models :** Build - and -Fix model, Water fall model, Object - oriented life cycle model, Comparison of life -Cycle models, **Testing :** Quality issues, Non execution - based testing, Execution -based testing, Correctness proofs, Testing distributed and real time software. **Introduction to Objects :** Models , Cohesion, Coupling Data Encapsulation, Abstract data types, Information hiding inheritance, Polymorphism and dynamic binding Reusability , portability. and interpretability. **Planning and Estimating:** planning the software process, Estimating duration and cost. **Requirement Specification:** Requirement analysis, Specification document. **Object - Oriented Analysis:** Use - Case modelling, Class modelling, Dynamic modelling . **Object - Oriented Design :** Sequence diagram , Collaboration diagram and detailed class diagram, Implementation, integration and maintenance, Introduction to Computer assisted software engineering.

Module Code	COS 3122	**Title**	Operating Systems	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Student should have the knowledge of internal structure of modern operating system. Student will learn various facilities provided by the operating system to the user.

Outline Syllabus:

Operating Systems as a virtual machine and as resource as a manager, Processes, Interprocess communication and synchronization, Process transition using **UNIX** (Solaris) as an example , Memory allocation, Segmentation , Paging Loading , Linking , and libraries , Resource allocation , Scheduling and deadlock , File systems , Consistency, Redundancy , **UNIX** and **DOS** file systems as examples , Distributed systems principles , Amoeda and Mach. **Current Operating Systems** : Introduction to windows NT architecture and file system . **System programming in the UNIX environment** : Review of C Programming, shell command language , System calls for process management, File access, Network system calls , RPC, Threading , Program development .

Module Code	COS 3131	**Title**	Practical for Operating Systems	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 3122

Outline Syllabus:

Practical for Operating Systems (COS 3122).

Module Code	ACU 3110	**Title**	Management and Entrepreneurial skills	
Credits	0	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Development of basic appreciation for managerial and entrepreneurial skills as a prospective environmental manager.

Outline Syllabus:

Management: Definition of Management, Function of Management, Planning, Organising, Staffing, Directing, Communication, Motivation, Leadership and Controlling. Communication in Management: Effective communication skills, Communication process, Presentation skills, Written communication and Data collection techniques. Motivation: Motivation and incentives, Needs, Drives and Obstacles, Behavioural theories, Morale. Groups and teams: Organisation of work group, Team building and characteristics of successful team. Leadership: Characteristics of leaders and Leadership styles. Interpersonal processes: Active listening skills, Non-verbal communication and Interviews and counselling. Managing change: Causes and nature of change, Resistance of change, Practices that support change and Handling conflict. Problem solving and decision making: Barriers to creative thinking, Problem definition, Problem solving techniques, Group discussion, Brainstorming and Decision making aids. Managing time: Benefits of time management, Time wasting activities, Time management aids, Personal time management plan measuring methods and Time management techniques. Entrepreneurial skills: Definition of entrepreneurial skills, Small business management, Micro based industry and Characteristics of entrepreneur. Total quality management: Concept of quality and customer, Customer requirements, Quality approach and Implications of quality systems. Customer care: Customer service, Words to use and words to avoid and Establishing rapport and new business. Purchasing skills: Stock control, Procedures, Supplier selection, Procurement policy and strategy. Negotiation skills: What is negotiation, Four stages of negotiation and Types of negotiation, Questioning techniques.

Module Code	PMA 3213	**Title**	Algebraic Structures and Complex Variables	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

The objective is to increase students' creativity, thinking and the knowledge of the algebraic properties of the Algebraic Structures. Complex variable techniques develop analytical reasoning skills. Also gain some experience to solve certain kinds of problems in the applied sciences.

Outline Syllabus:

Algebraic Structures: Elementary theory of groups, Normal subgroups, Quotient groups, Homomorphism, Characteristic subgroups, Conjugate classes and the normalizer of a subgroups, Isomorphism theorems. **Complex Variables:** Complex numbers and functions , Limits and continuity, Sequences and series, Taylor's and Laurent's series, Singularities and residues. The application of contour integrals to evaluate real integrals, The argument principle, Rouches theorem with applications.

Module Code	AMA 3213	**Title**	Analytical Dynamics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

The subject provides advanced theoretical developments, which prove elegant and versatile in solving dynamical problems. Develop a deep understanding of the fundamentals of analytical dynamics and applications to mechanical systems. Also introduce the skill in reformulation and generalization for practical application.

Outline Syllabus:

Theory of rotation axis, Kinematics of rigid body, Equation of motion of rigid body, Euler's equations, Lagrangian formulation and applications. Small oscillation, Impulsive motion, Two body central force problems. Hamiltonian formulation and applications, Canonical Transformations, Hamilton -Jacobian equation.

Module Code	STA 3213	**Title**	Applied Statistics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn about proper sampling methods, as well as common errors that occur during the sampling process that can lead to poor data collection.

Outline Syllabus:

Various methods of sampling , Detail study of Sample ,Stratified and systematic sampling, Optimal sampling where total sample size or total cost is fixed , Models for cost functions , Quota , Cluster , Systematic and multi- stage methods of sampling, census and sample surveys design, pilot surveys, Methods of data collation, Analysis of sample surveys, Estimation of means , Variances, Totals and proportions, Ration and regression estimators , Acceptance sampling ,Operation characteristic curves, Single and double sampling plans, Producers and consumers risk, Average sample number curves.

Module Code	COS 3213	**Title**	Internet programming	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn to program the Internet using Java. They will also learn HTML forms programming.

Outline Syllabus:

Introduction to Internet programming : Client ,Server model , Browsers - Graphical and Hypertext Access to the Internet , HTTP- Hyper Text Transfer Protocol (how it actually works).
Creating Internet World Wide Web pages: HTML - Hyper Text Markup Language, headers, body, html tags, tables, Text, graphics, sounds, video clips, multi - media, Client side image mapping, web page counters, HTML resources - html converters and tools .
HTML forms programming : Building a form , Text fields and value, size, max-length, html buttons, radio, checkboxes, pre-checked, selection lists, Introduction to CGI scripting, Action and Method - GET and POST, html form interface with CGI scripts, Automating processing such as info forms and email, programming CGI interfacing via forms.
Creating Interactive Executable Content - Intro to Java: Applets.
Advanced Java programming : Graphic User Interface with AWT, AWT calls, Windows, dialog boxes , pop - up menus, Graphics, Using a layout manager, Manipulating images, Image animation, Threads - Process Management, Socket Programming - client - sever processing, URL connections, Java Beans.

Module Code	COS 3222	**Title**	Computer Systems	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn elements of digital logic and data and number representation. They also learn computer organization and learn to program in assembly language.

Outline Syllabus:

Binary Notation, Logical operations : AND, OR, NOT, EXOR, Truth tables, Boolean algebra, Logical expressions and minimization. **Combination and Sequential Logic Devices:** Encoders, Decoders, Multiplexes, Address, Registers and counters. **Number System:** Binary, Octal Hexadecimal. **Data Representation:** Bytes and words. **Negative Number Representation:** Signed and tow's complements. **Memory Devices:** Read only and read / write memory, Back up storage, Access and cycle time, Principles of serial and parallel data transmission, Stored program control concept. The function and the interaction between arithmetic/logic, control and storage elements of a computer, Micro program control. **Typical Instruction Set:** Fetch and execution cycle, Addressing modes. **Assembly Language Programming:** Detail study of instruction set of a microprocessor and writing simple program.

Module Code	COS 3231	**Title**	Practical for Computer Systems	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in COS 3222.

Outline Syllabus:

Practical for Computer Systems (COS 3222).

Module Code	SCOS 3213	**Title**	Knowledge Based System (KBS) and Logic Programming	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student should have the knowledge in various methods of knowledge representation and storage. Student will be able to solve search and constraint problem using AI techniques. Also, Student will learn adaptive techniques.

Outline Syllabus:

Overview Of The Artificial Intelligence Field: Basic concepts, Definition of AI, Background and past achievements, Aims, Overview of application areas, Problems and problem solving, State space search, production rules, logic, Heuristic search techniques, Generate and test, Hill climbing search reduction, Strategies, **Knowledge Representation:** Representation models, Predicate logic, rules, Semantic nets, frames: Conceptual graphs, Scripts, Fuzzy logic: statistical techniques for determining, Probability Methodologies for developing KBS, The KBS Development Life Cycle; Knowledge acquisition, Prototyping: implementation, Development environments. **Adaptive Approaches:** In both of the following approaches, learning and applications will be emphasized, Neural networks, Architectures: Hop field network: multi-layer perception: Feed forward: Back-propagation, Genetic algorithms, Basic concepts: population: chromosomes: operators, Schemata: coding, Rule induction, Basic concepts: Decision trees/ rule sets. **Major Application Areas:** Expert systems, Natural language and processing, Machine vision and robotics, Data mining and intelligent business support, Intelligent agents.

Module Code	SCOS 3223	**Title**	Parallel Computing	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn parallel architecture and to design parallel programs to these architecture. They will also learn to program in MPI/PVM environment.

Outline Syllabus:

Parallel architectures (SIMD, MIMD, etc.), Parallel algorithm design, Scalability, Communication techniques, Speed and efficiency of parallel algorithms.
Introduction to MPI/PVM.
General introduction to the concept of cluster based distributed computing. Hardware technologies for cluster computing, including a survey of the possible node hardware and high-speed networking hardware and software. Software for cluster computing.
Software and software architectures for cluster computing, including both shared memory (OpenMP) and message-passing (MPI/PVM) models. Programming, features and performance of standard MPI variants (LAM/MPICH/vendor specific MPI versions) and variants based on new low level protocols (MVICH), evaluation and tuning of system and software performance.

Module Code	SCOC 3232	**Title**	Practical for Knowledge Based System (KBS) and Logic Programming	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in SCOS 3213.				
Outline Syllabus: Practical for Knowledge Based System (KBS) and Logic Programming (SCOS 3213).				

Module Code	SCOS 3241	**Title**	Practical for Parallel computing	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in SCOS 3223.				
Outline Syllabus: Practical for Parallel Computing (SCOS 3223)				

LEVEL 4

Module Code	SCOS 4113	**Title**	Advanced Numerical Analysis	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn about solving large sparse matrix equation and semi iterative methods to solve large system. They will also learn to solve Eigen value problem.

Outline Syllabus:

Sparse matrices and their representation, sparse matrix techniques, graph theory, adjacency level structure, pseudo peripheral vertex, Gibbs algorithm, Cuthill and Makee algorithm to reduce the bandwidth, Eigen value problem: Power methods, Jacobi, Householders method QR, LR methods, avoiding complex arithmetic by double QR method.

Module Code	SCOS 4123	**Title**	Combinatorial mathematics and Graph Theory	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students should be able to get clear understanding about the concept of graph theory and to make easy to handle graphics programing.

Outline Syllabus:

Introduction, Numbers and counting, Subsets, partitions, permutations, Recurrence relations and generating functions, The principle of inclusion and exclusion, Latin squares and SDRs, Extremal set theory, Steiner triple systems, Finite geometry, Ramsey's theorem, Graphs, Posets, lattices, and matroids, Automorphism groups and permutations, Enumeration under group action, Designs, Error-correcting codes.
Introduction, Graphs: Graphs and simple graphs; Graphs isomorphism; The incidence and adjacency matrices; Vertex degrees; Paths and connection; Cycles and the shortest path problem, Trees: Trees; Cut edges and bonds; Cut vertices; Cayley's formula and Kruskal's algorithm, Connectivity: Connectivity; Blocks and construction of reliable communication networks, Euler Tours and Hamilton Cycles: Euler tours; Hamilton cycles; The Chinese postman problem and the traveling salesman problem, Planar Graphs: Planar graphs; Dual graphs and Euler's formula, Networks: Flows; Cuts; The Max-Flow Min-Cut theorem and applications.

Module Code	SCOS 4133	**Title**	Networking Basics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn basic concepts in computer Network and emerging technologies.

Outline Syllabus:

Introduction to Networking, Networking Math,Networking Fundamentals. Networking Terminology, Bandwidth, Networking Models Networking Media. Copper Media, Optical Media, Wireless Media. Cable Testing -Discovering and Connecting to Neighbors, Background -Waves, Sine waves, etc., Signals and Noise. Cabling LANs and WANs- Cabling the LAN, Cabling the WAN, Ethernet Fundamentals-Ethernet. Fundamentals, Ethernet Operation, Ethernet Technologies- 10 Mbps and 100 Mbps Ethernet, 1000, Mbps and 10 Gigabit Ethernet
Ethernet Switching- Ethernet Switching, Collision Domains and Broadcast Domains, TCP/IP Protocol Suite and IP Addressing.
Introduction to TCP/IP, Internet Addresses, Obtaining an IP Address.
Routing Fundamentals and Subnets.
Routed Protocol, IP Routing Protocols, Mechanics of Subnetting.
TCP/IP Transport and Application Layer.
TCP/IP Transport Layer, TCP/IP Application Layer.

Module Code	SCOS 4143	**Title**	Object oriented analysis and design	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn object oriented methodologies such as UML, use cases. They will also learn user interface design and software quality assuarence.

Outline Syllabus:

Introduction and Overview, Object-oriented life cycle, Object-oriented methodologies - a guided tour, Unified Modeling Language, Object-oriented analysis with use cases, classification approach and identification of object relationships, attributes, and methods, Object-oriented design pertinent to classes and database management, Design of the user interface, Software quality assurance and assessment, Review and recapitulation.

Module Code	SCOS 4153	**Title**	Computer Graphics and Image processing	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn 2D, 3D graphics algorithms. They will also learn basic algorithm in image processing.

Outline Syllabus:

Graphic devices, 2D drawing algorithms: line, circle, curve, 2D filling algorithms, 2D clipping, 2D, 3D Transformation, Polygon representation, 3D Surface representation, projection, hidden surface removal, matrix representation, Color models, rendering, illumination, object modeling.
Visual Perception, Image Hardware and Software, Image representation, Image compression, Image file formats. Image Formation, Image Transforms: Fourier, Image Enhancement, Image Restoration, Image Interpretation: Edge detection, feature extraction, template matching, Hough transform, Case Studies.

Module Code	SCOS 4213	**Title**	Compiler Design	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn about lexical analysis, syntax analysis and passers for high level languages. They will also learn about code generation and optimization.

Outline Syllabus:

Introduction to Compilers; Introduction to Lexical Analysis, Generating Lexers; Introduction to Parsing, Shift-reduce Parsing, Parser Generators, Static Analysis; Type Checking, Introduction to code generation, Improving code quality, Implementing Functions; Implementing Objects; Introduction to Optimization; Optimization of Flow Graphs and Basic Blocks, Dataflow Analysis; Instruction Selection.

Module Code	SCOS 4223	**Title**	Theory of Computation	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn about finite state automata and formal language. They will also learn about Turing machines and P and NP classes.

Outline Syllabus:

Introduction to the theory of automata and formal languages with application to the theory of computation. Deterministic finite automata, regular languages, pushdown automata, context free grammars, Turing machines (TM), unsolvable problems about TM and grammars, P and NP classes, NP completeness.

Module Code	SCOS 4232	**Title**	Numerical Solution of Partial Differential Equations - Finite Element Method	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should be able to understand advanced numerical techniques (FEM) to solve PDEs and graphics techniques.

Outline Syllabus:

Introduction to finite element method. One dimensional problems. Two dimensional problems and applications to both linear and nonlinear elliptic and parabolic partial differential equations. Algorithm design and implementation using any programming language. Commercial finite element software.

Module Code	SCOS 4241	**Title**	Practical for Numerical Solution of Partial Differential Equations - Finite Element Method	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**
Learning Objectives: Students should be able to solve PDEs using FEM through any programming languages.				
Outline Syllabus: Matrix algorithms and graphics techniques, Mesh generation using any programming languages.				

Appendix B

Detailed Syllabus

Bachelor of Information and Communication Technology (BICT)

LEVEL 1

Module Code	ICT1113	**Title**	Discrete Structures	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students should have basic mathematics and logical understanding to follow the information technology courses.

Outline Syllabus:

Mathematical Reasoning, Set theory, Propositional logic, Boolean algebra, Number systems, Relations and Functions, Combinatorics, Difference equation, Theory of series, Probability concepts, Graph theory, Automata and languages, Turing machines.

Module Code	ICT1122	**Title**	Fundamentals of Computer Systems	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should have basic knowledge in computer / Information Technology.

Outline Syllabus:

Introduction: Early history of computing. The computer generation, Characterization, Classification of computers, Basic components and organization of a computer, Representation of information in a computer, Concept of programming and programming languages, Language translation.
Application software: Basic features of application software, tools for work and study- Desktop Accessories, word processing, spreadsheets, Database Management system, Graphics, Communications, Software suites, etc. Operating system and its functions, the need for an operating system, The types of operating systems, The features of the MS-DOS/Windows XP operating system, Linux. Utility programs, Utility packages.
Peripherals: Input devices and its functions, output devices and its functions, processing and memory hardware, Secondary storage and communication devices.
Computers and communication: Revolution in Computers and communications.
The digital future: Role of IT in society, Distinguish between data and information. Properties of Information and basic IT tools, e-learning, e-banking.
Social issues: Ethics and standards in computing, copyright, Intellectual property right, piracy, etc.

Module Code	ICT1132	**Title**	Introduction to Program Design and Programming	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

A Student should have a clear understanding what comprises a correct program in C++ and able to design, code and test C++ programs, which meet requirements expressed in English.

Outline Syllabus:

Techniques of Problem solving: Algorithm, Flowchart and Pseudo codes.
Introduction of C++ Programming, Fundamental of C++ Programming, Structure of a C++ Program, Input / Output Streams, Variable declaration, Arithmetic Operations, Relational Operations, Logical Operations, Control Structures: If/ Else, While repetition, For repetition, Switch multiple selection, Do /while, Break and Continue, Functions, scope of variable and Parameters, Recursion, Arrays, Records.
Object Oriented Concepts: Classes and objects, Inheritance, Encapsulation, Polymorphism, Linked list Class, String Class, etc.

Module Code	ICT1142	**Title**	Object Oriented Program Design	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

A Student should have a clear understanding of the object oriented terminology used to describe feature of C++ / Java.

Outline Syllabus:

Introduction, Specifying a class, Defining Member Functions, Constructors and Destructors, Copy Constructors, Static Data Members, Static Member Functions: Inheritance: Extending Classes, Defining Derived Classes, Single Inheritance, Making A Private Member Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructors In Derived Classes, Member Classes, Operator overloading and type conversions, Defining Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Binary Operators Using Friends, Manipulation of Strings Using Operators, Rules for Overloading Operators, Type Conversions, Pointers, Virtual Functions and Polymorphism, Pointers to objects, this pointer, Pointers to derived classes, Virtual functions, Pure Virtual functions.

Module Code	ICT1152	**Title**	Practical for Fundamentals of Computer Systems	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT1122.

Outline Syllabus:

Practicals for Fundamentals of Computer Systems (ICT1122).

Module Code	ICT1162	**Title**	Practical for Introduction to Program Design and Programming	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT1132.

Outline Syllabus:

Practicals for Introduction to Program Design and Programming (ICT1132).

Module Code	ICT1172	**Title**	Practical for Object Oriented Program Design	
Credits	02	**Hours**	**Lectures**	-
			Laboratory	**60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT1142.

Outline Syllabus:

Practicals for Object Oriented Program Design (ICT1142).

Module Code	ACU 1110	**Title**	English Language I	
Credits	0	**Hours**	**Lectures**	15
			Laboratory	**30**

Learning Objectives:

The students should be able to gain necessary skill to read, understand and communicate in English.

Outline Syllabus:

Reading: Basic Reading skills, Skimming, Scanning, Identifying main points, Understanding vocabulary, Understanding sequencing, Reading for comprehension. Writing: Introducing the Mechanics of writing, Introducing vocabulary in and around the University environment, Transferring graphic, statistical, pictorial Information into writing, Sequencing, Form filling, Writing notes, Preparing to write a project. Speaking: Introducing, Describing/ people/events/pictures, Interviewing at an elementary stage, Giving instructions/directions, Making short speeches on a previously prepared topic. Listening: Listening to discriminate sounds, Listening to discriminate sounds. Listening for specific information, Listening for the gist, Listening and responding to telephone conversion, Listening & comprehending Communicative grammar: Introducing basic structures, Word-order Tense, Negation, Question formation, Articles, Preposition, Pronouns, Quantifier, Word class, Active/passive, Conjunctions/ relativization Project: Topics to be selected from student's field of interest, Submission of individual projects to be before the end of the semester.

Module Code	ICT1213	**Title**	Data Structures	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student should be able to apply the fundamental structure of computer science to real life problem.

Outline Syllabus:

Arrays, Lists, Stacks, Queues, Trees, Graphs, Files and their applications in computer Science, Recursion.
Simple Sorting & Searching Algorithms : Selection sort, Bubble sort, Merge sort, Binary search, and their computational complexity.

Module Code	ICT1223	**Title**	Basic Electronics and Digital Logic Design	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Students will learn the Fundamentals of Electronics needed for ICT, its application in computer hardware and its process.

Outline Syllabus:

Introduction to electronics and electronic systems, Semiconductor and devices like diodes, BJT, FET, MOSFET, Rectifier and Filters, Transistor biasing. Small signal transistor amplifiers, Operational amplifiers, Feedback and Oscillators, Digital circuit and combinational logic, Sequential logic and flip-flops, ADC & DAC, Data acquisition systems, Memory systems, Case studies of electronic systems like microprocessors, radio & TV broadcasting, Mobile & cellular telephones, fiber optics & networking.

Module Code	ICT1233	**Title**	Operating Systems	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student should have the knowledge of internal structure of modern operating system. Student will learn various facilities provided by the operating system to the user.

Outline Syllabus:

Operating Systems as a virtual machine and as resource as a manager, Processes, Inter process communication and synchronization, Process transition using UNIX (Solaris) as an example , Memory allocation, Segmentation , Paging Loading , Linking , and libraries, Resource allocation, Scheduling and deadlock, File systems, Consistency, Redundancy, UNIX and DOS file systems as examples, Distributed systems principles, Amoeda and Mach. Current Operating Systems: Introduction to windows XP architecture and file system . System programming in the UNIX environment : Review of C Programming, Broughn /C shell command language, System calls for process management, File access, Network system calls , RPC, Threading, Program development .

Module Code	ICT1242	**Title**	Practical for Data Structures	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT1213.

Outline Syllabus:

Practicals for Data Structures (ICT1213).

Module Code	ICT1252	**Title**	Practical for Basic Electronics and Digital Logic Design	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT1223.

Outline Syllabus:

Practicals for Basic Electronics and Digital Logic Design (ICT1223).

Module Code	ICT1262	**Title**	Practical for Operating Systems	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT1233.

Outline Syllabus:

Practicals for Operating Systems (ICT1233).

Module Code	ACU 1210	**Title**	Communication skills	
Credits	0	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Student should develop skills and knowledge in broad self institutional, social and public communications and develop specialized knowledge and skills in creative, professional, organization and mass communications.

Outline Syllabus:

Introduction to Communication: The communication process, Exchange of meanings, Experience Transmission, Downward communication ,Upward communication, Horizontal communication , One-way communication, Two-way communication and Multi-directional communication. Importance of Communication: Communications for Management, Managerial time in communications and Effects of Good communication. Forms of Communication: Oral communication: Written communication, Non-verbal communication, Para-language Code, Signals, Symbols, Icons, Gestures, Freelance writing, Writing for your people and Publishing and Editing. Levels of communication: Inter personal communication, Public communication and Major components of communication. Planning and Organization: Provision of Information, Management Participation, Analytical skills, Establishment of objectives, Strategy formulation & Development, Activity Identification, Work grouping, Resource allocation, Delegation, Balancing & Timing, Activity Synchronization & Harmonization, Communication for coordination. Motivation: Legal Compliance. Instrumental Satisfaction, Self Expression, Goal Congruence and Communication in Motivation. Control: Issue of Instructions, Reporting & Recommendations, Performance Appraisal and Styles of Control. Staffing: Interview Techniques, Communication in Training & Development, Performance Evaluation & Feedback and Industrial Relations. Leadership: Supportive Leadership, Directive leadership, Achievement Oriented leadership and Participative leadership. Public Relations & Marketing Communication: Negotiating skills: Creating the climate, Opening process, Fabric of Negotiations, Conduct of Negotiation, Communication during Negotiations, Bargaining, Teamwork and Negotiating styles.

Module Code	ACU 1220	**Title**	Sri Lankan studies, Social Harmony and Natural Resources of Sri Lanka	
Credits	0	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

This course is designed to provide basic knowledge in Sri Lankan history and natural resources; social concepts; human rights and the importance of social harmony in a multicultural and multiethnic society.

Outline Syllabus:

S**ri Lankan Studies:** History, religion, languages, literature, arts, local wisdom and the lifestyle of Sri Lanka in the past, present and the future trend. **Social Harmony:**Concepts & Ideals: Human rights, dignity and values. Acceptance of Global and National pluralism. Acceptance and tolerance of other cultures, traditions, religions and languages. *Identification of issues relating to Social disharmony:* Discrimination, deprivation, Social injustice, Racism, Gender discrimination, Religious fundamentalism. *Historical background to social disharmony in Sri Lanka:* Denial of equal rights in language, employment, education, and economic development of the regions etc., lack of mutual understanding, criminalization of politics and politicization of social issues. *Steps to peace building:* Mutual understanding, progressive positive negotiations, dialogue instead of debate, sustainable peace process, participation of the grass root level society in the peace process, cultivating a "Culture of peace", reconciliation, conflict management. Activity based session to enhance and build social harmony. *At the political level:* Political reform and devolution of powers, good governance, cultivating a sound political culture, cohabitation among political parties and forces, effectively handling pressure groups, inclusive approach than an exclusive one. *Natural Resources of Sri Lanka:* Land aquatic-coastal and marine resources, inland aquatic resources, Renewable and Non-renewable resources.

LEVEL 2

Module Code	ICT2113	**Title**	Mathematics for Computing	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student should acquire necessary mathematical maturity to handle various topics in IT.

Outline Syllabus:

Differential Calculus: Limits and Continuity, differential coefficients, Mean Value Theorem, Taylor's Theorem, Integration, Definite integrals, Polynomial interpolation.
Linear Algebra: Matrices, Matrix operations, System of equations.
Coordinate Geometry: Coordinates, 2D and 3D coordinate transformation Equation of line, circle, etc.
Basic Statistics: Analysis and presentation data, Probability Distribution, Regression, Correlation.

Module Code	ICT2122	**Title**	Design and Analysis of Algorithms	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student should have knowledge in various algorithm design methods and be able to solve various real life problems.

Outline Syllabus:

Introduction: Characteristics of algorithms; designing, devising and expressing algorithms, use and removal of recursion; validation, analysis, testing and profiling.
Greedy Method: Graph algorithms such as finding spanning tree and single source shortest path etc. Knapsack problem, job sequencing, etc.
Divide and Conquer: Binary search; merge sort; quick sort, etc.
Backtracking: N-queen problem; sum of subsets, graph colouring; Hamiltonian cycle; knapsack problem.
Dynamic Programming: All pairs shortest paths; optimal binary search trees; O/I knapsack problem; traveling sales person problem.
Branch and Bound: O/I knapsack problem; traveling sales person problem.
Graph / Tree Algorithm: Breadth-first search in graph (AND-graph, OR-graph etc.); tree traversal on binary, threaded AVL and game trees, handling B* tree and disk memory management.
Symbol Table Algorithm: Dynamic tree tables, Hash tables.

Module Code	ICT2133	**Title**	Software Engineering	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student will learn how to analyse and evaluate system demands. They will study system design, project planning, system maintenance and testing. They will also learn different programming paradigms.

Outline Syllabus:

Scope of Software Engineering: Software crisis, Software engineering objectives, Object - oriented paradigm.
Software Life Cycle Models: Build -and-Fix model, Water fall model, Object-oriented life cycle model, Comparison of life-Cycle models, **Testing:** Quality issues, Non execution - based testing, Execution -based testing, Correctness proofs, Testing distributed and real time software.
Introduction to Objects: Models, Cohesion, Coupling Data Encapsulation, Abstract data types, Information hiding inheritance, Polymorphism and dynamic binding, Reusability, portability and interpretability. **Planning and estimating:** planning the software process, Estimating duration and cost. **Requirement Specification:** Requirement analysis, Specification documents.
Object-Oriented Analysis: Use-Case modeling, Class modeling, Dynamic modeling.
Object-Oriented Design: Sequence diagram, Collaboration diagram and detailed class diagram, Implementation, integration and maintenance, Introduction to Computer assisted software engineering (CASE).

Module Code	ICT2142	**Title**	Visual Computing (Rapid Application Development)	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

Student should be able to develop Rapid Application in Visual Programming Language.

Outline Syllabus:

An overview of visual thinking; Introduction to the Visual Languages and Visual programming; Examples of languages for handling visual information; Examples of languages for handling visual interactions; Visualization of software design; Visual coaching system; Visual interface design system: Non textual programming environments (including diagrammatic systems and iconic systems); Table-and-form-based systems; Visual database design; Advances in visual languages and visual programming systems.

Module Code	ICT2152	**Title**	Practical for Design and Analysis of Algorithms	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT2122.

Outline Syllabus:

Practicals for Design and Analysis of Algorithms (ICT2122).

Module Code	ICT2161	**Title**	Practical for Software Engineering	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT2133.

Outline Syllabus:

Students will undertake a small project and submit a project report using software engineering principles and do a presentation.

Module Code	ICT2172	**Title**	Practical for Visual Computing (Rapid Application Development)	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT2142.

Outline Syllabus:

Practicals for Visual Computing (Rapid Application Development) (ICT2142).

Module Code	ACU 2110	**Title**	English Language II	
Credits	0	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

To test the students' communicative abilities and other skills such as informative, writing and comprehensive powers.

Outline Syllabus:

Exposure to significant structures of the English language as the basis of developing language abilities: Reading, Writing, listening and speaking through language skill integration with emphasis on communicative competence at a higher level.
Reading: Basic reading skills, Reading for details, Understanding vocabulary in and from context, Finding main ideas, Understanding sequences, Intensive reading, Reading comprehension, Making inference, Summarizing.
Writing: (a) Introducing basic structures and grammatical items - all tenses, active/passive voices, relativization, joining sentences, prepositions, adverbials, adjectives and question formation. (b) Controlled writing - Transforming graphic information into writing, picture composition, sequencing, form-filling. (c)Communicating in writing - writing notes, memos, personal/official letters, report writing.
Listening: Listening for specific information; for specific details; for gist of the passages; for comprehension, for making inferences, listening and note taking; listening reproducing. Speaking: Introducing describing people/events/pictures; asking for information; giving directions/instructions, making requests/complains. Using model dialogues/improvisations/reading to stimulate conversations and small group discussion.
Project: Writing an essay of not less than 600 words on a topic selected from students' fields of interest. Each student has to choose his/her topic from a list of 5 topics proposed for him/her by the examiners at the end of the first semester in the second year. The written examination on essay is conducted during the last fortnight of the first half of the second semester of the second year.

Module Code	ICT2212	**Title**	Operational Research	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student should be able to solve industrial problems using linear programming techniques.

Outline Syllabus:

Simplex Method-Theory and Computational Procedure: Efficient Computational Techniques. Revised Simplex Method, Decomposition Algorithm and the Bound Variables Algorithm. Dual Problem and Post Optimality Analysis. Transportation Assignment and Allocation Problems: Project and Scheduling by PERT-CPM (Critical Path Method). Network Analysis, Applications.

Module Code	ICT2222	**Title**	Database Design	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student should have the basic knowledge in relational databases and their design principles.

Outline Syllabus:

Introduction: Definition as a centralized storage of database; prevention of redundancy and inconsistency; data independence; data abstraction; data models; data definition and data manipulation language (DDL and DML); database manager, administrator, users; overall system structure: Indexing and hashing.
Entity Model - Relationship Model: Entities, relationships, entity-sets, relationship-sets, attributes. Mapping constraints, keys, E-R diagrams, reduction of E-R diagrams to tables, design of an E-R database scheme.
Relational Model: Structure of relational database, relational algebra and calculus;
Normalisation and Relational Database Design: Relational database design and its pitfalls; normalisation (First second, and third) using functional dependencies and multivalued functional dependencies.
Query Processing: SQL

Module Code	ICT2232	**Title**	Computer Networks	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student should have the knowledge in basic technologies of Computer networks and communications.

Outline Syllabus:
Introduction to Computer Networks, Classification of Computer Networks, ISO-OSI architecture. **Data Communication and transmission:** Introduction to data transmission, Time domain, Frequency domain, Modulation techniques. **Transmission media:** Twisted pair, Coaxial cable, Optical fiber, Terrestrial Microwave, Satellite Microwave, Radio wave. **Transmission and switching:** Frequency Division and Time division multiplexing, Circuit switching, Packet switching. Datalink Layer, **Error detection and correction technique:** Parity checks, Cyclic Redundancy Checks (CRC), error-correcting code, Hamming distance. Framing: character count, starting and ending characters with character stuffing, Starting and ending flags with bit stuffing. **Protocols:** Stop and wait protocol, Sliding window protocol, go-back-n, Selective Repeat protocol, piggybacking, HDLC, LAN Techniques CSMA/CD, Ethernet, IEEE standard 802, Cabling, MAC sublayer, token ring, token bus, Cambridge Ring, FDDI. Network layer and Internetworking Connection less and Connection oriented Services, Virtual circuit and datagram delivery, Switches, and Routers, Internet Protocol(IP), Routing and Routing algorithms, Building routing table, RIP, OSP.

Module Code	ICT2243	**Title**	Computer Graphics	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student should have theoretical knowledge in modeling and construction of interactive 2-D and 3-D graphics system. The student will get knowledge in different methods for 3-D visualization.

Outline Syllabus:
Overview of Graphics Systems: Video display devices, Raster-scan systems, Random-scan systems, Graphics monitors and workstations, Input devices, Hard-copy devices. **Output Primitives:** Points and lines, Line-drawing algorithms, Loading the frame buffer, Circle-generating algorithms, Filled-area primitive. **Two-Dimensional Geometric Transformations:** Basic transformations (Translation, Rotation, Scaling, Reflection, Shear), Matrix representations and homogeneous coordinates, Composite transformations (General pivot-point rotation, General fixed-point rotation, General scaling directions), Transformations between coordinate system. **Two-Dimensional Viewing:** The viewing pipeline, Viewing coordinate reference frame, Window-to-viewport coordinate transformation, **Clipping operations:** Point clipping, Line clipping, Polygon clipping. **Three-Dimensional Geometric and modeling Transformations:** Translation, Rotation, Scaling, Reflections and Shears, Composite transformations. **Three-dimensional viewing:** Viewing pipeline, Viewing coordinates, Projections (Parallel and Perspective).

Module Code	ICT2252	**Title**	Management Information Systems	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student will be able to apply IT knowledge in managing business organization.

Outline Syllabus:
Management in organisation: Role of the management function within an organization, The evolution of the MIS function in an organization, Strategic management and MIS, Using MIS as a tool for changing the ways of business, MIS and the value Chain, Managing MIS Projects, Outsourcing considerations,
MIS support capabilities: The migration to distributed systems and client/ server Technologies, The applicability of packages versus bespoke applications, The management and control of information resources at the corporate level, Principals and application of trends in support such as BPR, DIP, Office automation products, their use and interface with other systems, Use of data modeling and mining facilities, **development of MIS:** The growth of MIS: the fore eras, The traditional MIS development life cycle and Contemporary development methodologies, Use of CASE, RAD and Object Oriented methodologies, Matching development methodologies with application requests, End-user computing, applications and implications, Re-engineering legacy systems. **Future trends:** Trends in hardware, software, communications, Impact of the communications revolution, Virtual organizations, Teleporting, The continued evolution of Internet applications

Module Code	ICT2262	**Title**	Practical for Database Design	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT2222.

Outline Syllabus:
Practical for Database Design (ICT2222).

Module Code	ICT2272	**Title**	Practical for Computer Graphics	
Credits	02	**Hours**	**Lectures**	-
			Laboratory	**60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT2243.

Outline Syllabus:
Practical for Computer Graphics (ICT2243).

Module Code	ACU 2210	**Title**	Career Guidance	
Credits	0	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

To give an overall view of the career prospective and guidance.

Outline Syllabus:
The world of work: Unemployment in Sri Lanka. Recent demographic, Economic and social changes of Sri Lanka and how they effect the graduate labour market. The private sector culture - emphasis on attitudes The role of scientists in various employment sectors. The expectations of private sector employer from new graduate employees. Career guidance Employment search.
Image Projection: Social graces, Public relations, Career development and survival skills of young graduates, Personality development, Leadership, Team work, Human relations, Effective communication, Problem solving, Stress management.
Presentation Techniques: The bio-data, Facing interviews, assertiveness.

LEVEL 3

Module Code	ICT3113	**Title**	Advanced Database Management Systems	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Student should understand current database technology in distributed environment.

Outline Syllabus:

Data Models: EER model and relationship to the OO model, Object Oriented data model and ODMG standard, other data models - NIAM, GOOD, ORM. **Query Optimisation:** Query Execution Algorithms, Heuristics in Query Execution, Cost Estimation in Query Execution, Semantic Query Optimisation. **Database Transactions and Recovery Procedures:** Transaction Processing Concepts, Transaction and System Concepts, Desirable Properties of a Transaction, Schedules and Recoverability, Serialisability of Schedules, Transaction Support in SQL, Recovery Techniques, Database Backup. **Concurrency control:** Locking techniques for Concurrency Control, Concurrency Control Techniques, Granularity of Data Items. **Database Security:** Access Privileges, Multilevel Security, And Statistical Database Security. **Distributed Databases:** Reliability and Commit protocols, Fragmentation and Distribution, View Integration, Distributed database design, Distributed algorithms for data management, Heterogeneous and Federated Database Systems. **Deductive Databases:** Recursive Queries, Prolog/Datalog Notation, Basic inference Mechanism for Logic Programs, Deductive Database Systems, Deductive Object Oriented Database Systems.

Module Code	ICT3122	**Title**	Project Management	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should be able to plan, manage, and estimates a software project in a group.

Outline Syllabus:

Stages In A Project: Use of requirements elicitation, gathering, analysis, Design of software, hardware and networks, Build and/or OTS purchase, Configuration and integration with current systems, Installation issues, methods of going live, The use of post-implementation evaluation, Causes of project failure and areas of risk in each stage. **Project Planning And Estimating:** Use of work breakdown structure WBS, Use of Gantt Charts, Use of precedence plans and networks analysis, Estimating techniques: development time and cost using CoCoMo2, Function Point Analysis, Delphi and Expert technique. Software packages, functionality and use of CASE tools in planning and estimating, Financial planning and budget failure in planning and estimating, **Human Factors:** Team building theory and practice, structures and responsibilities, How to staff a project stage with appropriate skill sets; how and where obtain skilled personnel, Team management, motivation, retention, Project management skills, interpersonal skills, transferable skills, Human causes of project failure and areas of risk, Process Monitoring, **Project Control And Reporting**, What to monitor and why, Where and when to monitor, Project control through monitoring, Use of plans in project control, Reason for reports: whom to report to and how to report, Types of report: exception, progress, management, Monitor and control project finances and quality, Implications and impact on the project, Risk analysis and causes of projects going out of control, **Project management:** Risk Management, Team Management (Personnel and Technical), Project Planning (Resource and Technical), Education and Training, Cost Estimation, Project Scheduling, software quality, Software Quality Assurance, Configuration Management and Change Control, Software Tools, The utilities, Standards, Documentation, Metrics.

Module Code	ICT3133	**Title**	Project	
Credits	03	**Hours**	**Lectures** **Laboratory**	- **3 - 4 months**

Learning Objectives:

This course facilitates the student interaction with the relevant industries.

Outline Syllabus:
They visit to industries where their subject of specialisation is put into practice. They study various progress and problems faced by the industries. The students will try to find solutions to various problems in consultation with staff of the Faculty as well as with outside experts. The candidate will submit a report at the end of this course and this report will be evaluated for 3 credits by a team of examiners.
This unit may span throughout the year. This is done by group of students.

Module Code	ICT3142	**Title**	Human Computer Interaction	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should be able to design and construct user-friendly user interface.

Outline Syllabus:
Basic knowledge on theories of cognitive psychology and on how the human being interacts with (computer) systems. How knowledge of the human capabilities can influence the way in which we construct technical systems. Methods and techniques for design and construction of user interfaces.

Module Code	ICT3152	**Title**	Server Management	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students should be able to gain knowledge in handling the OS's and to configure servers required in a LAN. Also students should be able to build security systems for a LAN and servers independently.

Outline Syllabus:
Installation and File management, user management, Web server setup and maintenance, email server setup and maintenance, Proxy server setup and maintenance, Firewall setup and security.

Module Code	ICT3162	**Title**	Practical for Advanced Database Management Systems	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT3113.

Outline Syllabus:
Practical for Advanced Database Management Systems (ICT3113).

Module Code	ICT3171	**Title**	Practical for Human Computer Interaction	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT3142.

Outline Syllabus:
Practical for Human Computer Interaction (ICT3142).

Module Code	ACU 3110	**Title**	Management and Entrepreneurial skills	
Credits	0	**Hours**	**Lectures** **Laboratory**	60

Learning Objectives:

Development of basic appreciation for managerial and entrepreneurial skills as a prospective environmental manager.

Outline Syllabus:
Management: Definition of Management, Function of Management, Planning, Organising, Staffing, Directing, Communication, Motivation, Leadership and Controlling. Communication in Management: Effective communication skills, Communication process, Presentation skills, Written communication and Data collection techniques. Motivation: Motivation and incentives, Needs, Drives and Obstacles, Behavioral theories, Morale. Groups and teams: Organisation of work group, Team building and characteristics of successful team. Leadership: Characteristics of leaders and Leadership styles. Interpersonal processes: Active listening skills, Non-verbal communication and Interviews and counseling. Managing change: Causes and nature of change, Resistance of change, Practices that support change and Handling conflict. Problem solving and decision making: Barriers to creative thinking, Problem definition, Problem solving techniques, Group discussion, Brainstorming and Decision making aids. Managing time: Benefits of time management, Time wasting activities, Time management aids, Personal time management plan measuring methods and Time management techniques. Entrepreneurial skills: Definition of entrepreneurial skills, Small business management, Micro based industry and Characteristics of entrepreneur. Total quality management: Concept of quality and customer, Customer requirements, Quality approach and Implications of quality systems. Customer care: Customer service, Words to use and words to avoid and Establishing rapport and new business. Purchasing skills: Stock control, Procedures, Supplier selection, Procurement policy and strategy. Negotiation skills: What is negotiation, Four stages of negotiation and Types of negotiation, Questioning techniques.

Module Code	ICT3213	**Title**	Knowledge Based System (KBS) and Logic Programming	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Student should have the knowledge in various methods of knowledge representation and storage. Student will be able to solve search and constraint problem using AI techniques. Also, Student will learn adaptive techniques.

Outline Syllabus:
Overview Of The Artificial Intelligence Field: Basic concepts, Definition of AI, Background and past achievements, Aims, Overview of application areas, Problems and problem solving, State space search, production rules, logic, Heuristic search techniques, Generate and test, Hill climbing search reduction, Strategies, **Knowledge Representation:** Representation models, Predicate logic, rules, Semantic nets, frames: Conceptual graphs, Scripts, Fuzzy logic: statistical techniques for determining, Probability Methodologies for developing KBS, The KBS Development Life Cycle; Knowledge acquisition, Prototyping: implementation, Development environments. **Adaptive Approaches:** In both of the following approaches, learning and applications will be emphasized, Neural networks, Architectures: Hop field network: multi-layer perception: Feed forward: Backpropagation, Genetic algorithms, Basic concepts: population: chromosomes: operators, Schemata: coding, Rule induction, Basic concepts: Decision trees/ rule sets. **Major Application Areas:** Expert systems, Natural language and processing, Machine vision and robotics, Data mining and intelligent business support, Intelligent agents.

Module Code	ICT3222	**Title**	Internet Security	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student should understand: The principles and practices of cryptographic techniques; Generic security threats and vulnerabilities; The design of security protocol.

Outline Syllabus:
Principles and practices of cryptography and network security; public key cryptography, digital signatures, confidentially, authenticity, web security, email security, firewalls,
e-commerce The principles and practices of cryptographic techniques; Generic security threats and vulnerabilities; The design of security protocols.

Module Code	ICT3232	**Title**	Multimedia and Web development	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student will learn compressing technique and will able to develop web using the current technology.

Outline Syllabus:
Multimedia Applications, An Introduction to Multimedia, Data Compression: Basic data compression techniques, Graphic compression, Audio compression, Video compression, Media Composition: Text and Graphic editors, Sound editors, Video editors Media Entertainment: Virtual reality, Interactive audio, Interactive video. Hardware that enables multimedia, file types, their features and usage, Authoring multimedia, multimedia on the Internet, E merging Trend and future, Social and Legal issues. Web Development: HTML, XHTML, XML, JavaScript, Java beans.

Module Code	ICT3242	**Title**	Internet Computing	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will be able to build client-server application.

Outline Syllabus:
An introduction to Internet and TCP/IP reference model, IP addressing: IPv4 and IPv6 addressing, Transitioning from IPv4 to IPv6, LAN addresses and ARP, Domain Name System (DNS), Internet Applications, World Wide Web, VoIP, VLAN concept, HTTP, FTP and TELNET, **Electronic Mail**: SMTP, Mail Access Protocols (POP3, IMAP), Web based e-mail; Internet Programming, An Introduction to Sockets, Socket Programming with TCP, Java and Pearl language, PHP Client/Server computing.

Module Code	ICT3252	**Title**	Practical for Knowledge Based System (KBS) and Logic Programming	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in ICT3213.				
Outline Syllabus: Practical for Knowledge Based System (KBS) and Logic Programming (ICT3213).				

Module Code	ICT3262	**Title**	Practical for Multimedia and Web development	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in ICT3232.				
Outline Syllabus: Practical for Multimedia and Web development (ICT3232).				

Module Code	ICT3272	**Title**	ICT Practical for Internet Computing	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **60**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT3242.

Outline Syllabus:
Practical for Internet Computing (ICT3242).

LEVEL 4

Module Code	ICT4113	**Title**	Computer Architecture and Assembly Language Programming	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Student will learn advanced architectures of microprocessors and learn how to write assembly language program.

Outline Syllabus:
The Computer System Computer components, Instruction fetch and Execute, CPU registers, instruction format, instruction execution, interrupts, interrupts and the instruction cycle, Interconnection structure, Bus Interconnection, micro programmed control. Computer Memory System Characteristics of Memory system, the memory hierarchy, Cache memory, Cache levels, RAID levels. Input/Output System I/O Module structure, programmed I/O, interrupt driven I/O, DMA transfer. Overview of Advanced Architecture Pipelining, RISC architecture, Superscalar architecture.
Assembly Language Programming : Detail study of an instruction set of a microprocessor and writing simple Program.

Module Code	ICT4122	**Title**	Bio Informatics and Computational Biology	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Students will learn the computational techniques in biologyand DNA computing.

Outline Syllabus:
Overview of DNA and Protein Sequences, Genomics, WEB Sites and Data Banks of Proteins, DNA Sequences, and 3D Structures, Searching and Matching on String, Arrays and Trees, Computer Analysis of Sequence Data, Regularities, Statistics, Sequence Comparison and Alignment, Two and Multiple, Local and Global, Phylogeny and the Inference of Evolutionary Trees, Computational Aspects of Physical Mapping and Sequence Assembly, Computer Analysis and Prediction of Protein Structure, 3D Matching, Export Techniques to Data Mining, Compression, DNA Computing.

Module Code	ICT4132	**Title**	Mobile Computing	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn wireless technologies and convergence technologies (Computer, telephone, multimedia, home entertainment).

Outline Syllabus:
Introduction / Problem Motivation, OS support for small devices, Wireless technologies (CDMA, Bluetooth, etc.)
Routing and transport in mobile / wireless environments, Ad hoc routing protocols, MEMS / Micro sensors.
Next generation naming (IPv6, NAT), Replication / Consistency in wide-area systems, Persistent storage: caching content (dynamic / multimedia) distribution, Resource allocation, Next generation applications "Convergence" (Computer, telephone, multimedia, home entertainment).

Module Code	ICT4142	**Title**	Advanced Computer Networks	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn advanced concept in computer Network and emerging technologies.

Outline Syllabus:
Scaling IP Addresses: Scaling networks with NAT and PAT, DHCP, WAN Technologies: WAN Technologies Overview, WAN Technologies, WAN Design, PPP: Serial Point-to-Point Links, PPP, PPP Configuration, ISDN and DDR: ISDN Concepts, ISDN Configuration, DDR Configuration, Frame Relay: Frame Relay Concepts, Basic Frame Relay Configuration, Introduction to Network Administration: Workstations and Servers, Network Management.
Emerging Technologies: Basics of Optical Networks, Optical Transmission and Multiplexing.

Module Code	ICT4152	**Title**	E-Commerce	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn electronic commerce technique and its implementations.

Outline Syllabus:
Setting the context to EC, Related terminologies- E markets, E Business, Web - Commerce, The ever-widening impact of EC, Types of EC - B2B, B2C, C2B, Government participation in EC, The EC bandwagon, Work-flow management, Customization of products and services, Supply chain management, Inter- organizational applications of EC, An Electronic Commerce Framework, EC requirements and services, Policy and regulatory issues in EC, Components of EC, EDI, Intranets and Extranets, Digital Currency and Electronic Catalogues,
Telecommunications infrastructure, Decision support systems, Interoperability, Storage and retrieval of information/ linking databases to the web, Workflow management, Markup languages EC business models, Developing an EC business case, EC implementation strategies, Key lessons to remember in EC implementation, Change Management and EC implementation, Information based Marketing, Advertising on the net, Approach to Interactive Marketing on the net, Security Issues and solutions.

Module Code	ICT4161	**Title**	Practical for Computer Architecture and Assembly Language Programming	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT4113.

Outline Syllabus:
Practical for Computer Architecture and Assembly Language Programming (ICT4113).

Module Code	ICT4171	**Title**	Practical for Bio Informatics and Computational Biology	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in ICT4122.				
Outline Syllabus: Practical for Bio Informatics and Computational Biology (ICT4122).				

Module Code	ICT4181	**Title**	Practical for Mobile Computing	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in ICT4132.				
Outline Syllabus: Practical for Mobile Computing (ICT4132).				

Module Code	ICT4191	**Title**	Practical for E-Commerce	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT4152.

Outline Syllabus:
Practical for E-Commerce (ICT4152).

Module Code	ICT4213	**Title**	Parallel and Cluster Computing	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Student will learn parallel architecture and to design parallel programs to these architecture. They will also learn to program in MPI/PVM environment.

Outline Syllabus:
Parallel architectures (SIMD, MIMD, etc.), Parallel algorithm design, Scalability, Communication techniques, Speed and efficiency of parallel algorithms. Introduction to MPI/PVM.
General introduction to the concept of cluster based distributed computing. Hardware technologies for cluster computing, including a survey of the possible node hardware and high-speed networking hardware and software. Software for cluster computing Configuring and Tuning Clusters: This will involve evaluation of the performance of various nodes and networking hardware such as Gigabit Ethernet, Myrinet, Infiniband, Quadrics etc., and special purpose driver software such as VIA. Setting up Clusters: OSCAR, NPCAI Rocks, Score etc. Software and software architectures for cluster computing, including both shared memory (OpenMP) and message-passing (MPI/PVM) models. Programming, features and performance of standard MPI variants (LAM/MPICH/vendor specific MPI versions) and variants based on new low level protocols (MVICH), evaluation and tuning of system and software performance. Managing cluster resources: single system images, system level middleware, distributed task scheduling, monitoring and administering system resources and possibly some of the following topics: Parallel I/O and Parallel Virtual File System, Scheduling: Condor, Maui Scheduler, Portable Batch System (PBS), Application steering and visualization: Cumulvs, GUIs for visualization and debugging Brief overview of meta-clustering: the Computational Grid, Globus, Grid Portals, Java RMI, Jini

Module Code	ICT4222	**Title**	Advanced Networking Technologies I (Routing)	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student will learn various routing technologies.

Outline Syllabus:
WANs and Routers: WANs, WAN Technologies, Routers, Introduction to Router: Operating Cisco IOS, Starting a Router, Configuring a Router: Configuring and Finishing the Configuration. Learning about Other Devices: Discovering and Connecting to Neighbors, Getting Information about Remote Devices.
Managing Cisco IOS: Router Boot Sequence and Verification , Managing the Cisco Router File System.
Routing and Routing Protocols: Static Routing , Dynamic Routing, Routing Protocols.
Distance Vector Routing Protocols: Distance Vector Routing, RIP, IGRP, TCP/IP Suite Error and Control Messages: TCP/IP Error Message , Overview of TCP/IP Control Messages, Basic Router Troubleshooting: Examining the Routing Table, Network Testing, Troubleshooting Router. Intermediate TCP/IP: TCP Operation, Overview of Transport Layer Ports.

Module Code	ICT4232	**Title**	Advanced Networking Technologies II (Switching)	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Students will learn various switching technologies.

Outline Syllabus:
Introduction to Classless Routing- VLSM, RIP Version 2, Single-Area OSPF: Link State Routing Protocol, Single Area OSPF Concepts, Single Area OSPF Configuration. EIGRP: EIGRP Concepts, EIGRP Configuration, Troubleshooting Routing Protocols, Switching Concepts: Introduction to Ethernet/802.3 LANs, Intro to LAN Switching, Switch Operation, Switches: LAN Design, LAN Switches, Switch Configuration: Starting the Switch, Configuring the Switch, Spanning Tree Protocol: Redundant Topologies, STP Overview, VLANs: VLAN Concepts, VLAN Configuration, Troubleshooting VLANs, VTP: Trunking, VTP, Inter-VLAN Routing.

Module Code	ICT4242	**Title**	Agent Technology	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Student will learn the fundamentals of Agent technologies.

Outline Syllabus:
Introduction to the agent concepts (competence & trust, degrees of automony), Agents Metaphors (e.g. personal assistants) and Indirect manipulation, Agent Learning and Knowledge Acquisition (direct programming, machine learning) Agent Architectures (horizontal, vertical, multi-agent), Agent Toolkits (e.g. JatLite, Aglets) , Agent Communication (e.g. KQML) , Applications of agents in autonomous systems (e.g. search engines, information filtering, load balancing).

Module Code	ICT4252	**Title**	Seminar / Presentation	
Credits	02	**Hours**	**Lectures** **Laboratory**	- **2 - 3 months**

Learning Objectives:

To upgrade the current technology upgrades and trend.

Outline Syllabus:
Students will have to do independent reading on new trends in Information and Communication Technology and conduct seminar / presentation.

Module Code	ICT4261	**Title**	Practical for Parallel and Cluster Computing	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT4213.

Outline Syllabus:
Practical for Parallel and Cluster Computing (ICT4213).

Module Code	ICT4271	**Title**	Practical for Advanced Networking Technologies I (Routing)	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**

Learning Objectives:

This practical course is designed to provide the practical implementation of the theory taught in ICT4222.

Outline Syllabus:
Practical for Advanced Networking Technologies I (Routing) (ICT4222).

Module Code	ICT4281	**Title**	Practical for Advanced Networking Technologies II (Switching)	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in ICT4232.				
Outline Syllabus: Practical for Advanced Networking Technologies II (Switching) (ICT4232).				

Module Code	ICT4291	**Title**	Practical for Agent Technology	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **30**
Learning Objectives: This practical course is designed to provide the practical implementation of the theory taught in ICT4242.				
Outline Syllabus: Practical for Agent Technology (ICT4242).				

Appendix C

Detailed Syllabus

B.Sc. (Environmental Science)

LEVEL 1

Module Code	ASB 1113	**Title**	Plant Diversity and Taxonomy	
Credits	03	**Hours**	**Lectures** **Laboratory**	35 **30**

Learning Objectives:

Developing an appreciation on the aspect of plant diversity. Developing scientific skills for identifying and classifying plants (as part of environmental science investigations).

Outline Syllabus:

Theory: Nomenclature and Classification system. A general study of the kingdom Monera, Protoctista, Fungi and Plantae (including their characteristic features, reproduction, ecology and distribution). The phylogeny relationships of the major groups of plant. Morphology of Angiosperm and reproduction of Angiosperm. A taxonomic study of Angiosperms with special reference to some important families in the flora of Sri Lanka and construction of identification keys. Field collection and herbarium. Practical/s: Study the Monocular and Binocular Microscope and Functions of different parts, Identify and Study the characters of different bacteria, cyanobacteria, algae, fungi, Phylum Bryophyta, Club mosses, Horsetails, Ferns & Gymnosperms, study the difference between Monocotyledons and Dicotyledons, and observe the different characters of seed dispersal, Study the morphology of Angiosperm, Field collection & herbarium techniques, Study the importance families and their characters.

Learning Outcome:

At the end of the course the student should be able to identify and classify the plants in the environment.

Module Code	ASB 1122	**Title**	General and Inorganic Chemistry and Chemical Thermodynamics	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Development of a general appreciation for the principles of inorganic chemistry and thermodynamics within the confinements of the field of environmental science.

Outline Syllabus:

General and Inorganic Chemistry: Units and dimension, electromagnetic spectrum, wave and particle nature, Heisenberg uncertainty principle, De-Broglie equation, atomic spectra, quantum numbers, electronic configuration, Aufbau principle Hund's rule, Pauli's exclusion principle, configuration of element. Electro valence, covalence, coordinate valence, types of chemical bond, theory of valence bond, introduction to bonding and anti-bonding, ∇ & $\triangle$ molecular orbital and their shapes, Van der Waals forces, hydrogen bond, metallic bond. Magnetism, dipole moment, polarization Fajan's rule radii of atoms and ions, energy factors, Born - Haber cycle, Electric potential date disproportionation, stability constant, activation energy. Chemical Thermodynamics: Definition of common terms used in thermodynamics, Laws of thermodynamics (1^{st} and 2^{nd} law work heat, reversible processes entropy changes, heat capacities Clausius-Claypeyron equation, Maxwell's relationships and their application, Henrys law. Inorganic chemistry: Characters and Reactions of Group 1, 2, 3, 4, 5, 6, 7, 8 and transition elements.

Learning Outcome:

Students will be able to apply the principles of the inorganic chemistry and thermodynamics in the field of environmental science.

Module Code	ASB 1131	**Title**	Practical unit: Inorganic Chemistry	
Credits	01	**Hours**	**Lectures**	-
			Laboratory	**45**

Learning Objectives:

Developments of basic laboratory skills in inorganic chemistry as per theoretical elements covered in ASB 1122.

Outline Syllabus:

Acid, base, precipitation and redox titration's Qualitative analysis of simple anion and simple cation mixtures.

Learning Outcome:

Students will demonstrate the practical skills in quantitative analysis based on volumetric titration and qualitative analysis of inorganic chemicals.

Module Code	ASB 1143	**Title**	Cell and Molecular biology	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Development of a basic appreciation for cell and molecular biology within the confinements of the field of environmental science.

Outline Syllabus:

Theory: *Cell Biology*: Cell organization and cell structure, chemical constants of cells Differences in plant and animal sub- cellular organelles: cell cytosol, nucleus, mucleolus, mitochondria, chloroplast, ribosome,lysosome, vacuoles, centrioles, Flagella and cilia, Golgibodies and Dictiozomes.Structure and function of cell membrane, Transport of molecules through cell membrane, Cell junctions; *Cell division*, mitosis and meiosis. Chemistry of living things: [Structure and function of Carbohydrates, protein, lipids, vitamins, and macro and micro elements. Enzymes structure and function; Cell metabolism. Photosynthesis]. *Genetic material and DNA Replication:* The structure of DNA Chromosomal and plastic DNA - chromosome structure and gene organization in pro and eukaryotes. Semiconservative model an overview of bacterial and eukaryotic DNA replication- replications, origin and termini. DNA unwinding synthesis of leading and lagging atands proteins and enzymes of replication. *Genetic code of protein synthesis*: triple codons, deciphering the gene code. Degeneracy of the code, termination codons, prokaryotic and eukaryotic protein synthesis -initiation, elongation and termination factors. *DNA damage and repair*; *RNA and RNA synthesis*: Biosynthesis of RNA in prokaryotes and eukaryotes enzymes and proteins involved in promotor selection. Gene regulation in prokaryotes and gene regulation in eukaryotes. Mutagenesis and chromosomal changes: hetroploidy chromosomal aberrations, point mutations.
Practical/s: Microscopy and techniques, Growth of bacteria, counting bacteria, Cell and cell organelles, Protein separation techniques, Electrophoresis, molecular weight determination, Nucleic acid extraction and DNA sequencing, PCR technology, Agarose gel Electrophoresis, Gene cloning, DNA sequencing and tissue culture.

Learning Outcome:

At the end of the course the students will be able to develop basic theoretical understanding of the basis of life form and will demonstrate practical skills on the relevant topics.

Module Code	ASB 1153	**Title**	Basic Mathematics and Statistics	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Student will gain the basic knowledge in mathematics and statistics for further studies in environmental studies

Outline Syllabus:

Basic Mathematics: Basic trignometry, real numbers and complex numbers, Indices and logarithms; Co-ordinate systems, differentiations, Maxima and Minima; integration; solution of simple differential equations. Statistics: Sampling method, Sampling distribution of the mean, Descriptive statistics- measures of location and dispersion, shapes of distribution.

Learning Outcome:

At the end of the course the students will be able to understand the mathematical and statistical concept and apply this knowledge for further studies

Module Code	CCCU 1113	**Title**	Fundamental concepts in Information Technology	
Credits	03	**Hours**	**Lectures** **Laboratory**	25 **60**

Learning Objectives:

Students will learn the basic concepts in IT and learn about various basic software packages.

Outline Syllabus:

Introduction: Early history of computing, The computer generation, Characterization/ Classification of computers, Basic components and organization of a computer, Representation of information in a computer, Number Systems, Computer logic, Concept of programming and programming languages, Introduction to Matlab. **Application software:** Basic features of application software, tools for work and study - Desktop Accessories, word processing, spreadsheets, Database Management system, Graphics, Communications, Software suites, etc. Operating system and its functions. Utility programs, Utility packages.**Introduction to operating systems:** The need for an operating system, The types of operating systems, The features of the MS-DOS/Windows X operating system, Linux.**Introduction to word processing :** Word processors and its advantages. Ms Word, LateX. **Introduction to spreadsheets packages:** Training in the usage of spreadsheet such as Excel;**Introduction to computer presentation techniques:** Ms power point.**Introduction to Database management system packages:** Ms Access. **Statistical packages:** A brief introduction to statistical packages, usage of packages such as Minitab/SAS. **Introduction to IT & Computer and communication:** Revolution in Computers and communications. The digital future: Role of IT in society, Distinguish between data and information. properties of Information and basis IT tools., Input devices and its functions, output devices and its functions, processing and memory hardware, Secondary storage and communication devices.**Development of communication/computer Technology:** Type of network: WAN, MAN, & LAN, Types of LAN and its components, Topology of LAN, Transmission Media: Twisted-pair, co axial and fibre optics cables, Circuit switching and packet switching, Basics of Protocol, VoIP (IP telephony). **Web design Tools**: Introduction to HTML and Macromedia Flash MX.

Learning Outcome:

At the end of the course the students will be able to understand the fundamental concepts of IT and to apply in their career.

Module Code	ACU 1112	**Title**	English Language - I	
Credits	2	**Hours**	**Lectures**	15
			Laboratory	**30**

Learning Objectives:

" The students should be able to gain necessary skill to read, understand and communicate in English.

Outline Syllabus:

Reading: Basic Reading skills, Skimming, Scanning, Identifying main points, Understanding vocabulary, Understanding sequencing, Reading for comprehension. Writing: Introducing the Mechanics of writing, Introducing vocabulary in and around the University environment, Transferring graphic, statistical, pictorial Information into writing, Sequencing, Form filling, Writing notes, Preparing to write a project. Speaking: Introducing, Describing/ people/events/pictures, Interviewing at an elementary stage, Giving instructions/directions, Making short speeches on a previously prepared topic. Listening: Listening to discriminate sounds, Listening to discriminate sounds. Listening for specific information, Listening for the gist, Listening and responding to telephone conversion, Listening & comprehending Communicative grammar: Introducing basic structures, Word-order Tense, Negation, Question formation, Articles, Preposition, Pronouns, Quantifier, Word class, Active/passive, Conjunctions/ relativization. **Project**: Topics to be selected from student's field of interest, Submission of individual projects to be before the end of the semester.

Learning Outcome:

At the end of the course the students will be able to read, understand and communicate in English.

Module Code	ASB 1212	**Title**	Plant Anatomy and Physiology	
Credits	02	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

" Development of a general appreciation of plant physiology within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Cell: [Structure of a generalized plant cell. Structure and function of plant cell wall, Nucleus, Cytoplasm, Mitochondrion, Chloroplast, Endoplasm reticulum, Golgi complex, Lysosome and plasma membrane]. Anatomy: [Primary plant body, Tissue differentiation, Secondary growth in stem and root, Wood properties, Secondary phloem, Wound healing and grafting. Anomalous growth in plants]. Photosynthesis: [Photochemical and biochemical reactions. Carbon fixing pathways. Phloem transport. Measurement of photosynthesis. Factors affecting photosynthesis]. Respiration: [Respiratory pathways- fermentation, Kreb's cycle, respiration and growth, factors affecting respiration, photorespiration]. Plant water relationship: [Function of water in the plant. Soil water potential. The concept of water potential. Factors affecting the water potential, water uptake by roots, the role of tugor pressure in the plant cells, measurements of transpiration rates, plant anti-transpitrants, water stress and its physiological consequences, stomatas, water loss and gas exchange]. Mineral nutrition, Nutrition uptake and ion transport.
Practical/s: Study the anatomy of different parts (leaf, stem and root) of monocot and dicot plants, and study the anatomical differences between C_3 and C_4 plants. Study the different physiological activities of plant. (Osmosis, Plasmolysis, Diffusion, Imbibitions)

Learning Outcome:

At the end of the course the students will be able to understand the anatomy and physiology of plants and will be able to identify anatomical & physiological variations in plants.

Module Code	ASB 1223	**Title**	Organic Chemistry	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Development of general appreciation/s for the principles of organic chemistry within the confinements of the field of environmental science.

Outline Syllabus:

Nomenclature of organic compounds, stereochemistry:- Optical activity, Chirality, enantiomers, diastreoisomers, racemic modification and their separation, projection formula, R, S system nomenclature, geometrical isomerism, conformation of decalin. Reaction intermediates in organic chemistry, stability and reactivity of these intermediates, resonance and inductive effect, strength of acids and bases. Synthesis and reaction of alkanes, alkenes, alkynes, alkyl halides, alcohols and ethers. Mechanisms- $S_N1, S_N2, E_1, E_2, \mathrm{E1cB}$, addition and rearrangement reactions. Factors affecting these reactions.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of organic chemistry in relation to the environmental science.

Module Code	ASB 1231	**Title**	Practical unit- Organic Chemistry	
Credits	01	**Hours**	**Lectures** **Laboratory**	- **45**

Learning Objectives:

Developments of basic laboratory skills in organic chemistry as per theoretical elements covered in ASB 1263.

Outline Syllabus:

Elemental and functional group analysis of organic compounds.

Learning Outcome:

At the end of the course the students will be able to demonstrate the practical skills in qualitative analysis in organic chemistry.

Module Code	ASB 1242	**Title**	Vertebrate Diversity	
Credits	02	**Hours**	**Lectures** **Laboratory**	20 **30**

Learning Objectives:

Development of a general appeciation for vertebrate diversity within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Vertebrate diversity as illustrated by *cyclostomes* and *gnathostomes*; classification, distribution, life style, adaptations and evolution of the fishes, amphibians, reptiles, birds, and mammals.
Practical/s: Levels of organization and Anatomy & structure of vertebrates.

Learning Outcome:

At the end of the course the students will be able to identify & classify various vertebrates in the environment.

Module Code	ASB 1252	**Title**	Invertebrate Diversity	
Credits	02	**Hours**	**Lectures** **Laboratory**	20 30

Learning Objectives:

Development of a general appreciation for invertebrate diversity within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Animal kingdom and levels of organisation; classification and nomenclature; concept of species, taxonomy, patterns of animal life style (habit & habitat) and organisations from evolutionary point-of-view, unicellular animals, poriferans, cnidarians, platyhelminthes, nematodes, annelids, arthropods, molluscs, echinoderms, proto-chordates.
Practical/s: Levels of organization and Anatomy & structure of invertebrates.

Learning Outcome:

At the end of the course the students will be able to identify & classify various Invertebrates in the environment

Module Code	ASB 1262	**Title**	Development Physiology and Post Harvest Technology	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Development of a general appreciation of development physiology and post harvest technology within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Plant growth substance. Structure and physiological effects of plant growth substances [e.g. Auxin, Gibberellins, Cytokinin, Ethylene and growth inhibitors]. Plant growth and development. Movement and orientation of plants. Flowering physiology. Factors affecting flowering, Photoperiodism. Vernalization. Fruit set, Fruit growth and development, Ripening and abscission of fruit. Harvesting, physiochemical changes. Use of chemical/s to induce fruit ripening and their impacts on environment. Influence of pre-harvest factors on storage. Post harvest physiology and bio chemistry of fruits and vegetables. Types of storage. Major causes of losses, post harvest handling and reduction of post harvest losses.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of the plant growth substances, development physiology of plants and post harvest factors, which influences the plant growth.

Module Code	ASB 1273	**Title**	Basic Microbiology	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Development of a general appreciation of basic micro biology within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Microbiological techniques. Isolation and characterization of micro organisms. Morphology of bacteria (staining, etc) Physiological characters such as carbohydrate dissimulation, proteolysis test, test for specific enzymes and serological tests. Cell growth, methods of determining bacterial cell numbers, breeds methods, dilution count, and plate count. Bacterial growth curve. Factors affecting the rate of cell division. Microbiology of air: [Contamination of air borne infections, prevention and control of air contamination]. Microbiology of soil: [Soil micro organism. Role of soil micro organisms in plants, animals and soil fertility]. Micro biology of water: [Water micro organisms. Problems of water micro organisms, microbial standards of water]. Water born infections. Purification of water. Food micro biology: [Food micro organism, spoilage of food, food poisoning and food infection, methods of food preservation].
Practical/s: Introduction to microbiological equipments, Sterilization techniques in microbiology, Plate preparation, Isolation methods: streak, pour plate and contact slide method. Serial dilution and isolation of soil microbes, Study of airborne microbes, methylene blue reduction test in milk, staining technique in microbiology.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of microbiology and demonstrate the practical techniques in manipulating microbes in the environment.

Module Code	ACU 1220	**Title**	Sri Lankan Studies, Social Harmony, and Natural Resources of Sri Lanka	
Credits	00	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

This course is designed to provide basic knowledge in Sri Lankan history and natural resources; social concepts; human rights and the importance of social harmony in a multicultural and multiethnic society.
The student will develop general skills (and an appreciation) in applying sociological concepts and theories in effective conflict mitigation/resoultion in natural resource management at the culmination of this module.

Outline Syllabus:

Sri Lankan Studies: History, religion, languages, literature, arts, local wisdom and the lifestyle of Sri Lanka in the past, present and the future trend. *Social Harmony*: Organizing social life [Culture and society, Cultural integration, Socialization, Social interaction]; Social Harmony [Possible definition/s, Concepts, Ideals, Human Rights]; Identification of issues relating to social disharmony [Social stratification, Ethnicity, Prejudice and discrimination (race/gender/institutional), Criminal and deviant behaviours]; Conflict resolution/management and peace building [Definition of conflict, Understanding conflict management and resolution, Conflict resolution among groups (using tools such as negotiation, reconciliation, mediation, arbitration, interpersonal communication), Non-violence communication]; Dealing with conflict/s in environment and natural resources management (using case studies from local to global scenarios). *Natural Resources of Sri Lanka*: Land, aquatic-coastal and marine resources, inland aquatic resources, Renewable and Non-renewable resources.

Learning Outcome:

At the end of the course the students will be able to understand the history of Sri Lanka, multicultural nature and the resources available in Sri Lanka and develop the knowledge and attitude to manage and conserve natural resources, conflict mitigation and social harmony

Module Code	ACU 1211	**Title**	Communication skills	
Credits	01	**Hours**	**Lectures**	10
			Laboratory	**15**

Learning Objectives:

Students will develop skills and knowledge in broad self institutional, social, and, public communications; as well as specialized knowledge and skills in creative and innovative mass communication.

Outline Syllabus:

Introduction to Communication: The communication process, Exchange of meanings, Experience Transmission, Downward communication ,Upward communication, Horizontal communication , One-way communication, Two-way communication and Multi-directional communication. Importance of Communication: Communications for Management, Managerial time in communications and Effects of Good communication. Forms of Communication: Oral communication: Written communication, Non-verbal communication, Para-language Code, Signals, Symbols, Icons, Gestures, Freelance writing, Writing for your people and Publishing and Editing. Levels of communication: Inter personal communication, Public communication and Major components of communication. Planning and Organization: Provision of Information, Management Participation, Analytical skills, Establishment of objectives, Strategy formulation & Development, Activity Identification, Work grouping, Resource allocation, Delegation, Balancing & Timing, Activity Synchronization & Harmonization, Communication for coordination. Motivation: Legal Compliance. Instrumental Satisfaction, Self Expression, Goal Congruence and Communication in Motivation. Control: Issue of Instructions, Reporting & Recommendations, Performance Appraisal and Styles of Control. Staffing: Interview Techniques, Communication in Training & Development, Performance Evaluation & Feedback and Industrial Relations. Leadership: Supportive Leadership, Directive leadership, Achievement Oriented leadership and Participative leadership. Public Relations & Marketing Communication: Negotiating skills: Creating the climate, Opening process, Fabric of Negotiations, Conduct of Negotiation, Communication during Negotiations, Bargaining, Teamwork and Negotiating styles.

Learning Outcome:

At the end of the course the students will be able to communicate effectively in self institutional, society and public forums

LEVEL 2

Module Code	ENS 2112	**Title**	Biodiversity and Conservation	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Understanding the importance/s of the concept of *biodiversity* in environmental science.

Outline Syllabus:

Biodiversity - Ecosystem Diversity, Species Diversity, Genetic Diversity, and cultural diversity. Importance of Biodiversity; Role of genetic diversity on the stability of a population; Inbreeding and out breeding depression; Minimum Viable population, Evolution of Biodiversity, speciation, theory of Island bio-geography, extinction of species, threats to biodiversity globally and locally. IUCN Categories of threatened species, endemism, relict, keystone species, flagship species, Sustainable use of Biodiversity, Conservation strategies of biodiversity (special concern to Sri Lanka), National and International Legislation for Biodiversity Conservation, Habitat development. Effects of fragmentation. Restoration, reclamation, and regeneration of degraded ecosystems. Forest corridors; Reintroduction; Management of Nature Reserves. Semi domestication of wild animals for food production. Management of wildlife under captivity. Ecotourism.
Field visit:may be executed via field visits to biodiversity hotspots, *insitu* or *exsitu* conservation centres etc.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of the biodiversity and it's conservation for sustainable environmental management.
basic understanding of geo-physical aspects of hydrosphere and atmosphere.

Module Code	ENS 2123	**Title**	Environmental Pollution and Pollution Control	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Development of basic, comprehensive understanding/s on the issue of environmental pollution. Development of an appreciation for effects and control measures of environmental pollution.

Outline Syllabus:

Introducing the terms 'pollution' and, 'pollutants': the sources of pollution; types of pollution; **Air pollution** - [classification and properties of air pollutants, emission source - major emissions from global sources - importance of anthropogenic sources - behaviour and fate of air pollutants - photochemical smog - effects of air pollution; Global issues of air pollution: global warming, green house gases, acid rain, stratospheric ozone depletion etc. ecology of air, kinds of air pollution], Devices used to control air pollution - [electrostatic precipitator, fabric filter, gas adsorption and absorption]. **Water pollution** - [types of water pollution, kinds and sources of water pollutants, ecology of water pollution - sewage pollution. Significance of acidity, alkalinity, hardness, turbidity, suspended and dissolved solids, DO, BOD, COD, chlorides, fluorides, ammonia, nitrite-nitrate, total nitrogen-phosphates, sodium, potassium, calcium, magnesium, iron, manganese, heavy metals- pesticides]. Global episodes of environmental pollution. Control of water pollution, silt pollution, estuarine and marine pollution; Biology of polluted water: various kinds of wastes; biological and ecological changes of aquatic conditions due to domestic, industrial and agricultural waste discharge; Use of organisms as an indicator of water pollution. Pesticides in aquatic environment: types of pesticides that cause hazards in aquatic system; movement and fate of pesticides in aquatic environment and their toxicological and ecological effects. **Land pollution**; of pollutants, source of pollution, pesticide and herbicide contamination; Physical, chemical and biological pollutants in polluted water. **Industrial pollution** - types of pollutants (hazardous and non-hazardous), thermal pollution radioactive pollution; noise pollution, effects of noise pollution. **Practical**:Measurements of pollutants in air, water & land .

Learning Outcome:

At the end of the course the students will be able to understand the types of environmental pollution, impacts of pollution and available control measures. And also they will be able to measure the pollutants in air, water and land.

Module Code	ENS 2132	**Title**	Environment and Agriculture	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Understanding the effects of environment on agriculture and *vice versa*.

Outline Syllabus:

Climate as a resource in agriculture. Classification of Agro ecological zones in Sri Lanka. Ecological approaches to use natural resources. Sustainable Development, Sustainable agriculture, Indicators for assessing the sustainability. Cropping systems.Plantation development in relation to resource use. Forest as a natural resource in relation to agriculture. Livestock production in relation to environment. Impact of livestock on natural resources and environment. Livestock as vectors of diseases. Disposing animal excreta. Forage development to optimize natural resource utilization. Aquaculture resource availability and environment. Carrying capacities of different livestock enterprises. Agricultures' impact on environment: water, air, soil quality. Reducing agricultural pollutants. Organic farming, Integrated pest management.

Learning Outcome:

At the end of the course the students will be able to identify the impacts of crop cultivation & livestock activity on environment and the effects of environment on agriculture

Module Code	ENS 2143	**Title**	Earth and Atmospheric Sciences	
Credits	03	**Hours**	**Lectures**	45
			Laboratory	-

Learning Objectives:

Developing basic know-how on geo-physical aspects of Earth System Dynamics

Outline Syllabus:

The Earth : Origin of the earth and the solar system, Earth's rotation and seasons, Earth's crust, Earth quakes, Volcanoes, Thermal and electrical properties of earth. Geomagnetism .The Hydrosphere: The hydrological cycle, The oceans: physical changes due to temperature, Salination and living organisms, Physical properties of sea water and pure water, sound in the sea Light in the sea, colour of sea water, ocean currents, Ocean waves and tides. The Atmosphere: Chemical composition of the atmosphere, Temperature profile, Upper atmosphere, Radiation energy balance. Clouds formation and classification. Atmospheric optics. Meteorology: The wind, Monsoons, Thunder storms, Cyclones, Tornadoes, Hurricanes, Lightning and thunder, lightning protection. Meteorological instruments and observation Measurement of wind speed, Humidity and temperature. World climate, Climate records and climate variability, forecasting, remote sensing.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of geo-physical aspects of hydrosphere and atmosphere.

Module Code	ENS 2153	**Title**	Food, Nutrition and Environment	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Understandings on health and nutrition within the confinement of environment and community management developed.

Outline Syllabus:

Theory: Food: Definition and classification of foods, functions of food, diet. Nutrition: Macro and micro nutrition. Carbohydrates- Introduction, Structure, Function and Biological Significance Protein and Amino acids- Introduction, Structure, Function and Biological Significance Lipids- Introduction Structure, Function and Biological Signification Vitamins: Classification and biochemistry of vitamins, Sources of vitamin, Daily requirements of vitamins. Biochemical functions of vitamins. Cell respiration, Hormones. Human Nutrition: Nutritional role, digestion, absorption, transport and metabolism of carbohydrates, lipids and proteins. Carbohydrate metabolism; Fate of glucose in the tissues, glycogenolysis, control of glycogenesis and glycogenelysis, Blood glucose and glucose tolerance test. Endocrine regulation of carbohydrate metabolism.Inborn errors of carbohydrate metabolism.Lipid metabolism; lipoprotein, chilomicrons, VLDL, LDL, HDL,. Liver and lipid metabolism, Adipose tissue, release of fatty acid, and to the blood. Lipogenesis, ketogenesis and its physiological significance . Cholesterol metabolism. Protein metabolism: Revision on protein synthesis, effect of antibiotics on protein synthesis. Mineral nutrition: Importance of trace elements, requirements, absorption. Transport and storage. Iodine metabolism, hypothyrodism/hyperthyroidism. Tests for thyroid function. Iron and its function, intestinal absorption, iron deficiency and overload. Calcium and phosphorous: Dietary sources, factors affecting the absorption of calcium; Importance of Zn, Cr, and Fe. Balanced diet, Nutritional values and the effects of processing and cooking of cereals, pulses, meat, and meat products, eggs, fish, milk and milk products, fruits, vegetables and beverages; nutritive properties of unconventional foods; toxic compounds present in the foods. Assessing nutritional status in the community. Assessment methods. Common nutritional deficiency diseases with special reference to Sri Lanka. Guidelines for healthy nutrition surveillance. Nutrition intervention programmes. Food and Environment: Food pyramid, Food web. Microorganisms and food. Contamination and spoilage of food, water and air contamination, food, sanitation. Storage- milk sanitation. Changes on cooking and processing. Assessment of Nutritional status: assessment methods, Nutritional surveillance, nutritional status indicators. Food surveillance, Food borne intoxifications, Food toxicants, Food fortification.
Practical/s: Laboratory, identification tests for carbohydrates, lipids, protein compounds., vitamin *C. Community nutritional surveillance*: Anthropometric measurements. Nutritional assessment reports.

Learning Outcome:

At the end of the course the students will be able to develop the understanding of health and nutrition aspects for the community management. And will demonstrate the practical skills in lab-oriented analysis of food and field based case studies.

Module Code	ENS 2162	**Title**	Environmental Sanitation, Health, and, Legal Aspects	
Credits	02	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

Developing an appreciation for the role of environmental sanitation in effective environmental management
Learning about the different health and legal aspects of environmental sanitation.

Outline Syllabus:

Environmental Sanitation (WHO), Importance, rural and urban sanitation. Interactions between micro-organisms and Environment, Methods for monitoring microbial activities; petroleum microbiology; survival of airborne micro-organisms. Microbial degradation of selected pollutants and bio-control. Sanitation of water: water sanitation and diseases, Drinking water quality standards, Water treatment methods, purification of drinking water (in both large scale and household level), planning and designing of a sanitary water supply scheme, Domestic sewage disposal options (low cost), cattle farm sanitation, house hold and community solid waste disposals options - sanitary landfilling, composting, biogas production etc., management of health care or clinical waste management options. Indoor sanitation: Ventilation, lighting, indoor air pollution, disinfection of air, Noise and health effects of noise pollution. Environmental Housing/Residential environment (WHO recommendations). Brief description on solid wastes and management. Waste disposal. Disease and Environmental Sanitation: Diseases due to poor sanitary practices: epidemic-endemic-pandemic-sporadic diseases. Methods of infection and transmission- Diseases of intestinal origin, vector -borne, arthropod -borne diseases. Insect vectors- flies and mosquitoes- life histories- diseases transmitted by vectors, eradication methods- biological control versus chemical - rural and urban remedial measures - rats and rodents control- fumigation, disinfection, insecticides - use and abuse. Environmental protection and laws-environmental protection acts on food sanitation, water, air, solid waste management, etc.

Practical: Can be executed in the form of field visits and reports by assessing the local and national sanitary issues in the field.

Learning Outcome:

At the end of the course the students will be able to understand the concepts in environmental sanitation to apply for effective environmental management and develop the understanding of existing legal aspects.

Module Code	ACU 2113	**Title**	English Language II	
Credits	03	**Hours**	**Lectures**	30
			Laboratory	**15**

Learning Objectives:

Students will develop skills and knowledge in broad self institutional, social, and, public communications; as well as specialized knowledge and skills in creative and innovative mass communication.

Outline Syllabus:

Exposure to significant structures of the English language as the basis of developing language abilities, Reading, Writing, Listening and speaking through language skill integration with emphasis on communicative competence at a higher level. **Reading**: Basic reading skills, Reading for details, Understanding vocabulary in and from context, Finding main ideas, Understanding sequences, Intensive reading, Reading comprehension, Making inference and Summarizing. **Writing**: Introducing basic structures and grammatical items - all tenses, active/passive voices, relativization, Joining sentences, prepositions, adverbials, adjectives and question formation. 1. Controlled writing - Transforming graphic information into writing, picture composition, sequencing and form- filling. 2. Communicating in writing - writing notes, memos, personal/official letters and report writing. *1. Report writing on scientific survey / assignments 2. Recording of science practical 3. Preparation of field reports and assignments 4. Introducing topics from scientific journals/magazines 5. Enabling students to engage in write-ups on science 6. Preparing presentations to be introduced in a workshop/conference/seminar 7. Drafting out minutes, memos, character certificates,* etc.
Listening: Listening for specific information; for specific details; for gist of the passages; for comprehension, for making inferences, listening and note taking; listening reproducing. **Speaking**: Introducing describing people/ events/ pictures; asking for information; giving directions/ instructions, making requests/ complains, Using model dialogues/ improvisations / reading to stimulate conversations and small group discussion.

Learning Outcome:

At the end of the course the students will be able to develop skills in participating in creative and innovative mass communications.

Module Code	ENS 2213	**Title**	Analytical Chemistry	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Development of practical and theorretical skills (basic to medium) in analytical chemistry (within the confienements of the field of environmental science).

Outline Syllabus:

Theory: Statistical evaluation of analytical data, precision and accuracy errors and error analysis, standard deviation, sampling techniques. Titrimetry and gravimetric analysis Thermal analysis: Theromo gravimetry, differential thermal analysis, Thermometry titrimetry Electro analytical methods: Introduction potentiometry, coulometry, voltametry, conductormetry Chromatogrsphy-paper, thin, column, Gas HPLC. Solvent extraction and ion exchange Reagent in analysis.Radio chemical method: isotopic analysis, activation analysis, radio carbon dating,Beer-Lambert law, UV Spectroscopy, IR spectroscopy, Analytical atomic spectroscopy,AAS, Flame photometry.
Practical/s: Titrimetric analysis, Colorimetric analysis,, Determination of unknown from standard curve, Chromatographic techniques.

Learning Outcome:

At the end of the course the students will be able to develop the theoretical understanding of analytical chemistry related to environmental science.

Module Code	ENS 2222	**Title**	Animal Behaviour and Population Dynamics	
Credits	02	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

" Understanding wildlife behaviour and population dynamics for effective environmental management.

Outline Syllabus:

Theory: *Behaviour*: Behaviour of important animal with emphasis on fish, Amphibian, Reptiles, Birds and Mammals in the wild. Role of behavioural studies in management and conservation of wildlife in Sri Lanka, Human-animal conflict. *Population Dynamics*: Population as unit of study, population and population characters- distribution, mortality, growth, natality, density, Demographic techniques life tables etc. principles of community.
Practical/s: Population estimation techniques, Behavioural experiments, Habitat evaluation and management strategies for national parks, sanctuaries and habitats of large mammals and reptiles. Field visit to wild life area to study the behaviour of birds, mammals and reptiles.
Field visit: to wild life area to study the behaviour of birds, mammals and reptiles.

Learning Outcome:

Students will be able to develop the understanding of the behaviour of wild animals and their population characters. and to demonstrate the skills in wild animal estimation.

Module Code	ENS 2232	**Title**	Applied Ecology and Community Environment	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Developing an understanding of applied ecology and community environment with the perspectives of effective community management (within the confinements of the field of environmental science).

Outline Syllabus:

Biotic and abiotic components of Ecosystem, Ecological Niche, Limiting Factors, Ecological Indicators, Energy flow in an Ecosystem, Food Pyramids, Food Chains, Bio-accumulation, Bio-magnification, Cycle of Water and Nutrients, Water, N, C, S, and P; Distribution of Species, Succession and Cyclic changes in Vegetation.
Application of science of ecology to the real world ; Habitat Ecology, Biotas, Communities, Zonation and Productivity of major habitats, Population Ecology and Natural resource Management, Population growth and regulation; Population management (*insitu* and *exsitu*), Species Interactions; Ecology of human society.
Field visit to local habitat to ecosystem. .

Learning Outcome:

At the end of the course the students will be able to develop the basic underpinnings of ecology and community environment for the effective community management of real world through application of gained knowledge.

Module Code	ENS 2242	**Title**	Resource and Environment Economics	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Development of basic theoretical underpinnings of resource economics and management as environmental science professionals.

Outline Syllabus:

Micro economics and welfare theory: Introduction to economics. A market economy. Demand (Consumption). Supply (Production): markets and the price mechanism. Market failure - government intervention. Market failure as a cause of environmental degradation, Potential market economic solutions to mitigate environmental conservation, Introduction to environmental valuation techniques. Microeconomic models for peasant households. Integrating gender issues into microeconomic theory. Welfare theory - introduction to project evaluation. Applying microeconomic theory to the management of natural resources: Resource classification. Models for optimal management of renewable and non - renewable resources. Bio - economic models. Common property and externalities. Regulation tools - direct regulation, taxes, subsidies, tradable quotas. Case studies. Managing global common resources, Ethics of environmental conservation.

Learning Outcome:

At the end of the course the students will be able to understand the theoretical concepts behind resource and environmental economics and how it serves as a model tool for environmental management.

Module Code	ENS 2253	**Title**	Environmental Disaster Management	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Understanding the importance/s of the concept of biodiversity in environmental science.

Outline Syllabus:

Introduction & Dimensions of Natural & Anthropogenic Disasters, Principles/Components of Disaster Management, Organizational Structure for Disaster Management, Disaster Management Schemes/SOPs, Natural Disasters and Mitigation Efforts, Flood Control, Drought Management, Cyclones, Earth quick and tsunami , Mangroves, Land Use Planning, Inter-Linking of Rivers, Role of Union/States, Role of Armed Forces/Other Agencies in Disasters, Important Statutes/ Legal Provisions, IEDs/Bomb Threat Planning, NBC Threat and Safety Measures, Forest Fires, Oil Fires, Crisis in Power Sector, Accidents in Coal Mines, Terrorism and Emergency Management, Case Studies.

Learning Outcome:

At the end of the course the students will be able to develop the basic theoretical understanding of natural disasters, responses and safety measures and to develop the logical alternative in case of emergency situation.

Module Code	ENS 2263	**Title**	Soil Science and Fertility Management	
Credits	03	**Hours**	**Lectures**	35
			Laboratory	**30**

Learning Objectives:

Development of an appreciation for soil science (and soil fertility management) in effective environmental management.

Outline Syllabus:

Minerals and rocks, formation, classification & properties, Rocks of Sri Lanka, Rock Weathering and Soil formation, Soil physical properties; Composition of soil, Soil colour, bulk density, porosity, Soil texture, Soil structure, Soil moisture content, Soil moisture potentials, Soil moisture retention; Nature and properties of soil colloids, Ion exchange in soils, Soil reaction, Redox potential and Electrical conductivity, Soil profile, Soil taxonomy, Soils of Sri Lanka. Soil organisms, soil organic matter C/N ratio and its significance, soils as limited Resource, Processes and types of soil erosion, soil loss tolerance Estimation of soil loss, Agronomic and mechanical soil conservation methods, soil conservation act. Importance of soil fertility, Detailed interpretations and fertility parameters, Evaluation/ Assessment of soil fertility, Basic concepts to manage soil fertility, Behaviour/fate of fertilizers and amendments in soils Specific fertility management approaches for Sri Lankan soils. Problems of soil. Soil analysis.
Practical/s: Study the physical properties of minerals and rocks, Identify the Soil sampling equipment, Collection and preparation of soil sample, Determination of Soil moisture , Soil colour, Soil bulk density , Soil texture, Cation exchange capacity (CEC), Total exchangeable bases, Soil pH, Electrical conductivity, Soil organic matter, Total nitrogen in soil, Available Phosphorus in soil, Lime requirement in soils.

Learning Outcome:

At the end of the course the students will be able to develop the understanding of soil science and to demonstrate the laboratory skills in analysing various soil parameters for effective soil fertility management.

Module Code	ACU 2212	**Title**	Career Guidance	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

To give an overall view of the career prospective and guidance.

Outline Syllabus:

The world of work: Unemployment in Sri Lanka. Recent demographic, Economic and social changes of Sri Lanka and how they effect the graduate labour market. The private sector culture - emphasis on attitudes The role of scientists in various employment sectors. The expectations of private sector employer from new graduate employees. Career guidance Employment search. **Image Projection**: Social graces, Public relations, Career development and survival skills of young graduates, Personality development, Leadership, Team work, Human relations, Effective communication, Problem solving, Stress management. **Presentation Techniques**: The bio-data, Facing interviews, assertiveness.

Learning Outcome:

At the end of the course the students will be able to know the carrier prospects.

LEVEL 3

Module Code	ENS 3113	**Title**	Applied Hydrology and Water Resource Management (WRM)	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Developing a basic appreciation for the theoretical undepinnings in applied hydrology.
Understanding the various issues revolving around water resource management in local and global contexts.
Development of (applied) practical skills for investigating water resource management problems in the local contexts (this could be executed through field based investigations).
Development of appreciation for IWRM and its importance as a sustainable environmental management tool.

Outline Syllabus:

Theory: **Applied Hydrology**: [definition of hydrology, the hydrologic cycle, processes contributing to the hydrologic cycle (condensation, precipitation, infiltration, [interception], runoff and, evapotransipiration), water balance (conservation equation, water balance examples), runoff, factors affecting runoff, runoff measurement, hydrograph analysis, unit hydrograph, runoff prediction, flooding, reservoir and flood routing, watersheds/drainage-basins (*including*: the processes operating in a watershed, problems in a watershed i.e. sedimentation, soil erosion; and, strategies to prevent watershed degradation), aspects of irrigation (*including*: calculation of irrigation requirements), methods of developing surface and ground water resources]. **Managing water resources**: [uses of the water resource from local to global contexts, the hydrologic civilisation of Sri Lanka, concepts in water resource management, IWRM (definitions and the process), case studies on IWRM from Sri Lanka and the world, policies, strategies and legislations related to water resource management].
Practical/s: measurement of precipitation, introduction to modelling in Applied Hydrology and Water Resource Management (where the students will develop simple computer models as tools for problem solving in Applied Hydrology and Water Resources Management).

Learning Outcome:

At the end of the course the students will be able to develop the theoretical understanding hydrology and able to address the water related issues in local/global context. And to demonstrate the practical skill in investigating WRM problems and to provide sustainable solutions.

Module Code	ENS 3122	**Title**	Application of Geographic Information Systems (GIS) in Natural Resource Management (NRM)	
Credits	02	**Hours**	**Lectures** **Laboratory**	20 **30**

Learning Objectives:

Development of understandings on the theoretical fundamentals of GIS.
Development of the basic ability to design, implement and manage a GIS project as an environmental science professional.
Skill development in the usage of GIS software (off-the shelf, and custom made by the user)

Outline Syllabus:

Theory (divided in to parts 'a' and 'b'):**a. Fundamentals of GIS** - What is GIS? (Defining GIS, GIS in Geomatics, the components of a GIS and basic principles, GIS in NRM/Environmental Science); Spatial data (data types, remote sensing as a source of data in GIS); Spatial data modelling (including data management, data input methods, spatial analysis); Attribute data management; Data input and editing; Data analysis; The role of analytical modelling of environmental processes in GIS (including digital terrain modelling and spatial analysis); Output: from digital maps/images to enhanced decision making. Remote sensing (including aerial photography) - an introduction (from a GIS context). **b. Issues in GIS** - The development of computer methods for handling spatial data in the environmental sciences, Data quality issues in NRM when using GIS applications, Human and organizational issues with respect to applying GIS in NRM, GIS Project Design and Management in the environmental sciences (or NRM), GIS as a tool for EIA.
Practical/s: Grasping the basics of GIS using MS Excel - [building a simple GIS using MS Excel, understanding the functions overlaying, buffering and querying]. Learning to use GPS in field situations. Comprehensive training on the use of ArcView GIS.

Learning Outcome:

At the end of the course the students will be able to develop the basic theoretical understanding of GIS and to demonstrate the ability to manage environmental projects using the knowledge gained, executed via GIS manipulation devices/softwares.

Module Code	ENS 3132	**Title**	Forest Environmental Biology and Management	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Developing an understanding of the role of effective silvicultural management in general environmental management.
Learning field level skills in forest management.

Outline Syllabus:

Theory: Theories and concepts of origin and evolutional processes of Forest tree species from carboniferous, cretaceous and up to present eras. Influence of environment on evolution and adaptation of forest trees. Definition of basic concepts, forest community analysis. Forest structure and composition. Major forest types and their climatic control in Sri Lanka. Role of forest/s. Forest environment and its current status of forestry: Globally and locally Forest disturbances and recovery. Strategies for forestry problem in Sri Lanka. Sri Lankan forest policy: history and development role of different groups in the formulation and implementation of forest policy. Paradigms of forestry: quantitative information for decision making, planning and implementing sustainable/multiple use forest management. Role of agro-forestry. Classification of agro-forestry, Characteristics of agro-forestry practices in Sri Lanka. Species for agro-forestry.
Practical/s: Field visit to natural forest to identify the species, and measurement/s of the height, diameter and breath of forest tree species.

Learning Outcome:

At the end of the course the students will be able to develop the basic theoretical understanding of forest resources and to state the importance of silviculture. And to identify plant species and measure various parameters to estimate the monetary value of timber stands.

Module Code	ENS 3142	**Title**	Wild life Biology and Management	
Credits	02	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

Understanding wildlife biology for effective wildlife management.

Outline Syllabus:

Introduction: Goals of wildlife management. Population as a unit of study; estimation of population parameters; life tables; innate capacity for increase in numbers ; population growth and regulation; competition perdition and wildlife harvesting; methods of control; Fire as a management tool; methods of estimating population size. The concept of the Minimum Viable population; Effective population size; island biogeography; Inbreeding depression; Genetic problems contributing to risk of extinction; Rescue and recovery of near extinction; *In - situ* and *en - situ* conservation; Effects of fragmentation; Restoration, Reclamation, and regeneration of degraded ecosystem. Forest corridors, reintroduction. Management of nature reserve. International convention. Methods of wildlife study techniques: survey methods, radiometry, remote sensing. Wildlife ordinance of Sri Lanka.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of the biology of wild animals' for the effective management by considering various environmental factors.

Module Code	ENS 3153	**Title**	Solid and Hazardous Waste Management	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Developing understandings on the need of solid wastes and hazardous wastes management for effective environmental management.

Outline Syllabus:

Theory:Types of solidwastes, functional elements involved with the solidwaste management - waste handling, collection, transportation, segregation, disposal etc. Methods of disposal - sanitary land filling, bio reactor landfilling/sustainable landfilling, incineration, composting, vemicompost, recovery of energy from solid wastes (RDF) etc. **Solid waste Management**: Comprehensive overview of the planning of municipal solid waste management systems, particularly problems in cities and their appropriate solutions, emphasizing correlations with environmental health, water and sludge management for the sustainable development. **Hazardous wastes**: Introduction, sources of generation, composition, physical form; quantity and quality of hazardous wastes, physical and biological routes and transport of hazardous wastes substances, hazardous waste regulations, the Sri Lankan scenario/s. Special hazardous waste - Hazardous wastes sources and characterization categories and control - sampling and characterization. Analysis of hazardous wastes - analytical approach for hazardous waste characterization - proximate analysis, survey analysis, directed analysis, analytical methods. Hazardous waste treatment technologies- waste recovery processes solidification, stabilization and encapsulation - biological process and thermal processes. Storage and transportation, TSDF cradle to grave concept: ultimate disposal facilities - secure landfilling, deep well injection, ocean disposal. **Waste minimization techniques**: waste recovery processes, pollution prevention and recycling Environmental facility assessment and audit waste minimization, hazardous waste site remediation technologies.
Practical/s:Will be executed via case studies/ assignments.

Learning Outcome:

At the end of the course the students will be able to develop the detailed theoretical understanding of the solid wastes and hazardous wastes concepts and to state and quantify the impacts on the environment. And to provide appropriate problem-based solution to manage waste generation and disposal issues.

Module Code	ENS 3163	**Title**	Applied Statistics and Experimental Design	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Development of basic to medium skills in applied statistics (and experimental designing) to aid in applied environmental science research.
Skill development in the use of appropriate (and relevant) statistical software to aid in analysis.

Outline Syllabus:

Theory:Population and samples, Measures of centre and dispersion, Expected values, Frequency distributions, Histograms, Stem and leaf and Box plots, Concepts off probability sample space, Calculation of probability for discrete and continuous events, Normal distributions, Calculation of probabilities, Sampling distribution of sample means (for large and small samples) The "t" distribution, Pooled and paired "t" tests, Introduction to analysis of variance, Simple Linear Regression, Correlation coefficient interpretation, Lack of fit tests and alternative models, Introduction to multiple linear regression. Principles of experimental designs. Completely randomized, Complete block, and latin square designs. Covariance analysis, Transformation of date. Factorial Experiments, fixed effects and random effects models. Sub sampling nested factorial designs. Confounding in 2", factorial experiments fractional factorials (2"), split- plot designs.
Practical/s:Introduction to statistical packages, usage of packages such as Minitab, SAS, SPSS

Learning Outcome:

At the end of the course the students will be able to develop the skills in manipulating raw data to perform statistical analysis executed via various software tools.

Module Code	SENS 3173	**Title**	Environmental Biotechnology	
Credits	03	**Hours**	**Lectures** **Laboratory**	**40** **15**

Learning Objectives:

Developing an appreciation for the theoretical aspects and recent advancements of biotechnology within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Introduction to Environmental biotechnology: Scope and importance of renewable sources, energy waste materials, Biogas energy, production of non -conventional fuels - methane (biogas), hydrogen, alcohols and algal hydrocarbons. Use of micro-organisms in petroleum augmentation and recovery. Mining and metal biotechnology: Microbial transformation, accumulation and concentration of metals, metal leaching, extraction and future prospects. Biological control: Microbial control of plants, plant pests, pathogens and insects. Micro-organisms and microbial products. Exploitation of micro-organisms for soil fertility: Biological nitrogen fixation and bio-fertiliser phosphate solubilisation, VAM fungi and crop productivity. Micro-organisms to be used as SCP & as food and feed supplements. Microbial production of flavours and food colorants. Plants, animals and microbes as pollution indicators. Pollution using biological systems, Biological waste managements. Biodegradation with genetically engineered organisms. Microbial conversion of Biomass. Treatment of oil spillages, sewage and sewage disposal. Alternative to synthetic uses of chemical pesticides; fertilizers. Alternative energy uses; bio-diesel. Bio-processing.

Learning Outcome:

At the end of the course the students will be able to develop the basic theoretical aspects of biotechnology with the recent advancements in the handling techniques

Module Code	ACU 3112	**Title**	Management and Entrepreneurial Skills	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Development of basic appreciation for managerial and entrepreneurial skills as a prospective environmental manager.

Outline Syllabus:

Definition of Management, Function of Management, Planning Organizing, Staffing, Directing, Communication, Motivation, Leadership and Controlling. Communication in Management: [Effective communication skills, Communication process, Presentation skills, Written communication and Data collection techniques]. Motivation: [Motivation and incentives, Needs, drives and obstacles, Behavioural theories, Morale]. Groups and teams: [Organization of work group, Team building and Characteristics of successful team]. Leadership: [Characteristics of leaders and Leadership styles]. Interpersonal processes: [Active listening skills, Non-verbal communication and Interviews and counselling]. Managing change: [Causes and nature of change, Resistance of change, Practices that support change and Handling conflict]. Problem solving and decision making: Barriers to creative thinking, Problem definition, Problem solving techniques, Group discussion, brainstorming and Decision making aids. Managing time: [Benefits of time management, Time wasting activities, Time management aids, Personal time management plan measuring methods and Time management techniques]. Entrepreneurial skills: [Definition of entrepreneurial skills, small business management, Micro based industry and Characteristics of entrepreneur]. Total quality management: [Concept of quality and customer, Customer requirements, Quality approach and Implications of quality systems]. Customer care: [Customer service, Words to use and words to avoid and Establishing rapport and new business]. Purchasing skills: [Stock control, Procedures, Supplier selection, Procurement policy and strategy]. Negotiation skills: [What is negotiation, Four stages of negotiation and Types of negotiation questioning techniques].

Learning Outcome:

At the end of the course the students will be able to develop their entrepreneurial and managerial skills.

Module Code	ENS 3212	**Title**	Research Methods for Environmental and Resource Management	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

In parallel to the technical skills developed in ENS 3163, the students will learn about the theory of scientific reasoning, research and ethics for taking up and conducting effective applied environmental research projects.
Development of writing, presentation and referencing skills in scientific research.

Outline Syllabus:

The scientific method. The research process. Identification of environmental and resource management problems. Development of appropriate research designs. Impact analysis Data collection methods; RRA, PRA, Surveys, Observations, multidisciplinary research. Evaluation research. Analysis and presentation. Ethics of environmental research.

Learning Outcome:

At the end of the course the students will be able to provide scientific reasoning in the environmental research and to develop scientific writing and presentation.

Module Code	ENS 3222	**Title**	Marine Environment and Management	
Credits	02	**Hours**	**Lectures** **Laboratory**	**25** **15**

Learning Objectives:
Development of general appreciation of the marine environment and the various processes involved within.
Understanding the concepts, theories and practicalities of marine environmental management in the local and international contexts.
Development of the basic ability to apply environmental and management theories to solve management issues arising in the marine environment.

Outline Syllabus:

Theory: Introduction to the marine environment, structure of ocean basins, seawater chemistry. Role of marine life in its environment (Pelagic; neritic & oceanic [hydrothermal vents], Benthic; supra littoral, eulittoral, sub littoral [intertidal], Sea shore; rocky & sandy, Coastal: coral reefs, mangroves, dunes & beach, lagoons estuaries). phytoplanktons, zooplanktons, sea weeds(algae), sea grass, salt marsh and mangroves (plantae), marine invertebrates [porifera, coelenterate, annelids, molluscs, arthropods, echinoderms] and marine vertebrates: [Fish, Reptiles, Birds, Mammals], Marine Management: [MPAs, ICZM, SMAs (in the local contexts)], Marine pollution and management, Effects of El Nio, Carbon cycle and Global warming on the Marine Environment.
Practical/s:Will involve field visits to coastal areas such as Chilaw, Negombo, Hikkaduwa, Batticaloa and Trincomalee. Identifying, recording and culturing (if possible) the local marine organisms [fauna & flora]; (planktons, invertebrates, vertebrates, algae and plants); estimation/determination of physiochemical properties of marine water sample.

Learning Outcome:

At the end of the course the students will be able to develop the understanding of the concepts and theories in marine environment and to demonstrate the abilities in applying management terms in solving marine environment related issues.

Module Code	ENS 3231	**Title**	Environmental Law	
Credits	01	**Hours**	**Lectures** **Laboratory**	15 **30**

Learning Objectives:
Understanding the environmental laws

Outline Syllabus:

Principle and concepts of environmental law, Practice and enforcement of environmental law in Sri Lanka. Introduction to the Act and statutes related to environment conservation and management - National Environmental Act, Forest ordinance, plant protection ordinance, water hyacinth ordinance, fauna and flora protection ordinance, mine and mineral acts, state gem corporation, control of pesticides Act, regulation of fertilizer act, soil conservation act, coast conservation act, hazardous waste regulations act, Atomic Energy Authority act, Fisheries act, Marine Pollution Prevention Act, National Resources, Energy and Science Authority Act, Environmental protection licence (EPL) scheme. Environmental ethics. Rain water harvesting Act.

Learning Outcome:

At the end of the course the students will be able to understand and know the environmental law.

Module Code	ENS 3243	**Title**	Industrial Chemistry and Pollution monitoring methods	
Credits	03	**Hours**	**Lectures**	40
			Laboratory	**15**

Learning Objectives:

Understanding about industrial chemistry and appropriate pollution monitoring methods for effective environmental management.

Outline Syllabus:

Theory: Industrial chemistry: Theoretical fundamentals of chemical industry, role development of chemical industry. **Basic chemistry, processes and management of resource & waste in the following industries:** Cement, Ceramics, Glasses, Fertilizers, Soap, Paint and Vanishes, Paper industry, Tanning industry, Dye and Pesticides. **Cleaner Production Technology, Re-use, recycling of Wastes:** Types of wastes, industrial wastes and their disposal, collection of recyclable from consumers, Recycling of organic and inorganic wastes, Economic of recycling. **Practical/s**: **Water pollution monitoring:** pH and conductivity, turbidity, Colour and odour, hardness by EDTA method, alkalinity, Estimation of nitrate- nitrogen by PDA method, amonical - nitrogen, Nitrite - nitrogen , estimation of phosphorous, sulfate by spectrophometric & turbidimetric method, residual chlorine, chlorine demand, Dissolved oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Fluorides by SPADNS reagent, heavy metals by AAS, pesticide residue estimation. **Air pollution monitoring:**NOx, SOx, particulate matter, hydrocarbons.

Field visits to industries and pollution monitoring centres for the current waste monitoring techniques.

Learning Outcome:

At the end of the course the students will be able to develop the theoretical understanding of the environmental issues raised due to industrial chemicals and monitoring systems. And, to demonstrate laboratory skills in analysing change in water quality by executing various analysis process.

Module Code	ENS 3252	**Title**	Environmental Impact Assessment & Environmental Audit	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

Developing an understanding and basic practical skills of EIA as a tool for effective environmental management/monitoring

Outline Syllabus:

Components of an ecosystem. Development projects and their impact on the environment. Concept of Environmental Impact Assessment, Objectives of EIA, advantages and limitations of EIA, Problems of EIA. Environmental Impact assessment process. Preparation of terms of reference. Conducting environmental scoping methods used in EIA. Public participation in EIA. Economic valuation of environmental impacts, Extended benefit cost analysis. Monitoring plan. Social Impact Assessment (SIA), Strategic Environmental Assessment SEA). Basic concept of air quality, water quality and biodiversity in relation to EIA. GIS and its application to EIA. Legal frame work for EIA. Case studies of EIA.
Preparation of mini EIA report for development projects. Brief introduction on environmental audit for industrial process and quality control. Environmental audit and monitoring plan.

Learning Outcome:

At the end of the course the students will be able to demonstrate the basic practical skills in performing EIA and to produce report according the given guidelines.

Module Code	ENS 3262	**Title**	Sustainable Development and Environmental Policy	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Development of a general appreciation for the concept of sustainable development, and, the role of policy making for sustainable environmental management.

Outline Syllabus:

Anatomy of economic backwardness, role of Natural Resources in sustainable development, theories of economic growth and development. Economic Development and Planning. *Concept of sustainable development*. Economic policies related to environment and natural resource allocations with special reference to Sri Lanka. Dependency of natural resources regional and international corporation in natural resources allocation and management.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding of the concepts in sustainable development for the role of policy making.

Module Code	ENS 3272	**Title**	Environmental System/s Modelling (ESM)	
Credits	02	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

Understanding the concept (and theoretical underpinning) of system/s modelling.
Development of a comprehensive understanding on system/s thinking.
Development of skills of visualising, mapping and comprehending systems processes and issues in environmental science.
Developing the skills to construct and simulate simple (yet comprehensive and concise) models of environmental systems using appropriate software packages.

Outline Syllabus:

Theory: Systems thinking - [understanding systems, defining a system, connective loops and feedback processes, role of temporal and spatial elements in system dynamics, understanding 'change']. Assumptions, hypotheses and theories in the perspective/s of systems thinking. Defining models and modelling, the scope of modelling, the philosophy of modelling, the modeler versus the model. Types of models [classifications based on phase in research project, phases in model development, from the perspectives of managing a modelling research project and the perspectives adopted by the modeler - as per field of interest, knowledge and level of thinking]. Basics of modelling [construction of scenarios, simulations, validation of outputs, sensitivity analysis and the importance of visualization (i.e. visualization of outputs to visualizing a problem in different planes etc.)]. Application of systemic thinking in the development of models - [mapping out systems, root definitions and the rich picture, developing flow charts of systems' dynamics, role of data (spatial, temporal and of varying scales) in modelling]. Role of modelling in present day applied environmental science research (the need for blue skies and practical applications). Real world applications of environmental modelling e.g. models of vegetation dynamics, ecological models (small scale, terrestrial to global), GCMs etc. Interactive case study(ies) on developing an understanding on the construction and usage of environmental system models on the MS Excel platform e.g. this will be a computer based interactive exercise where the students will be lectured on the construction of models of geomorphic hill-slope evolution, reservoir dynamics and eco-system homeostasis (i.e. Daisy World); and will be taught on the various aspects of performing simulations to test different scenarios. System/s thinking and model development using the Stella platform - the theoretical aspects. **Practical/s**: Defining models on paper. Defining the root definition and developing the rich picture. Mapping modelling processes on flow chart form. Basics of MS Excel spreadsheets: [techniques, functions, features and capacities as a modelling platform]. Introduction to Stella, experimenting with models constructed in the Stella platform, building simple models on the Stella platform.

Learning Outcome:

At the end of the course the students will be able to conceptualize the aspects in systems modelling, as a tool for environmental management. And to demonstrate the ability in visualizing, mapping and comprehending systems processes to address environmental issues. And to construct and simulate simple models in software tools.

Module Code	ENS 3281	**Title**	Seminar	
Credits	01	**Hours**	**Lectures** **Laboratory**	- -

Learning Objectives:

Development of skills to identify and investigate the local and national environmental issues within the confinements of Sri Lanka.

Outline Syllabus:

Use of logical, analytical and critical thinking for the problem identification, investigating the issue via gathering and analyzing data, validation, conclusion/s, recommendations and producing final documentation in the form of hard bound report.

Learning Outcome:

At the end of the course the students will be able to identify and investigate the local and national environmental issues within the confinements of Sri Lanka

Module Code	SENS 3283	**Title**	Pesticide Chemistry and Environmental Toxicology	
Credits	03	**Hours**	**Lectures** **Laboratory**	**40** **15**

Learning Objectives:

Development of an appreciation for pesticide chemistry and environmental toxicology for effective environmental management.

Outline Syllabus:

Introduction to pests, pesticides, toxicants: Classification of pesticides - [respect to chemical composition -organochlorines, organophosphates, carbamides etc, respect to nature of action respect to control organism insecticides and acaricides, fungicides, herbicides, rodenticides etc: Poisons and poisoning]. The toxicity of pesticides: [LD Values - classification of pesticides on toxicity -LD 50 values, Chemistry, fate and distribution of toxicants in the environment; Mechanisms of their action -pesticide action]. Absorption and translocation of toxicants, Metabolism in an organism. Toxicity to harmful organisms. Toxic syndrome in human beings-carcinogenic, teratogenic & mutagenic effects; Pesticide resistance. Influence of pesticides on environment, air, water soil, biocoenoses, plants safety measures for using, storing pesticides. Pesticide application methods. Toxicant includes mycotoxins, naturally occurring toxins, N-nitroso compounds, solvents, plastics etc.

Learning Outcome:

At the end of the course the students will be able to develop the theoretical basics of chemical pesticides and to address the levels of toxicity and their impacts on the environment.

LEVEL 4

Module Code	SENS 4113	**Title**	Ground and Surface Water Management	
Credits	03	**Hours**	**Lectures** **Laboratory**	45 -

Learning Objectives:

Development of basic understandings and knowledge on the science of ground and surface water management in the local and global contexts.

Outline Syllabus:

Considerations for water treatment processes facilities; mixing and flocculation; turbidity removal; iron and manganese removal, filtration, disinfection; design of water treatment processes facilities. Groundwater flow, porosity and specific yields, vertical distribution of soil. Transmissivity and storage coefficient and their physical significance, tracer techniques in ground water, types of aquifers (confined and unconfined), revisiting Darcy's law, ground water flow contours and their applications. Basic differential equation and its physical significance determination of T & S in confined and unconfined aquifers recharge of ground water, salt water intrusion into the ground water- status of North east of Sri Lanka and coastal aquifers and its remediation. Sorption and other chemical reactions, factors influencing sorption, hydrophobic theory for sorption contaminants, sorption effects on fate and transport of pollutants. Economic aspects in surface and ground water management.

Learning Outcome:

At the end of the course the students will be able to understand the principles and application part of ground and surface water management and to address the economic aspects of surface and ground water management.

Module Code	SENS 4123	**Title**	The SoilP̃lantW̃ater System	
Credits	03	**Hours**	**Lectures**	35
			Laboratory	**30**

Learning Objectives:

Enabling students to gain understandings on various aspects of plant growth, so that they can develop understandings on modern concepts of organic farming.

Outline Syllabus:

Theory:Nutritional aspects of plants, Nutrient movement in soil. Fertilizers, Manures (organic Fertilizer) and Bio fertilizers and their types, uses, and effects on environment. Soil degradation - soil acidification, Salinization, nutrient depletion and enrichment, compaction, desertification, etc. rehabilitation of degraded soil. Legal aspects of soil conservation. Organic farming, Definition of organic farming, main features of organic farming, importance of organic farming, use of green manures (Sespania rostrata, Gliricidia, sunhemp, etc) , compost making, making simple liquid fertilizer, organic pesticides, integrated farming, ideas of organic farming in coconut land, Vegetable growing and paddy land.
Practical/s:Calculation of fertilizer requirements for different soils, preparation of compost, preparation of liquid fertilizers , Field visits to organic farms, identify the problems in farmers field.

Learning Outcome:

At the end of the course the students will be able to develop the understanding of various aspects in soil plant water interaction and to identify the problems in farmer fields in order to put forward the concepts in organic farming.

Module Code	SENS 4132	**Title**	Limnology and Wetland Management	
Credits	03	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

Developing understandings on the availability, utilization and management of Inland resources. Further, understanding limnology within the context of fishing industry.
Understanding the importance of wetlands, and, develop basic to medium skills in effective wetland management.

Outline Syllabus:

Theory:**Limnology:** Introduction to limnology; basic principles, origin and types of lakes, Abiotic and biotic factors of inland water bodies, Nutrition cycling, trophic status, primary and secondary productivity, Plankton identification, quantification and diversity indices, Sustainable/socio-economic development of inland water fisheries (food fish culture and ornamental fish culture). **Wetland Management:** Introduction to Wetlands (composition, processes, systemic processes, functions etc.), Types of Wetlands, Wetland Types in Sri Lanka, Development threats and alternatives, Wetland conservation and development strategy, role of man-made wetlands in environmental management.
Practical/s:Introduction to Lake Survey and field techniques [Lake Morphometry], Assessment of abiotic and biotic factors of inland water body.

Learning Outcome:

At the end of the course the students will be able to develop the theoretical underpinnings in limnology and wetland management. And to demonstrate the field level skills in lake surveys and assessment of abiotic/biotic factors of a local inland resources.

Module Code	SENS 4142	**Title**	Domestic and Industrial Waste Water Treatment technology	
Credits	02	**Hours**	**Lectures**	30
			Laboratory	-

Learning Objectives:

Developing understandings on effective industrial waste water treatment methods as part of the means of environmental management.

Outline Syllabus:

Characteristics of industrial wastewater, determination of physical, chemical and biological parameters, selection of treatment system based on BOD and COD, design of wastewater treatment plant for screening, grit removal etc. Microbial treatment process, Kinetics of biological growth involved with biological treatment, efficiency of a treatment plant, Basic processes of treatment: Volume reduction, strength reduction, neutralization, equalization and proportionalisation - pre-treatment - primary treatment, sedimentation, floatation, secondary (biological) treatment, and tertiary treatment - techniques of nutrient removal, removal of residuals. On-site industrial/household wastewater and sewage disposal - site evaluation, septic systems, leaching field etc. Evaporation systems, intermitted sand filters, design and construction soakage pit in household level. Sludge treatment, processes involved, standard rate and high rate processes of sludge treatment, digestion, sludge disposal etc. Industrial water quality requirements of various industries for different pressure boiler feed waters, cooling water and process water. Waste generation, characterization and treatment technologies of different industries like paper and pulp, breweries and distilleries, textile, tannery, bulk drugs and pharmaceutical industries etc. **Field visits** to industries to understand the practicalities of industries in the area of wastewater treatment.

Learning Outcome:

At the end of the course the students will be able to develop the basic understanding on domestic and industrial wastewater treatment methods as a tool for resource recycling and to reduce adverse effects on the environment.

Module Code	SENS 4152	**Title**	Project Management	
Credits	02	**Hours**	**Lectures** **Laboratory**	30 -

Learning Objectives:

To introduce the concepts of Project Management to Environmental Science students.
To illustrate how the Project Management act as a key to the development of environment.

Outline Syllabus:

Introduction to Project Management concepts and practice, Understand the phases/ life cycle of a project. Project identification, Project selection, Project appraisal, Project Planning: Estimating costs, Time cost tradeoffs, The pricing process and risk, Cost control. Resource profile and levelling, Quality management concepts. Human Resource and Communication. Project monitoring and control, Project procurement, Risk Management plan, Project performance/ completion and success. Application of Microsoft project software.

Learning Outcome:

At the end of the course the students will be able to understand the concepts of project management and to develop the skills to manage the projects related environmental management and development.

Module Code	SENS 4163	**Title**	Food Microbiology & Toxicology	
Credits	03	**Hours**	**Lectures**	35
			Laboratory	**30**

Learning Objectives:

Developing understandings on food microbiology and toxicology within the confinements of the field of environmental science.

Outline Syllabus:

Theory: Major groups of micro-organisms & their action on foods, Intrinsic & extrinsic parameters in foods controlling microbial activity, Ecology & distribution of spoilage & other micro-organisms in food, Food born illnesses & detection of causative micro-organisms, Rapid methods for detection enumeration of micro-organisms, indices of food sanitary quality & microbiological standards & criteria. Molecular biology of micro-organisms in foods, metabolic pathways for fermentation & fermentation products, Microbial food spoilage. Epidemiology of food borne diseases, adulterants & contaminants& chemical residues in food, chemical contaminants preservatives& additives, genetically modified materials, hazard analysis and critical control points, scientific basis of safe use of additives.
Practical/s: General microbiological techniques, bacterial colonies.

Learning Outcome:

At the end of the course the students will be able to develop the theoretical basics of food microbiology & toxicology and to demonstrate laboratory skills in microbial manipulation.

Module Code	SENS 4173	**Title**	Eco tourism	
Credits	03	**Hours**	**Lectures**	30
			Laboratory	**45**

Learning Objectives:

Understanding and appreciating the concept of ecotourism as a means of environmental management/conservation and as a way to generate income.

Outline Syllabus:

Introduction to ecotourism, mass tourism, environment and climate. Identification of different environment and climatic zones in Sri Lanka. Targets of Ecotourism in Sri Lanka; Protected areas: Forest reserves, National parks, Sancturies, Beaches. Sanctured areas in Srilanka and its important cultural activities and its location in Sri Lanka. Marketing and hotel management: Marketing tourism, Designing and managing environmentally friendly restaurants and lodges, Training local people: As guides, Managers. Increasing number of visitors and managing high number of visitors, encourage high spending. Increasing sympathy for nature, plant and wild life of the area, Communication: Preparing handouts, posters, guidelines, audiovisual products, websites, and information centres. Negative and positive impact on Wildlife, Vegetation Ancient monuments, pollution, littering, constructions.
Practical: Field visits to hotel industries, Field visits to protected areas, field visits to sacred and other tourist attractive areas.

Learning Outcome:

At the end of the course the students will be able to develop the understanding of the concepts in ecotourism as a means of environmental management/conservation.

Module Code	SENS 4182	**Title**	Environmental Remote Sensing (ERS)	
Credits	02	**Hours**	**Lectures**	25
			Laboratory	**15**

Learning Objectives:

Developing understandings on the fundamentals of ERS
Development of skills to handle ERS software packages.
Development of basic skills to design, implement and manage ERS projects within the confinements of the field of Environmental Science.

Outline Syllabus:

Theory:Introduction to ERS, ERS in Geomatics, basic principles of remote sensing, remote sensing system classification, image processing and image classification (including aspects of extracting metric information and thematic information from remotely sensed images), digital remote sensed data types and formats, aerial photographs, overview of remote sensing applications in environmental science: (including disaster management, forest fire detection, forestry applications, agricultural applications, urban planning and development e.g. water supply, coastal zone management, fishery and marine applications, geological applications, archaeological applications, applications in wildlife conservations/rangeland monitoring), types of sensors and satellites, high resolution optical satellites, moderate low resolution satellites. ERS and GIS - integration and the linkages, applications of RS in the EIA process. **Practical/s:** Learning to use ERDAS Imagine^{TM} for analyzing environmental (digital) datasets [this will include aspects of data acquisition (and transformation of format/s), geometric correction, image processing, classification, spatial modelling and the creation of reports].

Learning Outcome:

At the end of the course the students will be able to develop the basic theoretical understanding of RS. And to demonstrate the skills in handling RS software tools to design, implement and manage ERS projects.

Module Code	SENS 4193	**Title**	Advanced Spectroscopic methods	
Credits	03	**Hours**	**Lectures** **Laboratory**	**40** **15**

Learning Objectives:

Development of analytical skills using advanced spectroscopy methods for conducting research projects in environmental scieneces.

Outline Syllabus:

Ultraviolet and Visible Spectra: Introduction continued from ENS2213, Absorption laws, Chromophores, Solvent effects; Infra red Spectroscopy: Preparation of Samples, Selection rules, Use of tables of characteristic group frequencies, Absorption frequencies for functional groups; ^{1}H- NMR Spectroscopy and ^{13}C NMR spectroscopy: Pulse and Fourier transform NMR, Spin systems of nuclei, ^{1}H chemical shifts, Spin-spin coupling, Shift reagents, spin decoupling, The Nuclear Overhauser Effect, ^{13}C-NMR, NOESY spectra, (^{13}C - ^{13}C), 2 D NMR spectroscopy-DEPT, COSY (H-H), HMQC (^{1}H^{13}C COSY), interpreting NMR spectrum; Mass spectroscopy: mass spectrometer, Factors controlling fragmentation modes, Interpreting the Mass spectra. Practical: Structure elucidation of Organic compound using these spectroscopic details.

Learning Outcome:

At the end of the course the students will be able to develop the analytical skills in spectroscopy techniques to conduct research projects.

Module Code	SENS 41(10)2	**Title**	Plantation Forestry and Environment	
Credits	02	**Hours**	**Lectures** **Laboratory**	**30** -

Learning Objectives:

Understanding the importance of plantation forestry as an effective means of environmental management/conservation.

Outline Syllabus:

Role of plantation forestry on environment. Reforestation / Aforestation. Choice of tree species for different climatic zone. Nursery techniques, field planting, fertilizer application. Silvicultural treatment- clearing, pruning, thinning. Timber stand improvement, silvicultural System, growth and dynamics of stand, forest mensuration - age, diameter, height stem form Bark thickness, etc. Introduction to social forest and urban forest.

Learning Outcome:

At the end of the course the students will be able to identify the importance of forestry and to develop the basic theoretical understanding of silviculture systems.

Module Code	SENS 41(11)2	**Title**	Integrated Approaches in Pest and Weed Management	
Credits	02	**Hours**	**Lectures** **Laboratory**	**25** **15**

Learning Objectives:

Understanding the *integrated* approaches to pest and weed management as an environmentally sustainable measure *in-par* with sustainable environmental management and industrial metabolism concepts.

Outline Syllabus:

Roles and effect of entomological venture to the environment. Entomological operations threatening to environmental deterioration. Their improvement and other disciplines relating to conservation of the environment. Definition of weed. Weed nomenclature and classification. Reproduction of weeds. Effect of environment on weed and crop physiology. Competitiveness of weeds and nature of weeds competition. allelopathy in weed problems. Special weed problems and its effect on environment. Aquatic weeds, poisonous, parasitic and invasive weeds. Weed control- Chemical weed control, Integrated weed control.Biological interventions, Field visits, Assessment of pest populations, Report writing, Assignments.

Learning Outcome:

At the end of the course the students will be able to identify various types of pests & weeds in agriculture fields and to demonstrate the skills in integrated pest and weed management approaches as an environmentally sustainable measure to reduce the risk.

Module Code	SENS 41(12)3	**Title**	Introduction to Science/Environment Communication	
Credits	03	**Hours**	**Lectures** **Laboratory**	**30** **45**

Learning Objectives:

On completion of this course the students will have developed understandings/skills on: 'The effective application of theories and communication methodologies so as to effectively produce pieces of journalistic work on critical (socio-) environmental issues in the local and global contexts that need the **effective application of (applied) sciences**, and, socio-administrative attention'

Outline Syllabus:

Theory: (i). Introduction to communication and communication theories (including research methodologies in communication), (ii). Modern trends in journalism, (iii). Reporting, writing and editing, (iv) Media Laws and ethics, (v) Media planning tools and media playing, (vi) Print journalism (including newspaper organization and printing), (vii) E-journalism (radio, television and web), (viii) Advertising and public relations (principles of public relations, process of public relations, creating advertisements including advertisement campaigns), (ix) Communication for development, and, (x). Writing and publication targeted to the scientific community (i.e. producing journal articles, peer reviews, conference presentations, developing book chapters etc. and, aspects of plagiarism).
Practical/s: (i). Writing skills, (ii). Photo journalism, (iii). Videography and documentary making, (iv). e-Blogging as an effective way of disseminating scientific information, and, (v). Presenting skills (the art of presentation) for writing, photo journalism, videography (and documentary making) and e-blogging.

Learning Outcome:

At the end of the course the students will be able to produce pieces of journalistic work on critical socio environmental issues in the local and global contexts.

Module Code	SENS 41(13)2	**Title**	Global Environmental Changes (GEC)	
Credits	02	**Hours**	**Lectures** **Laboratory**	**30** -

Learning Objectives:

Developing understandings on GEC and its environmental consequences.
Understanding the concept of geophysiology as an effective means for Earth System management.

Outline Syllabus:

The Earth as a system: Justification for the study of Earth systems science. Time scales in Earth Systems Science (geologic, biologic and anthropogenic). Introduction to GEC - the definitions and the perspectives. Natural processes and GEC: i.e. in the geosphere, hydrosphere, biosphere and atmosphere (this will include climate change, geological evolution, oceanographic aspects and biological consequences of GEC). Theories in the Earth Systems science - the Gaia theory, systems evolution and change, geophysiology, needs for comprehensive geophysiological approaches in science, geo-physiological limits, the life support system-towards Earth sense.

Learning Outcome:

At the end of the course the students will be able to identify consequences of GEC and to develop understanding of the concepts in geophysiology as an effective means for Earth System management.

Module Code	SENS 41(14)1	**Title**	Cleaner Production	
Credits	01	**Hours**	**Lectures** **Laboratory**	**15** -

Learning Objectives:

Understanding the importance of Cleaner Production strategy in environmental management for the sustainable development.

Outline Syllabus:

Definition of Cleaner production; Evolution of environmental strategies from reactive to proactive CP techniques; Comparison of CP vs end-of-pipe method; CP practices - Good house keeping, input substitution, better process control, onsite recycling etc.; Procedures for the implementation of CP techniques to industries; benefits, and, barriers of CP; CP towards sustainable development for the green industrial development; role of international organizations and stakeholders in developing CP; materials balance; life cycle assessment; waste audit procedure etc. Students are required to complete an assessment to produce CP strategy for a selected industry.

Learning Outcome:

At the end of the course the students will be able to address the importance of CP strategies in industries as an environmental management term and to demonstrate skills in CP assessment and to show courage towards the implementation of CP techniques in industries.

Module Code	SENS 4211	**Title**	Industrial Training	
Credits	01	**Hours**	**Lectures** **Laboratory**	- -

Learning Objectives:

Developing hands-on skills and understanding the practicalities in relevant industries of specialisation.

Outline Syllabus:

Students have to follow two months industrial training during the fourth year second semester vacation and submit a report and present their experience. The head of the department make the arrangement to find the relevant industries for the students to obtain the training. The evaluation of this unit will be done by the institution where the student obtains the training and a panel of senior staff at the Dept. Of Bioscience and it is based on:
Attendance and punctuality during training period=10 marks, Output and the quality of the work done=10marks, Reliability without supervision=05 marks, Industriousness=05 marks, Enthusiasm= 05 marks, Personality=05 marks, Leadership=10 marks, Preparation of report (Training report) =30 marks, Presentation of report =10 marks, Oral examination =10 marks= Total of 100marks

Learning Outcome:

At the end of the training the students will be able to complete any given assignments with limited guidance and adapt to the working environment.

Module Code	SENS 4226	**Title**	Research Project	
Credits	06	**Hours**	**Lectures** **Laboratory**	- -

Learning Objectives:

Developing skills on designing, implementing and reporting of scientific investigation/s. Learning to apply various aspects of scientific theories to solve environmental problems (management of systemic) as an applied scientist

Outline Syllabus:

This module worth 6 credits will be centred on an individual research project conducted by the student culminating in the production and defence of the thesis. As per the student's choice (or specialisation path) - an academic staff member will be assigned to function as the supervisor for the project. Depending on the nature of the research, the possibility of having one or more supervisors (even from outside the campus) will also be encouraged - so as to facilitate research and learning. The evaluation of project will be based on:
[Project proposal = 10 marks, Conduct of project = 20 marks, Report/Thesis = 40 marks, Seminar (Oral presentation) = 15 marks, Oral examination = 15 marks] = Total of 100 marks.

Learning Outcome:

At the end of the Research Project, the students will be able to develop skills on designing, implementing and reporting scientific investigation and to have knowledge to apply various aspects of scientific theories to solve environmental problems as an applied scientist.