Master of Science in Environmental Sciences

(MSc in Env.Sc)
2017-2021

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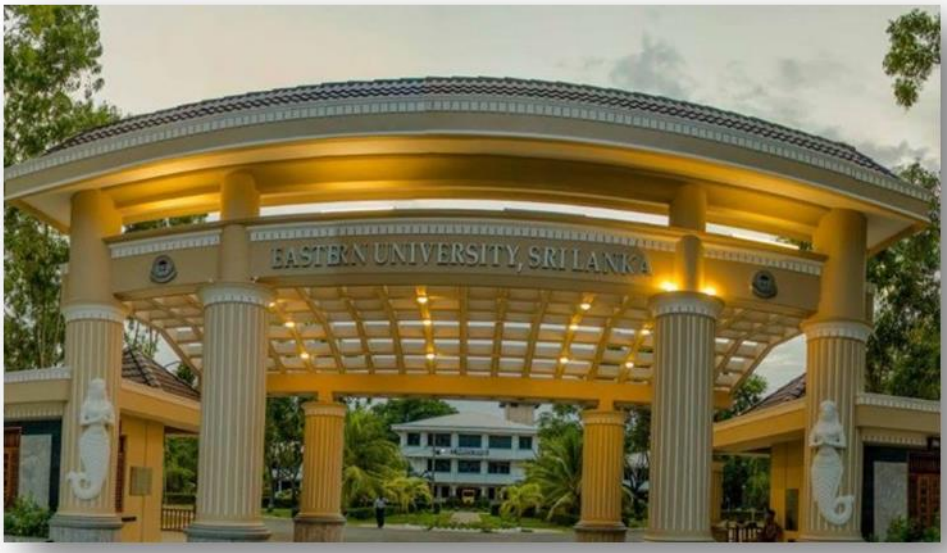
Please note that whilst every care has been taken to ensure that the information in this Handbook is accurate, it must be read as subject to change over the coming year. The Handbook is intended as a guide only. Reference should be made to the University for the full rules and regulations.

Vision of EUSL

Centre of excellence for higher learning in Sri Lanka

Mission of EUSL

To facilitate learning, research, and dissemination of knowledge to produce competent graduate through conducive environment with industry-community collaboration to serve socio-economic and cultural needs of the community.



Contents

Faculty of Science Welcomes…

Dear Students,
A warm welcome to the Faculty of Science!

You start your postgraduate at a very exciting time. Research in the field of Environmental Sciences is transforming rapidly, reach ever deeper into our daily lives.

We hope that, through your study and research here at EUSL, you will encounter many new and challenging ideas about the nature and the environment. We know, also, that each of you bring a wealth of experience from around your environment and we look forward to learning from you.

This course provides the students with the opportunity to construct a cross-cutting study programme that meets their particular interests, drawing on a wide range of environmental science disciplines. This focus also shapes our teaching, as you will see from the range and content of the courses we offer. At the end of your degree, to enable you to conduct your own independent research in this field. EUSL is an ideal setting for such study, with valuable professional, educational and research benefit.

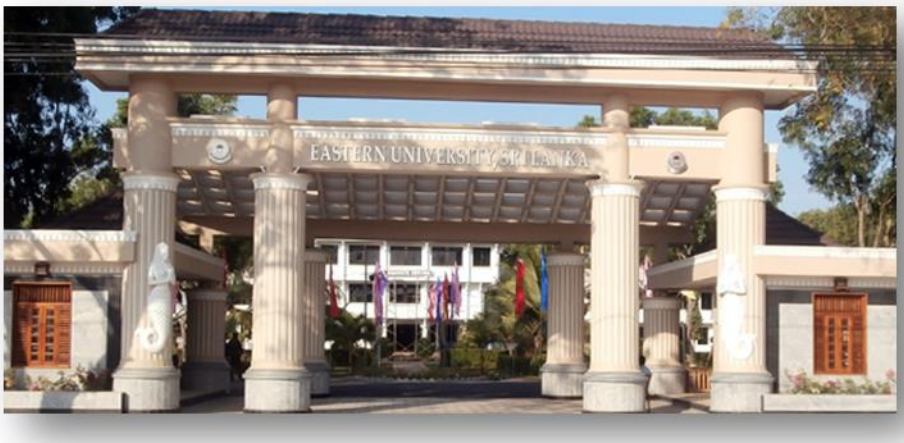
Together with all our academic colleagues who worked very hard for this programme in the Faculty, we wish you a rewarding experience in Batticaloa and at EUSL. You will work hard, no doubt, but we hope you also find inspiration and fun!

Faculty of Science
Eastern University, Sri Lanka

Eastern University, Sri Lanka at a Glance…

The Eastern University, Sri Lanka was established on the 01st of October 1986 by a University Order dated 26th September 1986 issued under Section 2 of the Universities Act No: 16 of 1978. The University was preceded by the Batticaloa University College established on 01st August 1981.

EUSL is located in Vantharumoolai which is 17 km north from Batticaloa town and four faculties: Faculty of Agriculture, Faculty of Science, Faculty of Commerce & Management and Faculty of Arts & Culture are housed here. Faculty of Health Care Sciences is situated in Batticaloa town. Swamy Vipulananda Institute of Aesthetic Studies is situated 3 km south from the Faculty of Health Care Sciences. Trincomalee Campus is located at Konesapuri in Trincomalee district, 180 km away from the EUSL, having two faculties & one unit: Faculty of Communication and Business studies, Faculty of Applied Sciences and Siddha Medicine Unit.



Faculty of Science at a Glance…

Faculty of Science at EUSL has established a reputation for over last 30 years to impart fundamentals of different branches of pure sciences, and has shown interest in maintaining high academic standards.

The faculty, while being committed to the above philosophy, is transforming to meet the modern educational practices and trends by introducing innovative teaching, learning and evaluation strategies with the goal of producing graduates with knowledge, skills and attitude to adapt to a range of professional and social environments to work with a concern and passion towards others. The faculty provides a conducive intellectual, social and physical environment in which learning and research may flourish. Apart from undergraduate BSc degree programs, the faculty has been conducting research degree programs (MPhil and PhD) and taught postgraduate programmes.

INTRODUCTION

Preample

Course Profile

Sri Lanka Qualification Framework (SLQF)

Aim and Objectives

Target Group

Duration and Medium of Instruction

Admission Requirements

Application and Selection Procedures

Course Fee

1.0 Preamble

The natural world is complex and is becoming more crowded, more consuming, and more connected. Growing populations and higher standards of living put increasing pressure on our environment. Human activity can have unexpected consequences that are hard to reverse. Environmental problems are just as real, controversial, and in need of intelligent solutions.

The study of how physical and biological processes maintain life, and how humans affect nature, requires a broad interdisciplinary perspective. Environmental problems and their associated solutions typically involve social, political and economic aspects which the scientist must be aware of.

This is why the dedicated study of environmental science is so important.

2.0 Course Profile

This prospectus primarily provides general information for the students who follow the MSc in Environmental Sciences (MSc in Env.Sc).

It is a **full-time** programme and is designed in a way to include theory, practical, field work and a research component. The course is offered over two semesters and each semester consists of 15 weeks of study period. The course structure is described in Section 5.

2.1 Sri Lanka Qualification Framework (SLQF)

This programme complies with the Sri Lanka Qualification Framework (SLQF) level 9 requirements. The purpose of this qualification is to enhance the capacity of graduates/holders of professional qualifications to advance their knowledge and investigative skills, and other abilities relevant to areas within a specific field of study or discipline enabling conversion into a different discipline/profession, forming the basis for academic advancement or enhancing the managerial, administrative and technological capacity. This

qualification demands a high level of theoretical engagement and guided independent study.

2.2 Aim and Objectives

Sri Lankan Universities have initiated and implemented a variety of postgraduate programmes, which are recognized and successful. Since, there is no programme that is residential and full-time in the entire university system at present, this MSc programme full fills the needs.

Environmental Science is a broad discipline and we ensure that you acquire the necessary knowledge and skills to appreciate the socio-economic issues related to environmental issues as well as specialist scientific knowledge on geological, biological and chemical processes.

This course provides the student with the opportunity to construct a cross-cutting study programme that meets their particular interests, drawing on a wide range of environmental science disciplines.

On the completion of the M.Sc. Degree Programme the postgraduates will gain adequate knowledge and necessary skills to independently manage, solve and significantly contribute to the research and development regarding Environmental related issues at local, national and international level at large.

2.3 Target Group

The postgraduate course (course work and a research component) is intended for graduates, who are engaged or seeking career opportunities in,

- Industries
- Academic Institutes
- Organizations dealing with Environmental Management and Pollution Control
- Scientific Services (Government, Corporation and other Statutory bodies)
- Research Institutes

2.4 Duration and Medium of instruction

The duration of the MSc programme shall be **ONE year** (FULL Time). The medium of Instruction is in **English**.

2.5 Admission requirements

2.5.1 Intake

The number of students admitted to the Postgraduate Degree Programme will however be limited and determined annually by the Faculty of Science.

2.5.2 Eligibility

Applicants with the following qualifications will be considered for admission.

- BSc general degree/Special degree in Science from a recognized university with Botany, Chemistry or Zoology OR
- BSc in Agriculture from a recognized university with strong background in Chemistry OR
- Environmental Officers with BSc Degree OR
- Any other equivalent qualification acceptable by the Faculty of Science and the Senate of EUSL
  AND
- Able to understand the medium of instruction in English

This MSc programme is intended to attract **national and international candidates** those who are interested in the field of environmental sciences.

2.6 Application and Selection Procedures

2.6.1 Application

Each applicant should submit a duly filled application form to the *Assistant Registrar, Faculty of Science, Eastern University, Vantharumoolai, Chenkalady 30350, Sri Lanka* together with the following documents under registered post by the stipulated deadline.

(a) Certified copies of academic records/transcript.

(b) Two referee reports (within sealed envelope from your University).

(c) Letter from the employer confirming experience and leave to follow the postgraduate programmes (where appropriate).
(d) Evidence for the payment of **non-refundable** application processing fee (original receipt) of Rs.1000 for local applicants and US$ 50 for Foreign applicants and drawn in favour of the "*Bursar, Eastern University, Sri Lanka*".

Account No: 227100140000024
Account Name: The Bursar, Eastern University, Sri Lanka
Brancj code: 227, Chenkalady
SWIFT code: BCEYLKLX

The acknowledgement for the received documents will be notified via e-mail to the applicants.

2.6.2 Selection procedures

Suitable applicants will be selected after the evaluation by a panel of experts. The results will be notified to the applicants within two months from the deadline.

2.7 Course Fee

The following fees should be **paid in full** at the commencement of the M. Sc. Degree Programme. **Fees paid will not be refunded**. The course fee for local applicants Rs. 143 500[1], applicants from SAARC countries US$ 2000[2] and for other foreign applicants US$ 3000[3].

[1, 2, 3] the fees may be subjected to change. If it is changed, this will be informed at earliest or notified at the advertisement.

EXAMINATION AND EVALUATION

Evaluation

Grade Point (GP) and Grade Point Average (GPA)

Award of Postgraduate Diploma/Degree

Re-sit Examination

3.0 Examination and Evaluation

3.1 Evaluation

- All theory course units and the relevant practical, research project /case study (where applicable) and the field visit will be evaluated according to the criteria given in the syllabi.
- A grade is assigned to each course unit depending on the overall performance of the course unit.
- The evaluation of each course shall be based on two components. **Summative assessments** (End of course examination) and **Formative assessments** (on going feedback/in-course examination). Course with laboratory and/field work shall be evaluated, where applicable, on a continuous assessment basis (Formative assessment).
- Based on the scheme given, the overall performance of a student in a given course shall be evaluated and a grade will be assigned (see sec.3.2).
- A candidate is entitled to receive a transcript giving grades obtained for each course unit of the above examination after the confirmation of the results by the Department of Academic and Student Affairs of the Eastern University, Sri Lanka.

3.2 Grade Point (GP) and Grade Point Average (GPA)

Marks obtained in respect of a course unit will be graded according to Table 1. A Grade Point (GP) as indicated in table 1 is assigned to each grade. GPA is the credit-weighted arithmetic mean of the Grade Point Values, i.e. the GPA is determined by dividing the total credit-weighted Grade Point Value by the total number of credits.

The grade Point Average (GPA) will be computed using the following formulae

$$\text{GPA} = \frac{\sum c_i g_i}{\sum c_i}$$

Where, c_i = number of credits for the i^{th} course, and

g_i = grade point for the i^{th} course

On completion of the summative assessment, the GPA would be calculated and grades assigned as follows.

Table 1: Grading system and Grade Point (GP)

Range of Marks	Grade	GP
85-100	A+	4.00
75-84	A	3.70
65-74	A-	3.40
60-64	B+	3.10
55-59	B	2.80
50-54	B-	2.50
40-49	C+	2.00
30-39	C	1.00
< 30	E	0.00

GPA shall be calculated to two decimal places.

Example: A student who has completed one course unit with two credits, three course units each of three credits and two course units each of one credit with grades A, C, B, B+, C+, and A+ respectively would have GPA of 2.62 as calculated below:

$$\text{GPA} = \frac{(2 \times 3.70)+(3 \times 1.00)+(3 \times 2.80)+(3 \times 3.10)+(1 \times 2.00)+(1 \times 4.00)}{2 + 3 + 3 + 3 + 1 + 1}$$

$$= 34.1/13 = 2.6230$$

$$= 2.62 \text{ (to the two decimal places)}$$

All the prescribed course units of the programme will be taken into account in calculating the GPA for the award of the M.Sc. Degree.

3.3 Award of Postgraduate Diploma/Degree

3.3.1 MSc in Environmental Sciences

A student should be eligible for the award of Masters of Science in Environmental Sciences, if he/she satisfies the requirements given below **within TWO academic years (Students have to register each academic year):**

i. Obtain at least C grade or better in all taught course units (30 credits) with at least B- in 24 credits; and
ii. Obtain B- or better grade in research project; and
iii. Obtain a GPA of atleast **2.70**.

3.3.2 Postgraduate Diploma in Environmental Sciences

A candidate do not qualify for MSc in Env.Sc., will be awarded a Postgraduate Diploma in Environmental Sciences, if he/she satisfies the requirements given below **within TWO academic years (Students have to register each academic year)**:

i. Obtain at least C grade or better in all taught course units (30 credits) with at least C^+ in 24 credits; and
ii. Obtain C or better grade in research project; and
iii. Obtain a GPA of atleast **2.30**.

3.3.3 Effective date

The **effective date** of the degree/diploma shall be the date of the last examination (written, research/oral examination) **whichever the latter** for the entire batch.

3.4 Re-sit Examination

- A candidate will be allowed to sit a **repeat examination** for a course unit to a maximum of TWO.
- There will be **ONE repeat examination** held within six months after the release of second semester results.
- A candidate who obtains a grade below **B**$^-$ in a particular course unit may re-sit the examination in respect of the course unit for the purpose of improving. The best grade obtainable at a re-sit examination is **B**$^-$.
- In the event a candidate obtains a lower grade while *attempting to improve* the grade he/she will be entitled to the previous grade.
- A candidate is required to pay for re-sitting of the examination for each theory course unit and for the laboratory course unit.

4.0 Plagiarism/Academic dishonesty

"The work you submit for assessment (assignments, research project, etc.) must be your own. If you try to pass off the work of others as your own, you will be committing plagiarism".

- Any quotation from the published or unpublished works of other persons, including other candidates, must be clearly identified as such, being placed inside quotation marks and a full reference to their sources must be provided in proper form.
- A series of short quotations from several different sources, if not clearly identified as such, constitutes plagiarism just as much as does a single unacknowledged long quotation from a single source.
- If you summarize another person's ideas or judgments, you must refer to that person in your text and include the work referred to in your bibliography.
- All work submitted as part of your formal coursework requirements must be expressed in your own words and must incorporate your own ideas and judgments.
- Each piece of work is an individual assignment that is intended to allow you to demonstrate your understanding of the current state-of-the-art.

Failure to observe these rules may result in an allegation of plagiarism. The examiners are vigilant for cases of plagiarism. Work containing plagiarism may be referred as an Assessment Misconduct which may result in severe penalties.

You must therefore consult your supervisor if you are in any doubt about what is permissible.

COURSE STRUCTURE

Definition of Credits (SLQF)

Total Credits

Detail Course Structure

5.0 Course structure

5.1 Definition of credits (SLQF)

The volume of learning is described in terms of *credits*. In the SLQF credit system, the student workload of a study programme is defined as *notional learning hours* per academic year. The notional learning hours include direct contact hours with teachers and trainers, time spent in self-learning, preparation for assignments, carrying out assignments and assessments. The combination of learning activities may vary from one course unit to another.

One credit is considered equivalent to **50 notional learning hours** for a taught course, laboratory studies, course or field studies/clinical work. In case of industrial training, including time allocated for assessments and in case of research, including time allocated for literature survey, one credit is considered equivalent to a minimum of **100 notional hours**.

5.2 Total credits

Total credits of the programme are 36. It includes theory (22 credits), practical (8 credits) and research project (6 credits). Semester I and II covers 15 credits of course units each and the research project may spans over two semester (Table 2).

Table 2: Course structure (MES – Master of Environmental Sciences, T- Theory, P- Practical, Sem.- Semester).

Code MES	Course	Credit/s T	Credit/s P
	Semester I		
1501	Biological Molecules and cell organization	2	
1551	Practical on Biological Molecules and cell organization		1
1502	Fundamental of EIA methods	2	
1552	Practical on Fundamental of EIA methods		1
1503	Hazardous chemicals in environment	2	
1504	Natural products and Biochemistry	2	
1554	Practical on Natural products and Biochemistry		1
1505	Environmental Chemistry	2	
1555	Instrumental analysis of environment sciences		2
Total credits (Semester I)		**15 credits**	
	Semester II		
1506	Environmental Microbiology	2	
1556	Practical on Environmental Microbiology		1
1507	Ecology and Environment	2	
1557	Practical on Ecology and Environment		1
1508	Environmental Policy and Legal Aspects	2	
1509	Environment data analysis and interpretation methods	2	
1559	Practical on Environment data analysis and interpretation methods		1
1511	Scientific Writing and Research Methodology	2	
1512	Seminar series (Frontiers of environmental Sciences)	2	
1513	RESEARCH (This component will be carried out along with the course work)	06	
	Total credits (Semester II)	**21 credits**	
	Total Credits (Semester I & II)	**36 credits**	

Note: All course units are compulsory.

5.3 Detail course structure

MES 1501, Biological Molecules and Cell Organization (2 Credits)

ILOs: Upon successful completion of the course, students would familiarize/explain the concept, role, mechanism, structure and functions and interactions at the cellular level.

Course Capsule: water, simple and complex carbohydrates, lipids, amino acids and proteins; protein structure (channels, pumps, enzymes, antibodies), protein-protein interaction, protein synthesis; nucleotides and nucleic acids, DNA, RNA, prostaglandin; vitamins and co-factors; cell organelles (nucleus, cell membrane, nuclear membrane, mitochondria, ribosome); cell growth and division; replication of DNA.

Text books:

1. Lodish, H. et al., (1995). Molecular cell biology, 3rd Edition. Scientific American Books Inc., New York, USA
2. Walker, J.M. and E.B. Gingold (1993). Molecular biology and biotechnology, 3 Edition The Royal Society of Chemistry, U.K.
3. Lehninger, L., Nelson, D.L. and Cox, M.M. (2000). Principles of Biochemistry, Worth

Assessment criteria:

Formative: 33% for in-course assessment
Summatice: 67% for end-semester examination

MES 1551, Practical on Biological Molecules and cell Organization (1 Credit)

ILOs: Upon successful completion of the course, students able to identify bio-molecules and the factors that affects their activity.

Course Capsule: chemical and physical tests for carbohydrate, lipids and proteins; investigating effect of temperature on the activity of lipase/trypsin; investigating effect of pH on amylase activity; investigating effect of amylase on starch; investigate the effect of temperature on plant cell membrane; investigate the effects on blood cells of changing the osmotic potential of plasma.

Text books:

1. Smith and Wood. (1992). Biological molecules. Molecular and cell biochemistry. Chapman and Hall.
2. Jonathan Clark (2015). Explaining biological molecules: Protein, Carbohydrates and water. Kindle Edition

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1502, Fundamental of EIA methods (2 Credits)

ILOs: Upon completion of the subject, students will be able to realize the environmental issues and their importance; gain an in-depth understanding of the concepts, processes and methodologies of environmental impact assessment; contribute and apply significantly in conducting environmental impact assessment in a team.

Course Capsule: development and environment; need of environmental assessment, IEE, EIA, and EMP; studying TORs. Basic methods for appropriate sampling, data collection, analysis, reporting and associated computer package; legislations and basic approach to EIA, evaluation of an EIA, process of EIA, mitigatory measures of impacts.

Text books:

1. Central Environmental Authority (CEA). Hand-Book on Environmental Impact Assessments
2. CEA. (2003). Guidance for implementing the Environmental Impact Assessment (EIA) process. Ministry of Environment and Natural Resources.
3. United Nations. (1988). Environmental Impact Assessment: Basic procedures for developing countries. United Nations Environment Programme. Regional Office for Asia and the Pacific. Bangkok, Thailand. 16 pp

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1552, Practical on Fundamental of EIA methods (1 Credit)

ILOs: Upon completion of the subject, students will be able to learn and understand principles, process, and necessary techniques for environmental impact assessment, mitigation and monitoring in by field experience.

Course Capsule: A field site will be selected. Students shall go to the field and involve in different activities, with the knowledge of the subject MES 1502, to make a report on EIA. Students also expected to present their findings.

Text books:

1. CEA. (2003). Guidance for implementing the Environmental Impact Assessment (EIA) process. Ministry of Environment and Natural Resources.
2. CEA. (1998). Guidance for implementing the environmental impact assessment (EIA) process: no 1: a general guide for project approving agencies (PAA).
3. Betty Bowers Marriott (1997). Environmental Impact Assessment, A practical guide. McGraw-Hill.

Assessment criteria:

Formative: 10 % for participation
Summative: 40 %for presentation and 50 % for report

MES 1503, Hazardous chemicals in environment (2 Credits)

ILOs: Upon completion of the subject, students are identified/exposed to a whole range of activities and impacts around them from domestic, agriculture and industrial sector; to provide a detailed knowledge on all types of waste and waste management.

Course Capsule: Classification, nature, disposal and management of hazardous chemicals. Agro chemicals: classification, structure and function of disposal, residual effect and disintegration in nature, management of chemical loads; Fertilizers: types, use and leaching and runoff; Domestic and Industrial effluents and waste, types of wastes

and its components, disposal mechanisms and pollution, good clean mechanisms; Sanitation and sewage disposals.

Text books:

1. Allen Freez, R. (2000). The Environmental Pendulum – A Quest for the Truth about Toxic Chemicals, Human Health, and Environmental Protection.
2. Becky Allen (1999). Chemical hazards handbook – A workers guide to chemicals hazard and how to avoid them. London Hazard Centre Trust Ltd.
3. Richard P Pohanis (1997). Rapid guide to hazardous chemicals in the environment, 1st Edition. Wiley.

Assessment criteria:

Formative: 33% for in-course assessment

Summative: 67% for end-semester Examination

MES 1504, Natural products and Biochemistry (2 Credits)

ILOs: Upon completion of the subject, students able to recognize and draw complex natural products and biomolecules, evaluate the organic aspects of chemical processes important in biology, discuss the chemical reactivity and physical properties of important biomolecules (organic agriculture and pest control).

Course Capsule: Classification of nature products; Secondary metabolites in plants: phenolics, pigments, flavanoids, alkaloids; Biosynthesis and chemical syntheses; Biological controls and organic pesticides.

Text books:

1. Lehninger, L., Nelson, D.L. and Cox, M.M. (2000). Principles of Biochemistry, Worth
2. Alan Crozier, Michael N. Clifford and Hiroshi Ashihara (2006). Plant secondary metabolites. Occurrence, structure and role in human diet, Blackwell Publishing.
3. Harinder P.S. Makkar, P. Sidhuraju and Klaus Becker (2007). Plant Secondary Metabolites, Humana Press

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1554, Practical on Natural products and Biochemistry (1 Credit)

ILOs: Upon completion of the subject, students able to describe the importance of natural products in the industry and gain hands on experience on techniques and methodologies for analysis of natural products, identify the fundamental concepts of biochemistry, able to learn about the structures, properties and functions of amino acids, proteins, carbohydrates, lipids and nucleic acids.

Course Capsule: Separation and isolation of natural products using solvent extraction, Quantitative estimation of carbohydrates, amino acid and proteins, Determination of acid value, peroxide value, saponification number, iodine number of fats and oils, Study the effect of temperature, pH on the action of given enzyme.

Text books:

1. Stryer, L. (2001). Biochemistry, Freeman.
2. Voet, D and Voet, G. (1995). Biochemistry, John Wiley.
3. Lehninger, L., Nelson, D.L. and Cox, M.M. (2000). Principles of Biochemistry, Worth

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1505, Environmental Chemistry (2 Credits)

ILOs: Upon completion of the subject, students able to describe the basic principles of environmental chemistry, apply knowledge on analytical chemistry to environmental processes and samples, and understand the interconnections between different sectors of the environment (soil, water and atmosphere).

Course Capsule: Atmospheric chemistry: composition of the atmosphere, solar radiation, distraction of the ozone layer, photochemical smog, global warning, emissions from vehicles and industries, deforestation, burning fossil fuels, plastics, acid rain; Aquatic chemistry: quality of water, potable water; Chemistry of pollution – heavy metals, pesticides, resides, industrial chemicals, purification of water; Soil Chemistry: types of soil, their origin and chemistry, chemical properties of soil, soil amelioration, salinisation of soils and weathering of rocks.

Text books:

1. Ronald A. Hites, Jonathan D. Raff (2012). Elements of environmental chemistry, 2nd Edition. Wiley Publication
2. Manahan, Stanley E. (2008). Fundamentals of environmental chemistry. CRC publication.
3. Ibanez, J.G., Hernandez-Esparza, M., Doria-Serrano, C., Fregoso-Infante, A., Singh, M.M. (2007). Environmental chemistry, Fundamentals. Springer.

Assessment criteria:

Formative: 33% for in-course assessment

Summative: 67% for end-semester Examination

MES 1555, Instrumental Analysis of Environment Sciences (2 Credits)

ILOs: Upon completion of the subject, students gain skill to handle instrumentation and techniques for environmental analysis

Course Capsule: Measurement of climatic parameters viz sunlight, rainfall, wind speed, humidity; Testing of water quality: pH, conductivity, salinity, BOD, COD, hardness, temperature; Measuring of ions/heavy metals in water: use of atomic absorption spectrometers, colorimeters, UV and Mass spectrometer; Spot test for icons, titration techniques; Soil analysis, nutrient status, physical parameters etc.; Analysis of emissions, atmospheric pollutants; Isotope techniques

Text books:

1. Kebbekus, B and S. Mitra. (1998). Environmental chemical analysis. CRC Press.

2. Mahmood Barbooti. (2015). Environmental applications of instrumental chemical analysis. Apple Academic Press.
3. Randy D Down and Jay H Lehr. (2005). Environmental instrumentation and analysis handbook. John Wiley and Sons Inc.

Assessment criteria:

Formative: 33% for in-course assessment

Summative: 67% for end-semester Examination

MES 1506, Environmental Microbiology (2 Credits)

ILOs: Upon successfull completion of the subject, students will be able to research, evaluate and critically assess recent hypotheses and practical applications of environmental microbiology in selected aspects of environmental microbiology.

Course Capsule: Atmospheric microbiology: microbes in air, diseases, food spoilage; Aquatic microbiology: microbiology of waste water, sewage, estimation techniques, pollution and controls, eutrophication; Soil microbiology: Soil microbes and symbiotic associations, microbial decomposition.

Text books:

1. Aneja, K.R., Jain Pranay, Aneja Raman (2008, reprint 2015). A Textbook of Basic and Applied Microbiology New Age International Publishers, New Delhi.
2. Glazer, A.N. and Nikaido, H., (1995). Microbial biotechnology. Fundamentals of Applied Microbiology W.H. Freeman & Company, New York, USA.
3. Madigan, M.T., Martinko, J.M. and Parker. J. (2002). Brock Biology of Microorganisms, 10th Edition, Prentice Hall, USA.

Assessment criteria:

Formative: 33% for in-course assessment

Summative: 67% for end-semester Examination

MES 1556, Practical on Environmental Microbiology (1 Credit)

ILOs: Upon completion of the course students able to identify and isolate different types of microorganisms from the environment and their importance to human and the environment.

Course Capsule: Methods of *In-vitro* culturing of microbes from air and soil (pour plate and spread plate techniques); Portable water analysis – Coliform test and Membrane filter method.

Text books:

1. Arora, D. R. (2007). Text book of Microbiology, 2nd Edition, New Delhi: CBS pub.
2. Michael J. Leboffe, Burton E. Pierce and David Ferguson (2006). Microbiology Laboratory Theory & Application, 2nd Edition, Morton publishing Company, Englewood.
3. Michael J. Leboffe and Burton E. Pierce. (2015). Microbiology: Laboratory theory and application, 4th Edition. Morton Publishing Company.

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1507, Ecology and Environment (2 Credits)

ILOs: Upon completion of the course, students able to demonstrate fundamental concepts, methods and results in the scientific study of ecology, biodiversity and the environment; recognize the relationship of selected aspects of the ecology of terrestrial and aquatic systems.

Course Capsule: The principles of ecology an environment; basic food chains, energy chains, nutrient cycles, pollution; Ecosystems, nature and distribution; Biodiversity and bio geography of Sri Lanka with special emphasis to Eastern Province; Climate and natural resources; Environmental issues in relation to Eastern province; Coastal recourse units and aquaculture.

Text books:

1.John L. Harper (2010). Population Biology of Plants, The Black burn Press.
2.Anon (2000). Natural Resources of Sri Lanka The National Science Foundation, Sri Lanka
3.Sharma, P.D. (2009). Ecology and environment. Rastogi Publications.
4.Kimon Hadjibiros (2013). Ecology and applied environmental science, CRC Press, Tailor & Francis Group.

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1557, Practical on Ecology and Environment (1 Credit)

ILOs: Upon completion of the course, students able to use instruments to measure ecological parameters, learn various sampling techniques, data collection, analysis and interpretation.

Course Capsule: Assessment of vegetation (qualitative and quantitative); Sampling and sampling methods; Statistical approach in quantitative ecology–selection of suitable statistical test, hypothesis testing and interpretation.

Text books:

1. C. Philip Wheater, James R. Bell, Penny A. Cook. (2011). Practical field Ecology: A project guide. Wiley-Blackwell.
2. Henderson, P.A. (2003). Practical Methods in Ecology. Blackwell Publishing.
3. Jim Fowler, Lou Cohen and Phil Jarvis. (2003). Practical statistics for field biology, 2nd Edition. Wiley Publication.

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1508, Environmental Policy and Legal Aspects (2 Credits)

ILOs: Upon completion of the course, students able to learn, comprehend, apply, evaluate and reflect upon the rules and principles of environmental law; understand the national and global mechanisms that facilitates the management of environment

Course Capsule: National Environmental Policy, Global Conventions, Implementing agencies, Legislations on conversation of land, water, atmosphere, soil, biodiversity, culture etc. Management issues of environment,

Text books:

1. Nicholas A. Ashford and Charles C. Caldart. (2008). Environmental law, policy and economics, Reclaiming the environmental agenda. MIT Press.
2. Ravindranath Dabare (2009). Environment Law. Centre for environmental Justice.
3. Justice Shiranee Tilakawardane, Justice Nissanka Udalagama, justice N.E. Dissanayake and Justice L.K. Wimalachandra (2009). Judges and Environmental Law. A Handbook for Sri Lankan Judiciary. Environmental Foundation Limited.

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1509, Environment data analysis and interpretation methods (2 Credits)

ILOs: Upon completion of the course, students able to explain the concepts of basic statistical methods, learn different ways of gathering accurate information; efficiently analyze environmental data sets, and making valid interpretations through appropriate analysis.

Course Capsule: Types of data, survey; Designing of questionnaires for survey and analysis; Basic statistics; Analysis of data, data organization and entry; Computer software for analysis (MINITAB, SPSS);

Interpretation of results, assumptions and limits of interpretation; Environmental Modeling.

Text books:

1. Wynee R Ott. (1995). Environmental statistics and data analysis. Lewis Publishers
2. Clemens Reimann, Peter Filzmoser, Robert Garrett, Rudolf Dutter. (2008). Statistical Data Analysis Explained: Applied Environmental Statistics with R. Wiley
3. Zuur, Alain, Ieno, Elena N., Smith, Graham M. (2007). Analyzing ecological data. Springer

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1559, Practical on Environment data analysis and interpretation methods (1 Credit)

ILOs: Upon completion of the course, students able to have a comprehensive understanding of experimental design, ability to collect, analyse and evaluate the utility of different types of data in order to make sound judgements about the quality of the research.

Course Capsule: Designing experimental and observational studies, research methods, graphical presentation of environmental data, application of methods to analyse environmental data.

Text books:

1. Wynee R Ott. (1995). Environmental statistics and data analysis. Lewis Publishers
2. Clemens Reimann, Peter Filzmoser, Robert Garrett, Rudolf Dutter. (2008). Statistical Data Analysis Explained: Applied Environmental Statistics with R. Wiley.
3. Jim Fowler, Lou Cohen and Phil Jarvis. (2003). Practical statistics for field biology, 2nd Edition. Wiley Publication.

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1510, Scientific Writing and Research Methodology (2 Credits)

ILOs: Upon completion of the course, student able to explain and apply scientific methods, plan and perform experiments and be competent in scientific writing.

Course Capsule: Scientific methods, planning research, proposal drafting, data collection, sampling techniques, field trip planning, basic statics, literature survey, scientific report writing, abstract writing, Poster presentation, Power point presentation of results.

Text books:

1. Thomas, C. G. (2015). Research Methodology and Scientific Writing. Ane Books Pvt Ltd
2. Chawla, D. and Sondhi, N. (2011). Research methodology: Concepts and cases (2011). Vikas Publishing House Pvt. Ltd. Delhi.
3. Hofmann, A.H. (2010). Scientific writing and communication. Oxford University Press

Assessment criteria:

Formative: 33% for in-course assessment
Summative: 67% for end-semester Examination

MES 1511, Seminar series (Frontiers of Environmental Sciences) (2 Credits)

ILOs: After successful completion of the course, students able to independently learn and compile the information gathered into concise a series of seminar presentation, at the examination.

Course Capsule: Seminar topics will be given at the commencement of second semester. The Faculty staff are responsible for selecting the

relevant topics. A total of 6 topics will be given and students should present two presentations on selected topics for the End-semester examination

Assessment criteria: 100% End-Semester Examination

MES 1551, Research (6 Credits)

ILOs: Upon successful completion of the research project, students able to independently design a research, write a research proposal, and present their findings in the form of a scientific report and power point presentation

Course Capsule: Each student will carry out a research project (starting from mid of the first semester) under the supervision of a Faculty member. The student is required to deliver two seminars, (a) pre-project seminar, based on preparatory work and research plan and (b) end of the project seminar, based on the outcome of research and prepare a comprehensive report containing Title page, Abstract, Introduction and Literature Review, Objectives, Materials & Methods, Results, Discussion and References. The student may also be required to present the outcome in the form of a power point presentation

Assessment criteria:

Formative: 20% (Supervisor's evaluation)

Summative: 30% for oral Presentation and 50% for written Report

FACILITIES FOR STUDENTS

Library

Internet and IT Support

Accommodation

Health Facilities

English Language Teaching Unit (ELTU)

Religious

Sports and Leisure

6.0 Facilities for students

6.1 Library

The Library Network of the Eastern University, Sri Lanka comprises the Main Library which caters the faculties of Agriculture, Arts & Culture, Commerce & Management and Science; one branch library for the faculty of Health-Care Sciences; Trincomalee Campus Library for the faculties of Communication & Business Studies and Applied Sciences and the Institute Library of Swami Vipulanandha Institute of Aesthetics Studies for the faculty of Music.

The library provides many essential services for the users viz, e-journals and data base, research space and supports, digital rare collection, inter-library loans, discussion area for students and staff and many more. For further details, visit www.lib.esn.ac.lk.

6.2 Internet and IT support

The Centre for Information and Communication Technology (**CICT**) was established in Eastern University in 2003. CICT conducts various course units in computer science and information technology. CICT is to provide unlimited laboratory facilities to the students by opening the centre 8.00 am to 8.00 pm during weekdays and 8.00 am to 4.00 pm during weekends.

In addition to the course work, the students have the access to learning materials and electronic mailing facilities. The centre also maintains the university website, mail Server, university intranet while functioning as the sole service providers on internet and networking, Hardware and all IT related issues to all the campus, faculties, departments, branches and unit of the university. For further information visit http://www.esn.ac.lk/cict.

6.3 Accommodation

The Students Affairs Department is involved in the task of providing student accommodation in accordance with the rules and regulations formulated by the University. Accommodation for the MSc students also available. Contact the Students Affairs Department for further information and assistance.

6.4 Health facilities

Students who fall sick report to the Health Center for treatment. Patients who need admission and specialized treatment are sent either to the hospital nearby (Chenkalady Hospital or to Eravur Hospital) or to Teaching Hospital, Batticaloa in the University vehicle.

The sanitation of the University premises and the Hostels is looking after by the doctor. The University canteen, hostel canteens and the kitchens are visited by the Doctor and the cleanliness and any other regularities and necessities are reported to the University Registrar.

6.5 English Language Teaching Unit (ELTU)

The English Language Teaching Unit serves all the Faculties at the University and is set up for the specific purpose of teaching English to the undergraduates who enter the University with varying levels of proficiency in English, with a view to improving their knowledge of English to enable them to follow the course units and read the literature in English in their chosen disciplines.For further information visit http://www.esn.ac.lk/eltu

6.6 Religious

The university has multi-cultural communities viz Hindu, Buddhist, Muslims and Christians. The university provided worship places for all the religious people.

6.7 Sports and leisure

Sports Facilities are available at the main campus at Vantharumoolai. There are two bodies, which are set up to promote sports activities at the university.

The Department of Physical Education is responsible for the organization and administration of Physical Education and recreational programmes of the University. The sports activities are promoted by the Sports Council and Sports Advisory Board, the Department provides facilities for various games.