# Course Units: level I, Semester I

**Course Unit No.**: FSC1b14 **(2006-2016)**

**Name of the Course Unit**: Foundation Course on Chemistry for Aquatic Sciences I

**Objectives:** This Course Unit aims to make the student understand use of fundamentals of Chemistry in Aquatic Sciences

**Learning Outcomes**: Students should be able to understand fundamentals of Chemistry

Able to use Chemistry for explaining functions in water

Able to use Chemistry for water analysis

**Assignments**: No

**Mode of Assessment**:

1. End-of-semester examination (3 hours duration) - (100%)

**Course Unit Contents**: [60 hrs Theory]

***Inorganic chemistry***: Electronic structure of the atom, Periodic classification of elements, Periodicity of atomic properties, Polar molecules, Chemical bonds, Intermolecular forces, Hydrogen bonding, Lattice energy, Solubility of ionic compounds in water, Acids and bases and buffer solutions, Valence bond theory and molecular orbital theory, Some selected properties of s, p, d and f block elements and their compounds, Introductory courses on organometallic chemistry and Coordination chemistry

***Organic chemistry***: Nomenclature of organic compounds, Selected topics on aliphatic and aromatic compounds, Biochemistry, Petroleum, Humic substances and lignin, Fats & oil and Toxins.

***Physical chemistry***: Selected topics in chemical kinetics, Electrochemistry, Thermodynamics, Chemical equillibria, Equilibria between phases, Photochemistry and Chemistry of surfaces and colloids

***Analytical chemistry***: Precision, Accuracy, Types of errors in experiment data, titrimetric methods, Gravimetric methods, electrochemical methods, Mass spectrometry, Absorption spectroscopy, Chromatographic methods, Electrophoresis and Methods for monitoring radioactive materials.

**References (Recommended Textbooks)**: Shriver, D., and Atkins, P., 2014. Inorganic Chemistry. Sixth edition, W.H. Freeman & Co.

Lee, J.D., 1999. Concise Inorganic Chemistry. Fifth edition, Wiley-Blackwell.

Housecroft, C. and Sharpe, A.G., 2012, Inorganic Chemistry. Fourth edition, Pearson Education. Limited.

Skoog, D.A., West, D.M. and Holler, F.J., 2003. Fundamentals of Analytical Chemistry. Eighth edition, Brooks/Cole

**Course Unit No.**: FSC1b21 **(from 2006-2016)**

**Name of the Course Unit**: Foundation Course on Chemistry for Aquatic Sciences II

**Objectives:** This Course Unit aims to make the student practice the use of principles of chemistry in Water analysis

**Learning Outcomes**: Students should be able to aware good, safe and standard laboratory practice

Able to observe principles of Chemistry in water analysis

Able to explain chemical reactions based on the observations in aquatic sciences

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester practical examination (3 hours duration) - (100%)

**Course Unit Contents**: [45 hrs Practical]

Safe laboratory practices, Qualitative analysis of inorganic and organic samples, Titrimetric analysis (acid-base, redox, complexometric and precipitation), Preparation of buffer solutions, Gravimetric analysis, Chromatographic analysis (ion-exchange, paper, TLC, GC, HPLC), spectroscopic methods (UV-visible, AAS flame photometer), Electrochemical methods, Separation techniques (distillation and solvent extraction), Radiochemistry, Biochemistry and Electrophoresis

**References (Recommended Textbooks)** :

Fifield, F.W., and Kealey, D., 1995. Principles and Practice of Analytical Chemistry. Fourth edition, CRC Press Inc.

**Course Unit No.**: FSC1132 (2006-2016)

**Name of the Course Unit**: Basic Biology for Fisheries & Marine Sciences

**Objectives:** This Course Unit aims to make the student understand cell structure, function and nomenclature of aquatic organisms

**Learning Outcomes**: Students should be able to study the evolution theories of life with evidences

Able to identify different structures of the cell

Able to use scientific classification for aquatic organisms

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory)1 1/2 hours duration - (70%)

End-of-semester examination (Practical)1 1/2 hours duration - (30%)

**Course Unit Contents**: **(Theory, 23 hrs; Practical 12 hrs)**

Origin and evolution of life**,** Speciation**,** Cell biology, Taxonomy with special reference to aquatic organisms**,** Nomenclature for plants & animals.

**References (Recommended Textbooks)**: George, P., 2014. Principles of Cell Biology. Second edition, Jones and Bartlett Learning

**Course Unit No.**: FSC 1140 (2006-2016)

**Name of the Course Unit**: Information Literacy & Library Skills

**Objectives:** This Course Unit aims to make the student understand efficient and sustainable use of library resources

**Learning Outcomes**: Students should be able to practice use of library resources efficiently

Able to use searching techniques for collecting relevant information

Able to evaluate information for credibility

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (70%)

Continuous Assessment 1 1/2 hours duration - (30%)

**Course Unit Contents**: **(Theory, 22 hrs; Practical, 08 hrs)**
Introduction to libraries, Knowledge on various types of collections, facilities and services offered by a library, Tools used to organize library resources, General rules and regulations of the library, Print resources and non print information resources, Primary and secondary information resources, Searching techniques, Retrieval of print and electronic resources, Evaluating information for credibility currency and content.

**References (Recommended Textbooks)**: University of Chicago press staff, 2010. The Chicago manual of style. Sixteenth edition, University of Chicago press.

**Course Unit No.**: **FSC1b50 (2006-2016), (MMA 1b30 in 2006), FDN1142 (from 2017 to date)**

**Name of the Course Unit**: **Biomathematics**

**Objectives:** This Course Unit aims to make the student understand fundamental mathematics and their applications

**Learning Outcomes**: Students should be able to study fundamental mathematics

Able to use different calculation methods in statistics, chemistry and other subjects

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (100%)

**Course Unit Contents**: **(Theory, 30 hrs)**
Basic Algebra (including Complex Numbers), Logarithms, Trigonometric functions, Limits, Differentiation of a Product, Quotient and a function of a function, Maxima and Minima, Partial Differentiation, Total Differentiation, Homogeneous Functions and Euler's Theorem on Homogeneous functions, Integration by parts, Exact Differential equations, Definite Integral, Vectors, Determinants, Matrices, Introduction to Group Theory, Statistics for Chemistry (permutations, Configurations and Microstates, Molecular Assemblies, The importance of , W=W!/na! nb! ,The Boltzmann Distribution.)

**References (Recommended Textbooks)** :

MMaths. A self-Study Guide by Jenny Olive. Second Edition (510 OLI).

Pure Mathematics I by L Bostock and S. Chandler.

Basic concepts of elementary mathematics by Peterson John M. (510PET).
A biologist's basic mathematics by Causton, David R. (510.24574CAU).

**Course Unit No.**: CLC1b10 (from 2006- 2016), FDN1121 (from 2017 to date)

**Name of the Course Unit**: Computer Literacy Course (30hrs theory, 60hrs practical), Computer Literacy -I (15hrs Theory)

**Objectives:** This Course Unit aims to make the student understand on the use of computer office packages

**Learning Outcomes**: Students should be able to use basic and selected intermediate features of Word Processing and Spreadsheet applications such as MS Word and MS Excel - calculations, tables, mail merge, cell formulas, etc.
use basic and selected intermediate features of presentation applications such as MS Power Point - fonts, colors, slide animation and navigation, transition

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (100%)

**Course Unit Contents**: **(Theory, 30 hrs; Practical, 60 hrs)**

Basic concepts of software & hard ware, Windows operating systems, Word processing (MS-Word), Presentation tools (MS power point), Spreadsheet application (MS-Excel), Database Management systems (MS-Access), Computer programming fundamental (C-language)

**References (Recommended Textbooks)**:

Connie, M., Wells, D., Ruffolo, L., 2014. Computer Literacy Basics; A comprehensive guide to IC3, Cengage Leaning

**Course Unit No.**: **FDN 1110 (2006-2016), FDN 1111** (2017 to date, 15hrs theory)

**Name of the Course Unit**: **PRELIMINARY ENGLISH I**

**Objectives:** Developing the ability to communicate orally in their field of study.

- Developing the ability to comprehend and extract the required information from chosen text and/ or general reading material.
- Developing the ability to produce ideas related to the relevant field of study in an acceptable written form.
- Enhancing accuracy in the use of language through an exposure to the frequently used rules in English grammar.

**Learning Outcomes**: Students should be able to
describe and explain simple situations, condition or actions
ask simple questions accurately to elicit the required information.
read and understand simple texts connected to their academic or any other subjects.
produce a simple writing task accurately.
follow lectures conducted in English.
conceptualize and research scientific information and through charts, diagrams etc.

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 03 hours duration - (100%)

**Course Unit Contents**: (Theory, 30hrs)
Simple sentence, Identifying parts of speech, Nouns countable/ uncountable

Adjectives, Subject-Verb agreement, 'be' – 'do' – 'have', Present Simple (active-passive), Past Simple (active-passive), Present Continuous (active-passive), Past Continuous (active-passive), Adverbs, Transforms of above (negative & interrogative), Determiners, Prepositions.

**References (Recommended Textbooks)**:

Murphy., R.1989. Grammar in Use: Reference & Practice for Intermediate Students of English. Cambridge University Press.

**Course Unit No**: **FDN1131** (from 2017 to date as an optional course)

**Name of the Course Unit:** Snorkeling and Lifesaving

**Objectives:** To develop student's ability to
gain basic swimming and snorkeling skills

**Learning outcomes:** At the end of the Course unit students should be able to

- use skills, safety, and the proper use and care of the equipment used in snorkeling
- use field skills to study marine and near-shore environments

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 hour duration - (60%)

End-of-semester examination (Practical) 1 hour duration - (40%)

**Course Unit Contents**: (9 hrs Theory, 18 hrs Practical)
Basic skills of snorkelling,
diving and life saving,
snorkelling gears, diving gears, diving hazards,
snorkelling and diving ethics,
underwater photography,
maintenance of snorkelling and diving gear, and underwater photographic equipment.

**References (Recommended Textbooks)**:

PADI Guide line Book

**Course Unit No.**: FAQ1112 (2006-2016)

**Name of the Course Unit**: Evolution and Basic Biology of fin fish

**Objectives:** This Course Unit aims to make the student understand origin, evaluation and biology of finfish

**Learning Outcomes**: Students should be able to study origin and evolution theories of finfish

Able to observe morphology of fish and morphometry characters for taxonomic classification

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (100%)

**Course Unit Contents**: (Theory, 30hrs)

Origin, evolution, biology, morphology, morphometry and taxonomy of fin fish.

**References (Recommended Textbooks)**:

Helfman, G. and Helfman, G., 2009. *The Diversity Of Fishes*. 2nd ed. Chichester: Wiley-Blackwell.

**Course Unit No.**: FAQ1121 (2006-2016)

**Name of the Course Unit**: Practical Course on Evolution and Basic Biology of fish

**Objectives:** This Course Unit aims to make the student understand origin, evaluation and biology of fish

**Learning Outcomes**: Students should be able to study origin and evolution theories of fish

to describe morphology of fish and morphometry characters for taxonomic classification

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Practical) 1 1/2 hours duration - (100%)

**Course Unit Contents**: (Practical, 45hrs)

Origin, evolution, biology, morphology, morphometry and taxonomy of fish.

**References (Recommended Textbooks)**:

**Course Unit No.**: **FAQ1132 (2006-2016)**

**Name of the Course Unit**: Evolution and Basic Biology of shellfish

**Objectives:** To develop student's ability to
explain biological and evolutionary processes relevant to shellfish

**Learning Outcomes**: Students should be able to
explain origin and evolution of shellfish
describe morphology and morphometric characters of shellfish
classify shellfish into taxonomic groups study origin and evolution theories of Shellfish

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (100%)

**Course Unit Contents**: (Theory, 30hrs)

Origin, evolution, biology, morphology, morphometry and taxonomy of cultured shell fish (shrimps, crabs, lobsters, mollucs, echinodermates).

**References (Recommended Textbooks)**:

**Course Unit No**: **FAQ1113 (2017-to date)**

**Name of the Course Unit:** Evolution and Basic Biology of finfish

**Objectives:** This Course Unit aims to develop student's ability to

- explain biological and evolutionary processes relevant to finfish

**Learning Outcomes**: Students should be able to

explain origin and evolution of finfish
describe morphology, and morphometric and meristic characteristics of finfish
classify finfish into taxonomic groups
identify specimens following taxonomic keysstudy origin and evolution theories of finfish

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination theory (75%), Practical (25%)

**Course Unit Contents**: (Theory, 35hrs, Practical 30hrs)

Origin, evolution, biology, morphology, morphometry and taxonomy of finfish
Morphometric characters and morphological features of finfish
Use of identification keys
Evolutionary characters
Anatomy of bony and cartilaginous fish

**References (Recommended Textbooks)**:

Helfman, G. and Helfman, G., 2009. *The Diversity Of Fishes*. 2nd ed. Chichester: Wiley-Blackwell.

**Course Unit No**: **FAQ1122 (2017-to date)**

**Name of the Course Unit:** Evolution and Basic Biology of shellfish
**Objectives:** This Course Unit aims to develop student's ability to explain biological and evolutionary processes relevant to shellfish
**Learning Outcomes**: Students should be able to
explain origin and evolution of shellfish
describe morphology and morphometric characters of shellfish
classify shellfish into taxonomic groups study origin and evolution theories of shellfish
describe morphology of finfish and morphometric characters for taxonomic classification

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory 75%, Practical 25%)

**Course Unit Contents**: (Theory, 24hrs, Practical 18hrs)
Origin, evolution, biology, morphology, morphometry and taxonomy of finfish
Morphometric characters and morphological features of finfish
Use of identification keys
Evolutionary characters
Anatomy of bony and cartilaginous fish

**References (Recommended Textbooks)**:

**Course Unit No.**: LIM 1122 (2006-2016)

**Name of the Course Unit**: Physical and Chemical Limnology

**Objectives:** This Course Unit aims to develop student's ability to
explain fundamentals of Limnology

apply scientific methods developed for Limnology

**Learning Outcomes**: At the completion of this course unit student should be able to
define basic terms in Limnology

classify inland aquatic systems

apply scientific methods for understanding aquatic systems

calculate morphometric parameters of water bodies

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [30 hrs Theory]

Physico-chemical parameters of Freshwater (DO, pH, conductivity, salinity, NO3-, PO4-3, NH4+, DOC & other dissolved gasses, Major cations), [5 hrs]

Classification of freshwater systems, [5 hrs]

Stratification, [3 hrs]

Mixing patterns, [6 hrs]

Mictic & Amictic Lakes[5 hrs]

Map reading and morphometry of lentic lotic systems (fetch calculation, SLD, slope determination [6 hrs]

**References**:

Tundisi, J.G., and Tundisi, T.M., 2012. Limnology. CRC Press.

Wetzel, R.G., 2001. Limnology. Third edition, Academic Press.

**Course Unit No.**: LIM 1131 (2006-2016)

**Name of the Course Unit**: Limnological Laboratory Exercises

**Objectives:** This Course Unit aims to provide laboratory and field practices of limnological analysis

**Learning Outcomes**: Students should be able to analyse limnological parameters of water

Able to study spatial and temporal variations of limnological parameters of water

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester practical examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs Practical]

Map reading & geographical coordinates, [6 hrs]

Morphometry of lentic & lotic waters bodies, [9 hrs]

Analysis of physico-chemical parameters of freshwater [30 hrs]

**References**:

Water Analysis …APHA methods……..

**Course Unit No**: **LIM1112 (2017 to date)**

**Name of the Course Unit**: Introduction to Limnology

**Objectives:** To develop student's ability to
explain fundamentals of Limnology

apply scientific methods developed for Limnology

**Learning Outcomes**: At the completion of this course unit student should be able to
define basic terms in Limnology

classify inland aquatic systems

apply scientific methods for understanding aquatic systems

calculate morphometric parameters of water bodies

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) – 80%
End semester exam (Practical) – 20%

**Course Unit Contents**: [24 hrs Theory, 18 hrs Practical]

Theory (24hrs): Definitions, history and development of Limnology; (6hrs)
Water as a natural resource; Hydrologic cycle; (6hrs)
Origin, forms and distribution of lentic and lotic aquatic systems including lakes, reservoirs, streams, (6hrs), Wetlands and ground water aquifers, (6hrs), Lake as an ecosystem, Lake Succession process and eutrophication, (6hrs)

Practical (18hrs): Identification and reading of basic Limnological Maps, Practise on the use of basic Limnological instruments, Calculation of limnological parameters

**References (Recommended Textbooks)**:

Tundisi, J.G., and Tundisi, T.M., 2012. Limnology, CRC Press.

Wetzel, R.G., 2001. Limnology. Third edition, Academic Press.

**Course Unit No.**: LIM 1122 (2017 to date)

**Name of the Course Unit**: Freshwater Fauna

**Objectives:** To develop student's ability to
identify characteristics of freshwater fauna

describe adaptations of freshwater fauna living in various habitat

**Learning Outcomes**: At the completion of this course unit student should be able to
explain characteristics of freshwater fauna
compare biology and adaptations of freshwater fauna
describe importance of the freshwater fauna in different ecosystems
classify freshwater fauna into taxonomic groups

**Prerequisite**: No

**Mode of Assessment**:

End semester exam (Theory) – 80%
Continuous Assessment (Practical) – 20%

**Course Unit Contents**: [24 hrs Theory, 18hrs Practical]

Theory (24hrs): Basic introduction of scientific classification of fauna: 2hrs, Protozoa: 4hrs, Rotifera: 2hrs, Platyhelminthes, Nematods: 3hrs, Microcrustaceans: 5hrs, Aquatic Insects: 3hrs, Amphibia: 3hrs, Birds: 2 hrs

Practical (18hrs): Identification of basic structure of different fauna using live and preserved specimens, study the biology and adaptations of fauna, classification of fauna

**References**:

Edward, E.R., 2013. Invertebrate Zoology. Seventh edition, Thompson Brooks.

**Course Unit No.**: **CHM1111 (2017 to date)**

**Name of the Course Unit**: Principles in Chemistry

**Objectives:** to develop student's ability to
apply basic concepts in Chemistry in other subject areas

**Learning Outcomes**: At the completion of this course unit student should be able to
explain fundamentals in Chemistry.
define the structure of the atom based on atomic structure models.
compare different types of intra and inter molecular bonding.
evaluate molecular geometry

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) – 80%
Continuous assessments – 20%

**Course Unit Contents**: [15 hrs Theory]

Atom, Attraction forces and bonding, (5hrs)
Molecular shapes & energetics of chemical reactions, (5hrs), Periodicity of atomic properties (5hrs)

**References**:

Shriver, D., and Atkins, P., 2014. Inorganic Chemistry. Sixth edition, W.H. Freeman & Co.

Lee, J.D., 1999. Concise Inorganic Chemistry. Fifth edition, Wiley-Blackwell.

Housecroft, C. and Sharpe, A.G., 2012, Inorganic Chemistry. Fourth edition, Pearson Education. Limited.

**Course Unit No.**: **CHM1122 (2017 to date)**

**Name of the Course Unit**: Analytical Chemistry –I

**Objectives:** This Course Unit aims to make the student understand and practice basic laboratory techniques to follow analytical methods

**Learning Outcomes**: Students should be able to

- practice safety and basic laboratory techniques
- explain principles and procedures used in different qualitative and quantitative analytical methods
- design, carry out, record and analyze the results of chemical experiments and Integrate theory and practice to solve qualitative and quantitative problems of a familiar and unfamiliar nature.

**Prerequisite**: No

**Assignments**: No (if any indicate like one tutorial or one Rainfall runoff and flood routing modeling assignment based on a software)

**Mode of Assessment**:

End semester exam (Theory) – 55%
End semester exam (Practical) – 35%
Continuous assessments – 10%

**Course Unit Contents**: [20 hrs Theory, 30 hrs Practical]

*Theory 20 hrs:* Basic statistics for chemical analysis: (6hrs), Buffer solutions: (6hrs), Volumetric analysis (8hrs)

Practical 30 hrs:

Take idea about the structure and glass ware types, Identification of actions of basic chemical solution, volumetric analyisis

**References**:

Skoog, D.A., West, D.M. and Holler, F.J., 2003. Fundamentals of Analytical Chemistry. Eighth edition, Brooks/Cole.

Christian, G.D., 2003. Analytical Chemistry. Sixth edition, Wiley.

Fifield, F.W., and Kealey, D., 1995. Principles and Practice of Analytical Chemistry. Fourth edition, CRC Press Inc.

**Course Unit No.**: **OCG1112 (2006-2016)**

**Name of the Course Unit**: Introduction to Oceanography

**Objectives:** This Course Unit aims to make the student understand the theories of Oceanography

**Learning Outcomes**: Students should be able to get an overall basic understanding on the field of oceanography and oceans.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [30 hrs theory]

History of oceanography, Major oceanographic expeditions and their findings. International Oceanographic Research Institutions, Origin & evolution of oceans and oceanic organisms, Zones of the Marine ecosystems, Vertical and horizontal distribution (zonation) of marine environment, Orgin and Evaluation of the Universe and Earth Systems. Origin and Evaluation of the life on the Earth and geological time scale. UNCLOS and other important conventions with respect to maritime zones

**References**:

Garrison, T., 2012, Oceanography: An invitation to Marine Sciences. Eighth edition, Cengage Learning.

**Course Unit No.**: **OCG1111 (2017 to date)**

**Name of the Course Unit**: Introduction to Oceanography

**Objectives:** This Course Unit aims to develop student's ability to

- explain the theories of Oceanography

**Learning Outcomes**: At the completion of this course unit student should be able to
describe fundamentals in oceanography
summarize developments in oceanography
explain ocean structure and processes

**Prerequisite**: No

**Mode of Assessment**: End Semester Exam (Theory) 70 %,
Assignments (2) - 30 %

**Course Unit Contents**: (15hrs Theory)

1 Definition for oceanography (1hr),
2 History of oceanography (1hr)
3 major oceanographic expeditions and their findings (2hrs),
4 international oceanographic research institutions (1hr),
5 ocean basins (2hrs), water and ocean structure (2hr),
6 Formation of ocean waves (3hrs), tides and currents (3 hrs)

**References**

Garrison, T., 2012, Oceanography: An invitation to Marine Sciences. Eighth edition, Cengage Learning.

**Course Unit No**: **OCG1121 (from 2017 to date)**

**Name of the Course Unit:** Earth History, origin and evolution of life
Introduction to Oceanography

**Objectives:** To develop students ability to
understand different hypotheses on the evolution of earth and life on the earth.
attain basic knowledge on fossils.

**Learning Outcomes**: At the completion of this course unit student should be able to
describe how the universe has been formed, different hypotheses on formation of the universe
explain how the elements, stars and solar systems have been formed
explain the origin of the sun, earth and other planets in the solar system
explain plate tectonic theory and geology of the earth
explain the theories on origin and evolution of life on earth

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:
End semester Exam (Theory) - 100 %

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)

Origin & evolution of earth, geological time scale, Numerical dating, early life and its patterns, earliest Palaeozoic history, major tectonic geological and climatic events and evolution of life through the geological history, fossils and fossilization.

**References:**
Prothero, D.R., and Dott, R.H., 2009. Evolution of the Earth. Eighth edition, McGraw-Hill Science/Engineering.

## Level I, Semester II

**Course Unit No.**: **FDN 1220**(2006-2016) FDN1211 (2017 to date)

**Name of the Course Unit**: **PRELIMINARY ENGLISH II**

**Objectives:** This Course Unit aims to make the student understand grammar and the uses in English for following the degree courses and for communication

**Learning Outcomes**: Students should be able to read and understand English in connection with their chosen field of study,

- write simple essays, both general, and in relation to their academic subjects,
- listen to and understand lectures, and participate appropriately in informal group discussions.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester examination (theory) 3 hours 100%)

**Course Unit Contents**: (15hrs theory)

Reading: Coherence & Cohesion, inference. Writing: Coherence, conveying personal messages in a formal letter, note and email. Listening: Dialogues, main and supporting ideas in lectures. Speaking : Informal group discussions. Grammar: Countable & uncountable nouns, determiners, singular/plural, tenses, prepositions.

**References**:

Murphy, R., 1989. Grammar in Use: Reference & Practice for Intermediate Students of English. Cambridge University Press.

**Course Unit No.**: **FDN1221** (2017 to date)

**Name of the Course Unit**: Computer Literacy -II

**Objectives:** This Course Unit aims to make the student understand uses of computer skills at different level of the degree

**Learning Outcomes**: Students should be able to explain and Use basic and selected intermediate features of data base management systems such as MS Access - Queries, tables, reports, forms.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) 60%
Continuous Assessment (Practical) 40%

**Course Unit Contents**: (15hrs theory)

Database Management Systems- I (MS-Access)

**References**: Connie, M., Wells, D., Ruffolo, L., 2014. Computer Literacy Basics; A comprehensive guide to IC3 , Cengage Leaning

**Course Unit No.**: FAQ 1213 (2006-2016)

**Name of the Course Unit**: **Fish Histology, Embryology and Genetics**

**Objectives:** This Course Unit aims to make the student understand …….

**Learning Outcomes**: At the completion of this course unit student should be able to
describe and identify the cell structure, organelles and cell theory & tissue types of fish
describe and identify histology of different tissues
describe and identify embryonic development stages of fish
use of different microscopic techniques for histological examinations

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester examination (theory 100%)

**Course Unit Contents**: [45 hrs Theory]

Histology: Histology of skin, Alimentary canal, Gonads, Liver, Thyroid, Kidney, Muscles, Bones, Gills, Brain and Neuron system etc.
Embryology and life history of oviparous, ovoviviparous & viviparous fish
Genetics: Basic principles of genetics & molecular biology applicable to fisheries & aquaculture.

**References**:

**Course Unit No.**: **FAQ1221 (2007 – 2016), (in 2006, FAQ 1231)**

**Name of the Course Unit**: **Practical Course on Histology, Embryology and Genetics**

**Objectives:** This Course Unit aims to make the student understand ……

**Learning Outcomes**: Students should be able to
identify the cell structure, organelles and cell theory & tissue types of fish
identify histology of different tissues
identify embryonic development stages of fish
use of different microscopic techniques for histological examinations

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester examination 1 ½ hrs(practical 100%)

**Course Unit Contents**: [45 hrs Practical]

Use of different microscopical techniques for histology (microtomy & staining); Histological studies on fish tissues; Identification of different embryonic developmental patterns and stages of life cycles of fin-fish & shell fish; Laboratory exercise on fish genetics.

**References**:

**Course Unit No.**: **FAQ1222 (from 2017 to date)**

**Name of the Course Unit**: Fundamentals of fish Genetics

**Objectives:** To develop student's ability to
explain fundamentals of Genetics

**Learning Outcomes**: At the completion of this course unit student should be able to
describe the principles of Mendelian inheritance
describe non Mendelian inheritance
identify the mode of inheritance of major traits such as body color, fin shape etc, which are important in fisheries & aquaculture

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester examination (75% theory, 25% Practical)

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)

1.History and major terms of genetics (2 hrs). Mendel's law (2 hrs),
2 Variations to Mendel's law; incomplete dominance and co-dominance (3 hrs),
3 gene interactions (7 hrs)
4 Sex linked genes, sex limited traits and sex influenced factors (3 hrs)
5, multiple alleles in fish (1 hr), polygenic traits and pleiotropy (1 hr), pedigree analysis (3 hrs), applications of genetics in fisheries and aquaculture (2 hrs).

21 hrs Practical

6, 7 Solve set of genetics problems to understand the mode of inheritance of different traits which are important in fisheries and aquaculture

**References**:

**Course Unit No.**: FAQ 1213 (2017 to date)

**Name of the Course Unit**: Cytology, Histology and Embryology of fish

**Objectives:** This Course Unit aims to make the student understand Histology and Embryology of fish

**Learning Outcomes**: At the completion of this course unit student should be able to
describe and identify the cell structure, organelles and cell theory & tissue types of fish
describe and identify histology of different tissues
describe and identify embryonic development stages of fish
use of different microscopic techniques for histological examinations

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester examination (Theory 75%, practical 25%)

**Course Unit Contents**: [37 hrs theory, 24 hrs practical)

Biology of cells of higher organisms: Structure & functions of cellular organelles, cell growth, mitotic & meiotic division and oncogenic transformation. Histology of skin, Alimentary canal, gonads, liver, thyroid, kidney, muscles, bones, gills, brain and neuron system etc., embryology and life history of oviparous, ovoviviparous and viviparous fish.

Use of different microscopic techniques for histology 9fixing, embedding, microtome & staining): histological studies on fish tissues; identification of different embryonic development patterns and stages of life cycles of finfish & shell fish

**References**:

**Course Unit No.**: LIM 1214 (2006-2016)

**Name of the Course Unit**: Basic Freshwater Biology

**Objectives:** This Course Unit aims to make the student understand the biology of freshwater organisms and their adaptations and importance

**Learning Outcomes**: Students should be able to

identify characteristics of different taxonomic group of freshwater organisms

explain biology and adaptations of the organisms

explain the importance of those organisms in freshwater

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester examination (theory) 3 hours: 100%)

**Course Unit Contents**: [60 hrs Theory]

Classification of major taxonomic groups, [5 hrs]

Morphology for classification, 5 hrs]

Biology, [5 hrs]

Distribution and importance of freshwater invertebrates for limnology, [5 hrs]

Vertebrates and plants (Bacteria, Algae, Protozoans, Nematodes, Rotifers, Insects, Crustaceans, Amphibians, Birds, Aquatic plants) for Limnology [40 hrs]

**References**:

Edward, E.R., 2013. Invertebrate Zoology. Seventh edition, Thompson Brooks.

Bellinger, E. G., and Sigee, D.C., 2015. Freshwater Algae: **Identification, Enumeration and Use as Bioindicators. Second e**dition, Wiley-Blackwell.

Cook , C.D., 1990. Aquatic plant book.
Balogh Scientific Books.

**Course Unit No.**: LIM 1221 (2006-2016)

**Name of the Course Unit**: Laboratory and Field Exercises for Basic Freshwater Biology

**Objectives:** This Course Unit aims to make the student identify different taxonomic groups based on morphology

**Learning Outcomes**: Students should be able to identify freshwater organisms at the most possible taxonomic level

To Describe morphological and taxonomical variation of freshwater organisms
To Identify adaptations of organisms for their habitat
To Identify ecological indicator species

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs Practical]

Laboratory and field exercises for identifying different organisms based on the morphology, studying their distribution at various habitats and their importance

**References**:

Edward, E.R., 2013. Invertebrate Zoology. Seventh edition, Thompson Brooks.

Bellinger, E. G., and Sigee, D.C., 2015. Freshwater Algae: **Identification, Enumeration and Use as Bioindicators. Second e**dition, Wiley-Blackwell.

Cook , C.D., 1990. Aquatic plant book.
Balogh Scientific Books.

**Course Unit No**: **LIM1212** (from 2017 to date)

**Name of the Course Unit:** Physical and Chemical Limnology

**Objectives:** To develop student's ability to
explain physical and chemical processes occurring in inland aquatic systems

**Learning outcomes:** At the completion of this course unit student should be able to
describe the physical and chemical properties of aquatic systems.
analyze physical and chemical parameters in aquatic systems
evaluate inter-relationships of physical and chemical parameters

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) – 80%
Continuous Assessment (Practical) – 20%

**Course Unit Contents**: 24 hrs (theory)
Light penetration (3hrs),
Heat balance and zonation (3hrs),
Types of flow, Turbulence, vertical and horizontal circulations (4hrs),
thermal stratification (2 hrs), and their influence on the chemical composition; nutrient availability and cycling in freshwater systems (12 hrs).

Practical 18 hrs Analyses of physical and chemical properties of water from different inland aquatic environment

**References**:

Tundisi, J.G., and Tundisi, T.M., 2012. Limnology. CRC Press.

Wetzel, R.G., 2001. Limnology. Third edition, Academic Press.

**Course Unit No**: **LIM1222** (from 2017 to date)

**Name of the Course Unit:** Freshwater Flora (24hrs Theory, 18hrs Practical)

Objective: To develop student's ability to
use morphology for identification and classification of freshwater flora
identify adaptations of freshwater flora for aquatic environment

**Curriculum learning outcomes:** At the completion of this course unit student should be able to
identify major groups of freshwater algae
use morphology for taxonomic classification of freshwater algae
explain the adaptations of freshwater flora
compare the distribution patterns of freshwater flora in different aquatic environment

**Prerequisite**: No

**Assignments**: Two

**Mode of Assessment**: End semester exam (Theory) – 80%
Continuous Assessment individual practical reports – 20%

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)
Classification (4hrs),
morphology (4hrs),
biology (6 hrs),
Distribution and importance of freshwater micro and macro algae (5 hrs) and other plants (5 hrs).

18 hrs Practical
Identification of different groups of algae from natural samples brought by students (9 hrs),
Use of identification keys and manuals of algae (3 hrs),
Identification of different aquatic plants and study their major role in ecosystem (6hrs)

**References**:

Bellinger, E. G., and Sigee, D.C., 2015. Freshwater Algae: Identification, Enumeration and Use as Bioindicators. Second edition, Wiley-Blackwell.

Cook , C.D., 1990. Aquatic plant book.
Balogh Scientific Books.

**Course Unit No**: **CHM1212** (from 2017 to date)

**Name of the Course Unit:** Inorganic Chemistry (24hrs Theory, 18 hrs Practical)

**Objective:** To develop student's ability to

- explain the chemistry of s, p, d and f block elements
- apply laboratory techniques of semi-micro analyses

**Learning outcomes:** At the completion of this course unit, student should be able to

explain the chemistry of s, p, d and f block elements.

design and conduct qualitative semi-micro analytical experiments.

synthesize double salts and coordination complexes.

**Prerequisite**: No

**Assignments**: Two

**Mode of Assessment**: End semester exam (Theory) – 70%
End semester exam (Practical) – 20%
Continuous assessments – 10%

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)
1 Selected topics on chemistry of s, p, d and f block elements (5 hrs):
2 Electron configurations (3hrs)
3, Oxidation states (2hrs),

4 Physical properties (3 hrs), Allotropes,
5 Organometallic chemistry and coordination chemistry (6hrs),
6 An elementary course on radio chemistry (3 hrs)
7 Semi-micro qualitative analyses and synthesis of double salts and coordination complexes (18 hrs)

**References**: Greenwood, N. N., and Earnshaw A., 1997. Chemistry of the Elements. Second edition, Elsevier.

Shriver, D., and Atkins, P., 2014. Inorganic Chemistry. Sixth edition, W.H. Freeman & Co.

**Course Unit No.**: **OCG1212** (2006-2016)

**Name of the Course Unit**: Basic Marine Biology I (flora)

**Objectives:** This Course Unit aims to make the student understanding on morphology and taxonomy of Marine flora

**Learning Outcomes**: Students should be able to Identify marine flora (Marine algae/sea grass/Mangroves) and seashore vegetation up to genus/species level
Describe morphological and taxonomical differences in species of marine algae, sea grass, mangroves and seashore flora
Identify adaptations of above flora for their respective habitat

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [30 hrs theory]

Classification of marine flora, Important and interesting characters, Life histories of marine flora

**References**:

**Course Unit No.**: **OCG1222** (2006-2016)

**Name of the Course Unit**: Basic Marine Biology II (fauna)

**Objectives:** This Course Unit aims to make the student understanding on morphology and taxonomy of marine fauna

**Learning Outcomes**: Students should be able to Identify marine fauna up to genus/species level
Identify unique phylum characteristics
Describe morphological and taxonomical differences between different species
Identify adaptations of marine fauna for their respective habitat
Describe basic biology of each phylum

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [30 hrs theory]

Classification of marine fauna, Important and interesting characters, Life histories of marine fauna

**References**:

**Course Unit No.**: OCG1231 (2006- 2016)

**Name of the Course Unit**: Basic Marine Biology Laboratory

**Objectives:** This Course Unit aims to make the student practice to use of morphology for taxonomic classification

**Learning Outcomes**: Students should be able to identify marine fauna/flora up to genus/species level
Identify unique phylum/division characteristics
Describe morphological and taxonomical differences between different species
Identify adaptations of marine fauna/flora for their respective habitat

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs practical]

Identification of marine organisms (plants & animals), Important and interesting adaptive features of marine organisms (plants & animals), Identification of different stages of life cycles of important marine organisms

**References**:

**Course Unit No.**: OCG1222 **(from 2017 to date)**

**Name of the Course Unit**: Marine Biology – Invertebrate Fauna
**Objectives:** This Course Unit aims to make the student

**Learning Outcomes**: To develop student's ability to
distinguish different invertebrate phyla
describe basic characteristics of (form and function) each invertebrate phylum
describe adaptations of different invertebrate species

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (theory) – 80%
End semester exam (practical) – 20%

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)

Diversity of marine fauna - Introduction, Diversity of marine invertebrate fauna-introduction, Basic characteristics, diversity and classification, general form and function, Form and function of marine groups /adaptations of phyla: Protozoans, Porifera, Cnidaria, Nematoda, Platyhelminthes, Annelida, Mollusca, Arthropoda, Echinodermata, Coelenterata.

**References**:

Brusca, R.C., and Brusca, G.J.,
2003. Invertebrates. Second edition, Sinauer Associates.

**Course Unit No.**: OCG1242 **(from 2017 to date)**

**Name of the Course Unit**: Introduction to Geospatial Analysis

**Objectives:** This Course Unit aims to make the student understanding on geospatial analytical techniques

**Learning Outcomes**: At the completion of this course unit student should be able to
use methods of spatial analysis
use modeling techniques that are provided within currently available and widely used geographic information systems (GIS) and associated software.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
Practical reports - 20%

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)
Introduction and terminology,
Basic Primitives,
Spatial Relationships, Spatial Statistics, Building Blocks of Spatial Analysis Spatial and Spatio-temporal Data Models and 5Methods Geometric and Related Operations, Queries, Computations and Density Distance Operations.
18 hrs Practicals

**References**:

Smith, M.J., Goodchild,M.F., Longley, P.A., 2009. Geospatial Analysis; A Comprehensive Guide to Principles, Techniques and Software Tools. Third edition, Matador.

**Course Unit No.**: OCG1252 **(from 2018 to date)**

**Name of the Course Unit**: Statistics for Experimental Analysis

**Objectives:** This Course Unit aims to make the student understanding on statistical methods for analyzing data

**Learning Outcomes**: At the completion of this course unit student should be able to apply statistics for experimental designing and analysing data

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment - 20%

**Course Unit Contents**: (24hrs Theory, 18 hrs Practical)
Types of data and presentations, populations and samples, measures of central tendency, measures of variability and dispersion, probabilities, the normal distribution, one-sample hypotheses, two-sample hypotheses paired-sample hypotheses, multi sample hypotheses, analysis of variance, multiple comparisons, data transformations, linear regression equations, linear correlation, multiple regression and correlation, polynomial regression, testing for goodness of fit

**References**:

Borradaile, G. 2010. Statistics of Earth Science Data. Springer.

## Courses for Level II Semester I

**Course Unit No.**: FSC2112 (2006-2017)

**Name of the Course Unit**: Basic Ecological Principles

**Objectives:** This Course Unit aims to make the student understand Ecological Principles to be applied for ecological studies

**Learning Outcomes**: Students should be able to describe the characteristics of a population
perform life table analysis and key factor analysis
describe growth models
explain the interactions among species and to demonstrate the possible scenarios of the competitions
calculate the energy transfer in ecosystem
analyze the distinguish properties of lotic and lentic ecosystems

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (70%)

End-of-semester examination (Practical) 1 1/2 hours duration - (30%)

**Course Unit Contents**: (Theory, 22 hrs; Practical, 24 hrs)

Population Ecology, Demographic Data Pyramids, Life Tables, Growth Models, Key Factor Analysis, Species Interactions, Community Characteristics, Patterns of Community Changes, Process of Succession, Energy Transfer in Ecosystems, Practical component

**References (Recommended Textbooks)** :

Lampert, W., and Sommer, U., 2007. Limno-Ecology: The ecology of Lakes and Streams. Second edition, Oxford University Press.

Walter K. D. and Whiles, M., 2010. Freshwater Ecology: Concepts and Environmental Applications of Limnology. Second edition, Academic Press.

**Course Unit No.**: FDN2110 (2006-2017). **FDN 2111** (from 2018 to date),

**Name of the Course Unit**: **INTERMEDIATE ENGLISH I**

**Objectives:** This Course Unit aims to make the student

**Learning Outcomes**: Students should be able to follow positive and negative commands and requests, identify specific details (numbers, letters, time reference, and key words) take part in classroom debates and deliver short welcome speeches.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs theory]

Reading; Practice reading of a variety of moderately complex narrative/ biographical/descriptive prose/short newspaper articles.
Writing; Paragraph writing, explaining information in a simple table, flow chart or diagram,
Listening; Dialogues, main and supporting ideas in lectures,
Speaking; Classroom debates, informal group discussions, formal speeches.
Grammar; Relative clauses, comparison, superlatives

**References**:

Murphy, R., 1989. Grammar in Use: Reference & Practice for Intermediate Students of English. Cambridge University Press.

**Course Unit No.**: **FDN 2121** (from 2018 to date)

**Name of the Course Unit**: Computer Literacy III

**Objectives:** This Course Unit aims to make the student understanding on use of simple programming

**Learning Outcomes**: Students should be able to explain and Use C programming language for simple programming - language syntax, compile and run time errors, variable declarations, operators, conditional statements, loops, arrays.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) 80%
Continuous Assessment (practical) 20 %

**Course Unit Contents**: [15 hrs theory]

Computer Programming Fundamentals (C-Language)

**References**:

Perry, G., Miller, D., 2013. C Programming Absolute Beginner's Guide. Third edition, Que Publishing .

**Course Unit No.**: FAQ2113 (2006-2017)

**Name of the Course Unit**: Fish Physiology and Biochemistry

**Objectives:** This Course Unit aims to make the student understanding on fish physiology

**Learning Outcomes**: Students should be able to describe each fish body system studied and explain their physiological functions

describe the adaptations in each body system to maintain their lives in an aquatic environment

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs theory]

Physiological and biochemical aspects related to sense organs, Endocrine organs and hormones, Digestion, Metabolism, Excretion and osmoregulation, Respiration, Reproduction, Swimming & activity of muscles, Immunology.

**References**:

Ostrander, G. K., 2000. *The Laboratory Fish.* 1 ed. s.l.:Elsevier

**Course Unit No.**: **FAQ2121 (2006-2017)**

**Name of the Course Unit**: Fish Behaviour

**Objectives:** This Course Unit aims to make the student understanding on fish behavioral patterns

**Learning Outcomes**: Students should be able to describe the physiological mechanism based on different behavioural patterns of fish
describe how the environment influences on the behavioural patterns of fish.
identify different fish behavioural adaptations for successful life in water

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 hour duration) - (100%)

**Course Unit Contents**: [15 hrs theory]

Behavioural patterns with respect to feeding, reproduction, parental care, territory, navigation, migration, etc.

**References**:

**Course Unit No.**: **FAQ 2131(2006-2017)**

**Name of the Course Unit**: Practical Course on Fish Physiology, Biochemistry & Behaviour

**Objectives:** This Course Unit aims to make the student understanding on fish physiology in practical

**Learning Outcomes**: Students should be able to
describe the role of each body system
identify the adaptation in each system for aquatic life
describe the impacts of environment on physiology of fish

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs practical]

Behavioural patterns with respect to feeding, reproduction, parental care, territory, navigation, migration, etc.
Laboratory exercises on fish physiology, Analysis of digestive enzymes, swimming modes of fish, Environmental effects on respiration & tolerance limits, Fish haematology, and reproductive physiology of fish. Laboratory exercise on fish behaviour.

**References**:

**Course Unit No.**: **FAQ2121 (2018 to date)**

**Name of the Course Unit**: Laboratory studies related to fish physiology

**Objectives:** This Course Unit aims to make the student

**Learning Outcomes**: Students should be able to describe the role of each body system
identify the adaptation in each system for aquatic life
describe the impacts of environment on physiology of fish

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs practical]

Laboratory exercises on fish physiology,
Analysis of digestive enzymes,
swimming modes of fish, Environmental effects on respiration & tolerance limits,
Fish haematology, and reproductive physiology of fish.
Laboratory exercise on fish behaviour.

**References**:

**Course Unit No.**: LIM 2112 (2006-2017)

**Name of the Course Unit**: Applications of Basic Ecological Principles to Freshwater Ecosystems

**Objectives:** This Course Unit aims to make the student confident on principles of Ecology

**Learning Outcomes**: Students should be able to apply ecological principles for studying functions of various freshwater ecosystems

**Course Unit Outline**: ecosystem functions, keystone species, and production of the ecosytems

**Prerequisite**: FSC2112

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (11/2 hours duration) - (100%)

**Course Unit Contents**: [30 hrs Theory]

Primary production & estimation methods, [3 hrs]

Seasonal variations of ecosystem functions, [6 hrs]

Annual changes of ecology [4 hrs]

Low & down fluctuations, [2hrs]

Local scenarios in lotic & lentic systems[7 hrs]

Distribution of zooplankton, Neuston, Periphyton & benthos specially in Sri Lanka, [5 hrs]

Secondary production & estimation methods, [3 hrs]

**References**:

Lampert, W., and Sommer, U., 2007. Limno-Ecology: The ecology of Lakes and Streams. Second edition, Oxford University Press.

Walter K. D. and Whiles, M., 2010. Freshwater Ecology: Concepts and Environmental Applications of Limnology. Second edition, Academic Press.

**Course Unit No.**: LIM 2121 (2006-2017)

**Name of the Course Unit**: Biodiversity and Diversity Indices

**Objectives:** This Course Unit aims to provide the knowledge on analysis of biodiversity of freshwater ecosystems

**Learning Outcomes**: Students should be able to apply different evaluation strategies of biodiversity

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination (1 hour duration) - (100%)

**Course Unit Contents**: [15 hrs Theory]

Ecosystem diversity, [2 hrs]

Species diversity, [2 hrs]

Genetic diversity, [1 hr]

Patterns of biodiversity (ά, ß, ð), [1 hr]

Threats to biodiversity, [2hrs]

Value of biodiversity, [2 hrs]

Biodiversity in Sri Lanka (lentic & lotic systems), [1 hrs]

Analysis of diversity & use of indices [4 hrs]

**References**:

Edward O. Wilson (1999). The Diversity Life, amaon.com
Maclaurin J. and Sterelny K. (2008). What is Biodiversity, University Chicago prints

**Course Unit No.**: LIM 2131 (2006-2017)

**Name of the Course Unit**: Laboratory Exercise on Basic Aquatic Ecology

**Objectives:** This Course Unit aims to provide practical experience on studying ecosystems functions and the importance

**Learning Outcomes**: Students should be able to conduct ecological research on various ecosystems

**Prerequisite**: No

**Assignments**: two group presentations based on two field visits

**Mode of Assessment**:

Presentation: 10%

End-of-semester Laboratory practical examination (1 ½ hrs) 90%

**Course Unit Contents**: [45 hrs Practical]

Sampling techniques to study the diversity and ecosystem functions [6 hrs]

Estimation of primary & secondary production, [6 hrs]

Qualitative & quantitative analysis of phytoplankton & zooplankton, [9 hrs]

Benthos & periphyton analysis [9hrs] , two field visits (15 hrs)

**References:**

Edward O. Wilson (1999). The Diversity Life, amaon.com
Maclaurin J. and Sterelny K. (2008). What is Biodiversity, University Chicago prints

**Course Unit No.**: LIM **2111** (2018 to date)

**Name of the Course Unit**: Physics of Water

**Objectives:** To develop student's ability to describe physical properties and behavior of water

**Learning Outcomes**: At the end of this course unit, students should be able to
describe the physical properties of water
explain the density variation responding to temperature fluctuations
analyze the phase diagram of water
define fundamentals of thermodynamics and fluid dynamics
describe the applications of supercritical water

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End semester exam (Theory) - 80 %
Class tutorials - 20%

**Course Unit Contents**: [15 hrs theory]

**References:** Spellman, F.R., 2014. The Science of Water: Concepts and Applications. Third edition, CRC Press.

**Course Unit No.**: LIM **2123** (2018 to date)

**Name of the Course Unit**: Theoretical Ecology and Ecological Modelling

**Objectives:** To develop student's ability to apply ecological principles to understand functions of aquatic ecosystems

**Learning Outcomes**: At the end of this course unit students should be able to
describe relationships between biotic-biotic and biotic-abiotic components
design ecological experiments
analyses ecological experimental data

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:
End semester exam (theory) – 80%
End semester exam (practical) – 20%

**Course Unit Contents**: [37 hrs theory, 24 hrs practical]
Introduction to ecology, Ecological principles and special features of aquatic habitats, Energy and material utilization, transition through biotic and abiotic interactions and niches aggregation, Primary and secondary production, Population dynamics and models applied in freshwater communities, growth models, Ecotones, Methods in ecological research.

**References:**

Lampert, W., and Sommer, U., 2007. Limno-Ecology: The ecology of Lakes and Streams. Second edition, Oxford University Press.

Walter K. D. and Whiles, M., 2010. Freshwater Ecology: Concepts and Environmental Applications of Limnology. Second edition, Academic Press.

**Course Unit No.**: LIM **2141** (2018 to date)

**Name of the Course Unit**: Biodiversity and Evaluation Strategies

**Objectives:** To develop student's ability to

- evaluate biodiversity at different ecosystems
- describe relationship between biodiversity and ecosystem functions

**Learning Outcomes**: At the end of this course unit students should be able to

calculate diversity at different ecosystems using appropriate methods
explain diversity using relevant indices
identify indicator species and their functions at different ecosystems

**Prerequisite**: No

**Assignments**: Report writing/presentation : 15%

**Mode of Assessment**: End semester exam; 85% (theory)
Report writing/presentation: 15%

**Course Unit Contents**: [12 hrs theory, 09 hrs practical]

Species diversity, ecosystem diversity and genetic diversity. Patterns of biodiversity (α, β and γ), Ecological indicators, indexes, and diversity indices for ecological conditions of various aquatic habitats

**References:** Edward O. Wilson (1999). The Diversity Life, amaon.com
Maclaurin J. and Sterelny K. (2008). What is Biodiversity, University Chicago prints

**Course Unit No.**: CHM2111 (from 2018 to date)

**Name of the Course Unit**: **Analytical Chemistry II**

**Objectives:** To develop student's ability to

- explain the fundamentals of electrochemistry and electroanalytical techniques
- apply electroanalytical techniques in chemical analyses
- describe the fundamentals of chromatography

**Learning Outcomes**: At the end of this course unit students should be able to

explain the fundamentals of electrochemistry

use instruments for electrochemical analyses

compare different electro analytical techniques

solve the mathematical problems in electrochemistry

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (theory) – 85%
End semester exam (Practical) – 15%

**Course Unit Contents**: (24hrs theory, 18 hrs practical)
Electrochemistry,Electro Analytical Chemistry: Classifications of electro analytical methods according to the electrical properties being measured, Fundamentals of electro chemistry, Potentiometric method, End point detection, Electrogravimetric and coulometric Methods; Electrogravimetric methods of analysis, Electrogravimetry, Coulometric Methods, Voltammetry,Excitation signals in voltametry, Voltametric Systems, Voltamograms, Introduction to Chromatography

**References:**
Bard, A. J., and Faulkner, L.R., 2000. Electrochemical Methods: Fundamentals and Applications. Second edition, Wiley.

Lundanes, E., Reubsaet, L., and Greibrokk T., 2013. Chromatography: Basic Principles, Sample Preparations and Related Methods. Wiley.

**Course Unit No.**: CHM**2122** (from 2018 to date)

**Name of the Course Unit**: **Organic Chemistry**

**Objectives:** To develop student's ability to;

- explain organic reactions and mechanisms

use laboratory techniques to identify organic compounds

**Learning Outcomes**: At the end of this course unit students should be able to,

classify organic compounds

recognize regioselective, stereoselective and stereospecific reactions.

use organic chemical laboratory techniques

**Course Unit Outline**:

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) – 70%
End semester exam (Practical) – 20%
Continuous assessments – 10%

**Course Unit Contents**: (24hrs theory, 18 hrs practical)
Basic concepts in Organic Chemistry, Nomenclature of Organic compounds, Conformational analysis, Isomerism, Structure and reactivity of Aliphatic compounds, Concept of Aromaticity and reactions of Aromatic compounds, Natural product Chemistry.

**References:**
Graham, T. W., Craig, B. F., and Scott, A. S., 2013. Organic Chemistry. Eleventh edition, Wiley.

Rensheng, X., Yang, Y. and Weimin, Z. 2012. Introduction to Natural Products Chemistry. CRC Press.

**Course Unit No.**: **OCG2111 (2006-2017)**

**Name of the Course Unit**: General Ecology of Marine & Coastal Ecosystems

**Objectives:** This Course Unit aims to make understanding on ecology principles applicable in marine ecosystem

**Learning Outcomes**: Students should be able to describe basic ecological principles
identify ecological interactions in marine and coastal ecosystems
describe routes of energy transfer marine and coastal ecosystems

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, theory (1 hour duration) - (100%)

**Course Unit Contents**: [15 hrs theory]

Energy flow within marine ecosystems-Important food chains, food webs & pyramids in marine environments, important interactions among marine organisms (predation, parasitism, symbiosis and commensalisms)

**References:**

**Course Unit No.**: **OCG2122 (2006-2017)**

**Name of the Course Unit**: Biological Oceanography

**Objectives:** This Course Unit aims to provide knowledge on biology in ocean

**Learning Outcomes**: Students should be able to describe diversity of different coastal and marine ecosystems
Describe adaptations and distribution of flora/fauna with respect to the ecosystem
Identify primary producers in coastal and marine ecosystems
Describe contribution of marine primary producers for global primary productivity
Identify reef forming species and describe their contribution

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, theory (1 hour duration) - (100%)

**Course Unit Contents**: [30 hrs theory]

Diversity of organisms in different marine & coastal ecosystems and their contribution to productivity in marine ecosystems, Photosynthetic organisms & primary productivity, Chemosynthetic organisms & their contribution to marine ecosystems, Benthic communities & their contribution to reef formation, Toxic organisms, Red tides etc., Bioluminescence

**References:**

**Course Unit No.**: **OCG2131 (2006-2017)**
**Name of the Course Unit**: General Ecological Surveys on Marine and Coastal Ecosystems

**Objectives:** This Course Unit aims to provide principles of ecology and methods to be applied for Surveys on Marine and Coastal Ecosystems

**Learning Outcomes**: Students should be able to Design sampling plan to assess biodiversity of a given ecosystem
Analyze biodiversity data
Analyze physiochemical parameters in coastal and marine ecosystems
Present results of a field survey through oral and written communication

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, practical (11/2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs practical]

Field surveys and laboratory experiences to study biodiversity indices for marine & coastal ecosystems**,** Studies on biological & physicochemical parameters**,** Studies on interactions among organisms and with the physical & chemical environment & niche segregation

**References:**

**Course Unit No.**: **OCG2141 (2006-2017)**
**Name of the Course Unit**: Tectonics and Ocean Basins

**Objectives:** This Course Unit aims to provide knowledge on plate tectonic theories

**Learning Outcomes**: Students should be able to explain plate tectonics
explain how ocean basins are developed by plate tectonics.
expalin features at the ocean basins and how they are being developed.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, practical (11/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs theory]

Structure and formation of oceanic lithosphere, Super continents, Continental drift and plate tectonics, Wilson cycle, Continental margins, Sea mounts and volcanic islands, evolution of Indian, Pacific and Atlantic basins, Geological characteristics of each basin

**References:**

**Course Unit No.**: OCG2111 (from 2018 to date as an optional course)

**Name of the Course Unit**: Tectonics and Ocean Basins

**Objectives:** This Course Unit aims to provide knowledge on tectonic theories

**Learning Outcomes**: Students should be able to explain

- plate tectonics
- how ocean basins are developed by plate tectonics
- features at the ocean basins and how they are being developed

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment - 20 %

**Course Unit Contents**: [15 hrs theory]

Structure and formation of oceanic lithosphere, Super continents, Continental drift and plate tectonics, Wilson cycle, Continental margins, Sea mounts and volcanic islands, evolution of Indian, Pacific and Atlantic basins, Geological characteristics of each basin

**References:** Kennett, J. 1982. Marine Geology, Prentice Hall.

Open University, 1998. The Ocean Basins; Their Evolution and Structure. Second edition, Butterworth-Heinemann.

**Course Unit No.**: OCG2122 (from 2018 to date)

**Name of the Course Unit**: Marine Biology–Flora

**Objectives:** To develop students ability to

- distinguish different species of marine algae and seagrass
- identify mangrove, seashore and sand dune flora
- describe adaptations of different species of marine flora in their respective habitats.
- device methods to assess diversity and abundance of marine flora in shallow, coastal marine habitats

**Learning Outcomes**: At the end of this course unit students should be able to

identify marine flora (Marine algae/seagrass/Mangroves) and seashore vegetation up to genus/species level

describe morphological and taxonomic differences in species of marine algae, sea grass, mangroves and seashore flora

identify adaptations of above flora for their respective habitats

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
End Semester exam (Practical) - 20%

**Course Unit Contents: (24 hrs theory, 18hrs practical)**

Diversity and classification of marine flora, basic characteristics and biology of sea grass, sea weeds, sea shore vegetation, mangroves.

**References:** Dring, M.J.,1982. The Biology of marine plants , Edward Arnold.

**Course Unit No.**: OCG2142 (from 2018 to date)

**Name of the Course Unit**: Marine Biology – Vertebrate Fauna

**Objectives:** To develop students ability to

- identify different species of protochordates, marine fish, marine reptiles, marine birds and marine mammals.
- describe basic biology (form and function) of above mentioned vertebrate groups.
- describe adaptations of above species for their respective habitats.

**Learning Outcomes**: At the end of this course unit students should be able to

Identify marine vertebrates up to genus/species level
Identify unique characteristics of each group
Describe morphological and taxonomic differences between different species
Identify adaptations of marine fauna for their respective habitat

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (theory) – 80%
End semester exam (practical) – 20%

**Course Unit Contents:** (24 hrs theory, 18hrs practical)
Protostomes and deuterostomes, protochordates, diversity of marine vertebrates, Basic characteristics/form and function of different group: Reptilia (Orders Chelonia, Crocodilia, sub order Ophidia) Aves, Mammalia

**References:**
John M. and Sumich, J, L, 2010. Introduction to the Biology of Marine Life. Tenth edition, Jones & Bartlett Learning.

# Courses for Level 2 Semester II

**Course Unit No.**: **FDN 2220 (2006-2017)** FDN2211 (from 2018 to date),

**Name of the Course Unit**: **INTERMEDIATE ENGLISH II**

**Objectives:** This Course Unit aims to provide knowledge on correct use of English language

**Learning Outcomes**: At the end of the course unit students should be able to
read and understand extended texts containing complex language, write passages using a variety of complex structures,
understand the content of a formal meeting,
prepare a general presentation

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, theory (3 hours duration) - (100%)

**Course Unit Contents**: [15hrs theory]

Reading; Practice reading of a variety of moderately complex narrative/ biographical/descriptive prose/short newspaper articles. Writing; Paragraph writing, explaining information in a simple table, flow chart or diagram, Listening; Dialogues, main and supporting ideas in lectures, Speaking; Classroom debates, informal group discussions, formal speeches. Grammar; Relative clauses, comparison, superlatives

**References:** Murphy, R., 1989. Grammar in Use: Reference & Practice for Intermediate Students of English. Cambridge University Press.

**Course Unit No**: FDN2221 (from 2018 to date)

**Name of the Course Unit:** Computer Literacy IV

**Objectives:** To provide knowledge on the use of computer programming languages

**Curriculum learning outcomes:** At the end of the course unit students should be able to
use MATLAB for their own project work,
prepare and tackle other procedural languages such as C++ or Visual Basic for model building..

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) 80%
Continuous Assessment (practical) 20 %

**Course Unit Contents**: [15hrs theory]

Reading; Practice reading of a variety of moderately complex narrative/ biographical/descriptive prose/short newspaper articles. Writing; Paragraph writing, explaining information in a simple table, flow chart or diagram, Listening; Dialogues, main and supporting ideas in lectures, Speaking; Classroom debates, informal group discussions, formal speeches. Grammar; Relative clauses, comparison, superlatives

**References:**

Perry, G., Miller, D., 2013. C Programming Absolute Beginner's Guide. Third edition, Que Publishing .

**Course Unit No.**: **FAQ2211 (2006-2017)**

**Name of the Course Unit**: **Fishing gear and Craft Technology**

**Objectives:** This Course Unit aims to provide

**Learning Outcomes**: Students should be able to

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, theory (1 hour duration) - (100%)

**Course Unit Contents**: [15 hrs theory]

Different fishing methods and gear types, Primitive and modern techniques, Designs & vessel construction methods, Vessel types and accessories.

**References:**

**Course Unit No.**: FAQ2223 **(2006-2017), FAQ 2213 (2018 to date)**

**Name of the Course Unit**: Fish Population Dynamics

**Objectives:** To develop student's ability to

- use of fish stock assessment methodologies and determine fish population fluctuations over the time
- assess the selectivity of commonly used fishing gears

**Learning Outcomes**: At the end of the course unit students should be able to

apply fish stock assessment techniques
estimate fish population fluctuations
calculate gear selectivity of commonly used fishing gear

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, theory (2hours duration) - (100%)

**Course Unit Contents**: [45 hrs theory]

Fish stocks and stock identification, Length-Weight relationships, Length frequency analysis, Fish growth models, Growth parameters and parameter estimation, Recruitment and selection, Mortality, Fish yield predictive models.

**References:**

**Course Unit No.**: FAQ2231 (in 2006 FAQ 2221) (2006-2017)

**Name of the Course Unit**: Practical Course on Fishing Gear and Crafts & Fish Population Dynamics

**Objectives:** This Course Unit aims to provide practical exposure on relevant fields

**Learning Outcomes**: Students should be able to ……

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

End-of-semester examination, Practical (2hours duration) - (100%)

**Course Unit Contents**: [45 hrs Practical]

Laboratory studies on models of fishing gears and vessels, Laboratory studies on length weight relationships, Length frequency and analysis, growth models.

**References:**

**Course Unit No.**: LIM 2212 (2006-2017)

**Name of the Course Unit**: Aquatic Pollution

**Objectives:** This Course Unit aims to make the student confident on pollution estimation methods and migratory measures applicable for local scenarios

**Learning Outcomes**: Students should be able to carry out complete study on determination of different pollution levels at local aquatic ecosystems

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester Practical examination (11/2 hours duration) - (30%)

End-of-semester Theory examination (11/2 hours duration) - (70%)

**Course Unit Contents**: [24 hrs Theory and 21 hrs Practical]

Catchment base pollution, [3 hrs] , Lake itself pollution, [3 hrs] , Human interventions, [2 hrs]

Fate dynamics of pollutants, [3 hrs] , Water quality concepts for pollution, [4 hrs]

Indices for pollution, [4hrs] , Legal aspects, [ 2hrs] , Quality criteria and Policy issues [2 hrs]

**References**:

Edward, A.L., 2013. Aquatic pollution: an introductory text. Third edition, Wiley.

**Course Unit No.**: LIM 2222 (2006-2017)

**Name of the Course Unit**: Aquatic Toxicology

**Revised Name:** Aquatic Toxicology and Human Health Risk [24 hrs Theory and 21 hrs Practical), from 2018 to date as an optional course

**Objectives:** This Course Unit aims to make the student understand fundamentals of Toxicology

**Learning Outcomes**: Students should be able to define the toxicity and key words used in toxicology.

- Numerically explain the toxicity of any substance on a given aquatic organisms.
- Explain the dose response relationships.
- Study local scenarios for understanding on toxicants in aquatic environments, their risk for human health and mitigatory measures.

**Prerequisite**: No

**Assignments**: presentations/reports

**Mode of Assessment**:

1. Continuous assessment - (30%)

2. End-of-semester examination (1 1/2 hours duration) - (70%)

**Course Unit Contents**: (theory 24 hrs, practical 21 hrs)

Manmade toxicants & biotoxins, toxicity tests, [7 hrs]

Dose-response relationships, [3 hrs]

Quantification of toxicants & the effects, [4 hrs]

Biological approach, testing organisms (4hrs)

Study the local scenarios [6 hrs]

practical 21 hrs: laboratory experiments for determination of different toxic endpoints

**References**: Gary M. R.1995, Aquatic Toxicology Effects, Environmental Fate and Risk Assessment. CRC Press.

Marvin R. 2011.Risk Assessment: Theory, methods and Applications, Wiley.

**Course Unit No.**: LIM2212 (from 2018 to date)

**Name of the Course Unit**: Limnology of Wetlands, Lagoons and Estuaries

**Objectives:** This Course Unit aims to make the student understand Limnology of Wetlands, Lagoons and Estuaries

**Learning Outcomes**: At the end of the course unit students should be able to,
explain ecological functions
describe importance of Wetlands, Lagoons and Estuaries

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) – 80%
Continuous Assessment (Practical) – 20%

**Course Unit Contents**: (theory 24 hrs, practical 18 hrs)
Geography of wetlands, geology and chemistry of wetlands, wetland ecosystems, physical and chemical processes of wetlands; biology, biodiversity and ecology different types of wetlands; Ecosystem services and values of wetlands; General features of lagoons and estuaries, sediment transportation and dynamics, chemical composition and processes in brackish waters, specific biological communities and their adaptations, and maintenance of their populations. Practical and field visits for estimation of ecosystem services and valuation

**References**: Shouldiam J. M., 2015. Wetlands. Fifth edition, Wiley.

John W. D., 2012. Estuarine Ecology. Second edition, Wiley-Blackwell.

**Course Unit No**: CHM2212 (from 2018 to date)

**Name of the Course Unit:** Physical Chemistry I

**Objectives:** To develop student's ability to
explain the fundamentals of physical chemistry
use laboratory techniques in physical chemistry

**Learning outcomes:** Students should be able to
explain concepts and facts in physical chemistry

- analyze and solve advanced problems with critical thinking
- employ a range of instrumental and non-instrumental laboratory techniques for the measurement of physical parameters.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) – 70%
End semester exam (Practical) – 10%
Continuous assessments – 20%

**Course Unit Contents**: (theory 24 hrs, practical 18 hrs)
Colligative properties,
chemical thermodynamics,
gaseous state of matter,
Chemical Kinetics, photochemistry, (th and Pr)
surface & colloidal chemistry (th and Pr)

**References**: Atkins, P.W. and Paula, J.D., 2009, Physical Chemistry. Ninth edition, Oxford University Press.

**Course Unit No.**: **OCG2212** (2006-2017)

**Name of the Course Unit:** Physical Oceanography

**Objectives:** This Course Unit aims to make the student understand theories and applications of physical oceanography

**Learning Outcomes**: Students should be able to ……

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: (theory 30 hrs),

Physical properties of sea water – conductivity, specific gravity, density, surface tension, viscosity; Movement of water masses in the oceans - Coriolis effect, Ekman spiral, currents & thermohaline vertical currents, *El-nino* & *La Ninna;* Waves- surface waves, tides, seiches, Storm waves & tsunami.

Air bubble formation in the sea & its effect on salt transportation to land; Behaviour of temperature in sea water - Thermocline, Halocline & Pycnocline; Behaviour of sound in sea water -pressure changes in oceans

**References**:

**Course Unit No.**: **OCG2222** (2006-2017)

**Name of the Course Unit:** Chemical Oceanography

**Objectives:** To develop Student's ability to

- explain the chemical nature of the oceans
- apply the knowledge gained to survey the ocean phenomena

**Learning Outcomes**: At the end of the course unit students should be able to
describe conservative, non-conservative and trace elements and their behaviour in the oceans
describe biogeochemical cycles of the major nutrients within the oceans.

explain behaviour of dissolved gases and their impact on ocean anoxia and carbonate chemistry.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: (theory 30 hrs),

Chemistry of sea water- Major, minor and trace constituents, Salinity of sea water, Conservative and non-conservative properties of sea water, Residence time, Dissolved gases (Oxygen, Carbondioxide, Nitrogen, Oozes (carbonate & siliceous), Carbonate rock formation, Manganese nodule formation

**References**: Millero, F.J., 2013 Chemical Oceanography. CRC press

**Course Unit No.**: OCG2231 **(2006-2017)**

**Name of the Course Unit:** Field and Laboratory Exercise on Physical & Chemical Oceanography

**Objectives:** This Course Unit aims to make the student understand on analysis of Physical & Chemical Oceanographic conditions

**Learning Outcomes**: Students should be able to describe conservative, non-conservative and trace elements and their behaviour in the oceans
describe biogeochemical cycles of the major nutrients within the oceans.

explain behaviour of dissolved gases and their impact on ocean anoxia and carbonate chemistry.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: (Practical 45 hrs),

Estimate of salinity, conductivity, DO, BOD, COD, phosphate, nitrate, major & minor elements, etc., Use of oceanographic equipment (water samplers, core samplers, salinometer, oxygen meter, echosounder, flow meter, tide gauge, current meter, etc).

**References**: Millero, F.J., 2013 Chemical Oceanography. CRC press

**Course Unit No**: OCG2222 (from 2018 to date) as an optional course

**Name of the Course Unit:** Geomorphology and Morphometric Analysis

**Objectives:** This Course Unit aims to make the student understand on stimulating earth morphometric data

**Curriculum learning outcomes:** Students should be able to
explain earth shaping processes
simulate those processes through computer modelling

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
Physical and chemical weathering, Fluvial processes and land forms, wind processes and land forms, glacial land forms, Earth's surface features as functions of geological structures, processes and time. Landform analysis using topographic maps and some stereographic aerial photos. Trigonometry, Introductions to surface mapping and modeling, Surface geometry, Watersheds and Drainage

**References**:

Hengl, T., and Reuter, H. I., 2008. Geomorphometry: Concepts, Software, Applications (Development in Soil Science), Elsevier.

**Course Unit No**: OCG2233 (from 2018 to date)

**Name of the Course Unit:** Chemical Oceanography

**Objectives**: To develop Student's ability to

- explain the chemical nature of the oceans
- apply the knowledge gained to survey the ocean phenomena

**Learning outcomes:** Students should be able to aware of

- conservative, non conservative and trace elements and their behaviour in the oceans
- biogeochemical cycles of the major nutrients within the oceans.
- the behaviour of dissolved gases and their impact on ocean anoxia and carbonate chemistry.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (30 hrs Theory, 45hrs Practical)
Major, minor, and trace elements, micronutrients, and organic matter in the ocean, carbonate system, dissolved gases, ionic interactions, atmospheric chemistry and ocean.

**References**

Millero, F.J., 2013 Chemical Oceanography. CRC press.

**Course Unit No**: OCG2243 (from 2018 to date)

**Name of the Course Unit:** Physical Oceanography

**Objectives:** To develop student's ability to

- explain the theories of physical oceanography
- explain the basic physical processes of the ocean
- practice data analysis techniques, observational methods, and instrumentation use by physical oceanographers

**Curriculum learning outcomes:** At the completion of this course unit students should be able to

describe the basic physical processes of the ocean
describe observational methods and instrumentation use by physical oceanographers
apply principles and data analysis techniques to solve problems related to physical oceanography

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 65%.
Continuous assessments - 10 %
End semester exam (Practical) - 25%

**Course Unit Contents**: (30 hrs Theory, 45hrs Practical)
Temperature, salinity and density, upper ocean response to winds, Geotropic currents, wind driven circulation, vortices in the ocean, deep circulation, equatorial processes, Ocean waves, coastal processes and tides.

**References**

Knauss, J. A., 2005. Introduction to Physical Oceanography. Second edition, Waveland Pr Inc.

**Course Unit No**: OCG 2253 (from 2018 to date)

**Course Unit Name:** Biological Oceanography (30 hrs Theory, 45hrs Practical)

**Objectives:** To develop students ability to

- identify appropriate methods for measure primary production in different coastal and marine ecosystems
- device methods to measure bioerosion, reef growth and calculate reef carbonate budgets

**Curriculum learning outcomes:** At the end of the course unit students should be able to
describe diversity of different coastal and marine ecosystems
describe adaptations and distribution of flora/fauna with respect to the ecosystem
identify primary producers in coastal and marine ecosystems
describe contribution of marine primary producers for global primary productivity
identify reef forming species and describe their contribution
describe bioluminescence processable

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 65%
Continuous Assessment (Practical) - 35%

**Course Unit Contents**: (30 hrs Theory, 45hrs Practical) Diversity of marine ecosystems, Zonation, Benthic/pelagic communities, Primary and secondary production in ocean, factors regulating primary production, Photosynthetic and Chemosynthetic organisms, Benthic communities and their contribution to reef formation and erosion, Toxic organisms, Red tides etc. Interactions among marine organisms.

**References**

Carol, L., Timothy R. P., 1997. Biological Oceanography; An Introduction. Butterworth-Heinemann.

# Courses for Level 3 Semester I

**Course Unit No.**: FDN3110 (2006-2018), **FDN3111** (from 2019),

**Name of the Course Unit: ADVANCED ENGLISH I**

**Objectives:** This Course Unit aims to make the student understand on general texts and those relating to their academic subjects

**Learning Outcomes**: At the end of the course unit students should be able to,
ILO 1: comprehend and extract required information from general texts and those relating to their academic subjects,
ILO 2: write essays, reports and articles, and prepare presentations

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (3 hours duration, theory) - (100%)

**Course Unit Contents**: (**(Theory, 15hrs;)**

Reading: Practice reading texts, both general and academic,
Writing: Essay writing, report-writing,
Listening: Practice advanced listening texts,
Speaking: Preparing an academic presentation,
Grammar: The infinitive, word order

**References**:

Murphy, R., 1989. Grammar in Use: Reference & Practice for Intermediate Students of English. Cambridge University Press.

**Course Unit No**: **FDN3122 (ND) (from 2019)**

**Name of the Course Unit:** Information Literacy and Library Skills

**Objectives:** This Course Unit aims to make the student understand on use of Information Literacy and Library Skills to their academic subjects and research

**Curriculum learning outcomes:** Students should be able to determine the extent of information needed and locate appropriate sources.

- evaluate information and its sources critically
- organize the information obtained and use them effectively to accomplish a specific purpose.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:
End Semester Exam (Theory)-80%
Assessment (continuous) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
Introduction to Information Literacy,
Organization of knowledge, Information search and retrieval, Evaluating information sources, legal and ethical use, Copyright and plagiarism, effective communication.

**References**:

University of Chicago press staff, 2010. The Chicago manual of style. Sixteenth edition, University of Chicago press.

**Course Unit No.**: **FAQ3113 (2006-2018)**

**Name of the Course Unit:** Basic-economics for Aquaculture and Fisheries

**Objectives:** This Course Unit aims to make the student understand on different economic theories in fisheries and aquaculture

**Learning Outcomes**: At the end of this course unit students should be able to,
apply the different economic theories in fisheries and aquaculture.
manage demand and supply chains for sustainable fish market

analyze the set of socio economic data which applicable in fisheries and aquaculture

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 1/2 hours duration, theory) - (70%)

End-of-semester examination (1 1/2 hours duration, Practical) - (30%)

**Course Unit Contents**: (**(Theory, 38 hrs; Practical, 21 hrs)**
Introduction to economics, Micro and Macroeconomics, Resource, Environmental, Agricultural, Fisheries & Aquaculture economics, Bio-economic modelling, Production economics, Demand and supply of fish and fishery products, Farm management, planning and operation, Marketing of fish and fishery products; Introduction to social research methods; Socio-economics.

**References**:

**Course Unit No.**: **FAQ 3112 (from 2019)**

**Name of the Course Unit:** Basic-economics for Aquaculture and Fisheries

**Objectives:** This Course Unit aims to make the student understand different economic theories in fisheries and aquaculture.

**Learning Outcomes**: At the end of this course unit students should be able to,
apply the different economic theories in fisheries and aquaculture.
manage demand and supply chains for sustainable fish market

analyze the set of socio economic data which applicable in fisheries and aquaculture

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 1/2 hours duration, theory) - (75%)

End-of-semester examination (1 1/2 hours duration, Practical) - (25%)

**Course Unit Contents**: **(Theory, 38 hrs; Practical, 21 hrs)**
Introduction to economics, Micro and Macroeconomics, Resource, Environmental, Agricultural, Fisheries & Aquaculture economics, Bio-economic modelling, Production economics, Demand and supply of fish and fishery products, Farm management, planning and operation, Marketing of fish and fishery products; Introduction to social research methods; Socio-economics.

**References**:

**Course Unit No.**: **FAQ3121 (from 2019 to date)**

**Name of the Course Unit:** Behavior of Fish

**Objectives:** This Course Unit aims to make the student ability to categorize different fish behavior patterns

**Learning Outcomes**: Students should be able to describe the physiological mechanism based on different behavioral patterns of fish
describe how the environment influences on the behavioral patterns of fish.
identify different fish behavioral adaptations for successful life in water

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 1/2 hours duration, theory)

**Course Unit Contents**: **(Theory, 14 hrs; Practical, 3 hrs)**
Behavioural patterns with respect to feeding, reproduction, Parental care, territory, Navigation, migration, etc.

**References**: Fishes: An Introduction to Ichthyology (Peter B. Moyle, Joseph J. Cech)

**Course Unit No.**: **AQU3112 (2006 to date)**

**Name of the Course Unit:** Aquaculture I-Introduction

**Objectives:** This Course Unit aims to make the student understand aquaculture and its importance

**Learning Outcomes**: Students should be able to explain the history and present status of aquaculture (global & Sri Lankan)
describe the importance of aquaculture in global economy and food security
describe different aquaculture systems
describe the criteria to select suitable sites and suitable species for aquaculture
identify the parts of earthen ponds and also able to describe the steps in pond construction
explain the impacts of aquaculture on natural environment

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 1/2 hours duration, theory) - (70%)

End-of-semester examination (1 1/2 hours duration, Practical) - (30%)

**Course Unit Contents**: (**(Theory, 24 hrs; Practical, 18 hrs)**
History & present status, Scope and role of aquaculture, Different type of aquaculture systems, Species selection, Site selection, Environmental demands; Pond construction

**References**:

**Course Unit No.**: **AQU3122 (2006-2018)**

**Name of the Course Unit: Aquaculture II-Feeds & Nutrition**

**Objectives:** This Course Unit aims to develop student's ability to

- apply principles of fish nutrition

**Learning Outcomes**: At the end of this course unit students should be able to,
describe the principles of nutrition and the nutritional requirements of cultured aquatic organisms
Apply feed formulation techniques
Identify live feeds used in aquaculture
Apply live feed culture techniques
Distinguish the importance of nutrients in maintaining healthy fish

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End-of-semester examination (1 1/2 hours duration, theory) - (75%)
End-of-semester examination (1 1/4 hours duration, Practical) - (25%)

**Course Unit Contents**: **(Theory, 24 hrs; Practical, 18 hrs)**

Major Nutrients, Nutrient requirements of fish , Artificial feed formulation, preparation and evaluation, Feeding strategies, Nutritional fish pathology; Culture of live feed

**References**:


1. Fish Nutrition in Aquaculture (**de Silva**, S.S., **Anderson**, T.A.)
2. Aquaculture: Principles and Practices ( T. V. R. Pillay & M. N. Kutty)

**Course Unit No.**: **AQU3123 (from 2019 to date)**

**Name of the Course Unit: Aquaculture II-Feeds & Nutrition**

**Objectives:** This Course Unit aims to make the student understand

**Learning Outcomes**: At the end of this course unit students should be able to,
describe the principles of nutrition and the nutritional requirements of cultured aquatic organisms
Apply feed formulation techniques
Identify live feeds used in aquaculture
Apply live feed culture techniques
Distinguish the importance of nutrients in maintaining healthy fish

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

**End-of-semester examination** (1 1/2 hours duration, theory) - (75%)
**End-of-semester examination** (1 1/4 hours duration, Practical) - (25%)

**Course Unit Contents**: (**(Theory, 24 hrs; Practical, 18 hrs)**
Major Nutrients, Nutrient requirements of fish , Artificial feed formulation, preparation and evaluation, Feeding strategies, Nutritional fish pathology; Culture of live feed

**References**:


1. Fish Nutrition in Aquaculture (**de Silva**, S.S., **Anderson**, T.A.)
2. Aquaculture: Principles and Practices ( T. V. R. Pillay & M. N. Kutty)

**Course Unit No.**: **FSH3113 (2006 to date)**

**Name of the Course Unit: Capture Fisheries**

**Objectives:** This Course Unit aims to make the student understand fishery resources in different regions in the world

**Learning Outcomes**: At the end of this course unit students should be able to,
describe the fishery resources in different regions in the world
utilize the acquired knowledge on consumption of fishery resources with maximum economical gain
evaluate the development of fisheries sector

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (2 hours duration) - (100%)

**Course Unit Contents**: **(Theory, 38 hrs; Practical, 21 hrs)**
Capture Fisheries of the world; Capture Fisheries of Sri Lanka – Marine, Brackish water and Freshwater fisheries.

**References**:

**Course Unit No: FAQ3132 (from 2019 to date)**

**Course Unit Name:** Microbiology for Aquaculture and Fisheries

**Objectives:** To develop student's ability to
explain basic microbiological applications on fisheries and aquaculture
apply basic microbiological techniques on fisheries and aquaculture

**Curriculum Learning Outcomes:** At the end of this course unit students should be able to,
describe microbial community analysis and gut microbial community in fish
describe different microbiological approaches which are used for aquaculture
apply basic microbiological techniques on fisheries and aquaculture

**Prerequisite**: No

**Assignments**: No

**Course Unit Contents**: **(Theory, 14 hrs; Practical, 3 hrs)**
Microbial community analysis
Gut microbial community of fish
Applications of microbiology in aquaculture, fisheries and fish processing
r-k selection, probiotics, prebiotics, biofloc technology
Quorum sensing and management of microbial community towards functionality
Basic microbiological techniques

**Mode of Assessment**:

End semester theory (75%), Practical (25%)

**References**: Vadstein, O., Attramadal, K., Bakke, I. and Olsen, Y. (2018). K-Selection as Microbial Community Management Strategy: A Method for Improved Viability of Larvae in Aquaculture. *Frontiers in Microbiology*, 9.
RINGØ, E., OLSEN, R., GIFSTAD, T., DALMO, R., AMLUND, H., HEMRE, G. and BAKKE, A. (2010). Prebiotics in aquaculture: a review. *Aquaculture Nutrition*, 16(2), pp.117-136.
Bentzon-Tilia, M., Sonnenschein, E. and Gram, L. (2019). *Monitoring and managing microbes in aquaculture - Towards a sustainable industry*.
Boone, D., Castenholz, R., Garrity, G. and Bergey, D. (2001). *Bergey's manual of systematic bacteriology*. New York: Springer.

Burdass, D., Grainger, J. and Hurst, J. (2005). *Basic practical microbiology*. Reading, U.K.: Society for General Microbiology.

**Course Unit No: AQU3132 (from 2019 to date)**

**Course Unit Name:** Methods for Aquaculture I for tropical finfish species

**Objectives:** To develop student's ability to

compare and contrast different culture methods applied for different finfish species commonly cultured in Sri Lanka At the end of this course, students should be able to. …

**Curriculum Learning Outcomes:** At the end of this course unit students should be able to,

identify different carp species, Tilapia and ornamental fish species commonly cultured in Sri Lanka

compare culture requirements and methods of Indian carps, Chinese carps, Tilapia and Ornamental fish

plan pond fertilization and liming

calculate the requirement for fertilization and liming

develop polyculture system

**Prerequisite**: No

**Assignments**: No

**Course Unit Contents**: **(Theory, 23 hrs; Practical, 21 hrs)**

Identification of Major carps and methods of carp culture

Tilapia culture and methods to control Tilapia reproduction

Ornamental fish culture

Pond fertilization and liming

Polyculture

**Mode of Assessment**: theory (75%), practical (25%)

**References**: Aquaculture Technology and Environment (2015), Ujwala Jadhau

El Sayed, A., 2006. *Tilapia Culture*. CABI.

Boyd, C., 1996. *Water Quality In Ponds For Aquaculture*. Songkhla, Thailand: Shrimp Mart (Thai) Co.

**Course Unit No: FSH3121 (2006 to 2018), FSH3131 (2019 to date)**

**Course Unit Name:** Fisheries Oceanography

**Objectives:**

**Curriculum Learning Outcomes:**

At the end of this course, students should be able to…….

**Prerequisite**: No

**Assignments**: No

**Course Unit Contents**: **(Theory, 12 hrs; Practical, 09 hrs)**

**Mode of Assessment**:

**References**:

**Course Unit No.**: LIM 3113 (2006-2018) as an optional course

**Name of the Course Unit**: Water and Wastewater Treatment

**Objectives:** This Course Unit aims to make the student understand different water and wastewater treatment methods

**Learning Outcomes**: At the end of the Course unit students should be able to design appropriate treatment technique for different water and wastewater types

**Prerequisite**: No

**Assignments**: No

**Course Unit Contents**: [38 hrs Theory and 24 hrs Practical]

Industrial & drinking water treatment methods,

Municipal waste water treatment methods,

Water quality management,

Natural processes to remove pollutants,

Established standards for different aspects

**Mode of Assessment**:

1. Continuous assessment (field reports, Viva voce)- (30%)

2. End-of-semester examination Theory (1 1/2 hours duration) - (70%)

**References**:

David, H., 2010.Fundamentals of water treatment unit process: physical, chemical and biological. CRC press.

**Course Unit No.**: LIM 3112 (2006-2018) as an optional course

**Name of the Course Unit**: Ecological Risk and Human Health Risk of Pollutants

**Objectives:** This Course Unit aims to make the student understand risk assessment methods for ecological and human health risk

**Learning Outcomes**: Students should be able to decide the appropriate data for risk assessment

Able to decide the relevant risk assessment methods for considered cases

Able to evaluate acceptable limits of the risk of the cases

Able to carry out social survey and design laboratory experiment for the risk assessment

**Prerequisite**: No

**Assignments**: submission of reports for assigned group experiment (sub topics are assigned to each)

**Mode of Assessment**:

Group assessment - (30%)

End-of-semester examination theory (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [24 hrs Theory and 18 hrs group experiment]

Evaluation of Ecological Risk, [4 hrs]

Human risk of pollutants & toxicants, [5hrs]

Expose & non-expose relationships, [5hrs]

Relative risk, Intensity, prevalence, & frequency of risk [4 hrs]

Case studies [6 hrs]

**References**:

Marvin R. 2011.Risk Assessment: Theory, methods and Applications, Wiley.

**Course Unit No**: LIM 3121 (from 2019 to date as an OP for Aquaculture)

**Name of the Course Unit:** Geochemistry

**Objectives:** To develop student's ability to understand earth processes

**Curriculum learning outcomes:** At the end of this course unit students should be able to,
explain how geochemistry can be applied to understand Earth processes.
apply geochemical knowledge to solve environmental and health issues

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End Semester exam (Theory)-100%

**Course Unit Contents**: (15 hrs Theory)
Behaviour of major and trace elements in different soil-water systems,
Geochemical Cycles,
Geological, chemical and biological processes for the mineral dissolution and precipitation,
microbial processes in the control of pH, redox and nutrient cycling,
determining `background' metal concentrations,
preparing and the use of geochemical maps,
geochemistry for human health: toxicity and deficiency.

**References**:

Nelson, E., 2003. Principles of Environmental Geochemistry. Cengage Learning.

**Course Unit No**: LIM 3132 (from 2019 to date)

**Name of the Course Unit:** Aquatic Pollution

**Objectives:** To develop student's ability to analyse pollution status

**Curriculum learning outcomes:** Students should be able to describe the sources and types of water pollution.

explain biological and chemical analytical techniques for the measurement and control of aquatic pollution.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: ((24 hrs Theory, 18hrs Practical)
Sources, and types of aquatic pollutants, their fate and transport mechanism, chemical methods and biological indices for estimation of aquatic pollution.

**References**: Edward, A.L., 2013. Aquatic pollution: an introductory text. Third edition, Wiley.

**Course Unit No**: LIM 3142 (from 2019 to date as an optional course for Aquaculture)

**Name of the Course Unit:** Water Treatment Technology

**Objectives:** To develop student's ability to understand various water treatment techniques

**Curriculum learning outcomes:** At the end of this course unit students should be able to,
explain the major physical, chemical and biological characteristics of clean fresh water, and their importance for aquatic organisms
explain the standard processes for producing potable water
explain issues of nitrates, trace organics, and fluoridation that can be dealt with potable water supply.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 60%
Continuous Assessment (Theory) - 20%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
Established water quality standards for different purposes and discharge, different techniques of Water treatment for Drinking, Industrial and other purposes. field visits to study different treatment techniques

**References**: David,H., 2010.Fundamentals of water treatment unit process: physical, chemical and biological. CRC press.

**Course Unit No**: LIM 3152 (from 2019 to date as an optional course to Aquaculture)

**Name of the Course Unit:** Wastewater Treatment Technology

**Objectives:** To develop student's ability to understand wastewater treatment techniques

**Curriculum learning outcomes:** Students should be able to explain, the suitable techniques for treatment of wastewater considering quality, quantity, source and economy.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 60%
Continuous Assessment (Theory) - 20%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
Features of wastewater from various sources, Collection systems and storm water management, Cartage and vacuum, conventional and small-bore sewerage, Decentralised treatment, Pit latrines, septic tanks, small-scale oxidation plants, Low-intensity and alternative systems,
Waste stabilisation ponds, constructed wetlands, aerated lagoons, oxidation ditches, Advanced biological oxidation, Enhanced mass transfer (pure oxygen, deep shaft), Biomass retention (fluidised and expanded bed, membrane bio-reactor, submerged aerated filters),
Nutrient removal and tertiary treatment,
Physico-chemical, biological including anammox, Anaerobic wastewater treatment, limitations and applications, types of process, Advanced integrated systems, Trade effluent.

**References**: David, H., 2010.Fundamentals of water treatment unit process: physical, chemical and biological. CRC press.

**Course Unit No**: LIM 3161 (from 2019 to date)

**Name of the Course Unit:** Quality Assessment of aquatic systems

**Objectives:** To develop student's ability to
conduct a complete water quality assessment for a given water body

**Curriculum learning outcomes:** Students should be able to conduct a complete water quality assessment for a given water body

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
1. Strategies for water quality assessment,
2. Selection of water quality variables,
3. Hydrological variables,
4. General variables, Nutrients
5. Organic matter, Major ions, inorganic variables, Metals, Organic contaminants, Microbiological indicators, Selection of variables,
6. Data handling and presentations

**References**: Gholamreza, A., 2014. Water quality Management and Assessment and Interpretation. Springer

**Course Unit No**: CHM3112 (from 2019 to date)

**Name of the Course Unit:** Advanced Aquatic Chemistry

**Objectives:** To develop student's ability to understand molecular level interactions in aquatic systems.

**Curriculum learning outcomes:** Students should be able to explain molecular level interactions in aquatic systems.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (12 hrs Theory, 15hrs Practical)
1.Atmosphere-water interactions,
2. precipitation and Dissolution, (th and Pr)
3. solid-solution interface and kinetics at the interface, adsorption, inter particle interactions;
4. trace metal cycling regulation and biological role, (th and Pr)
5. kinetics of redox processes,
6.photochemical processes (th and Pr)

**References**:

Morel, F.M.M. and Hering J.G., 1993. Principles and Applications of Aquatic Chemistry. Wiley-Interscience

**Course Unit No**: CHM3122 (from 2019 to date)
**Name of the Course Unit:** Physical Chemistry II

**Objectives:** To develop student's ability to
deduce structures of organic and inorganic molecules using spectroscopic data.
employ a range of instrumental and non-instrumental laboratory techniques for the measurement of physical parameters

**Curriculum learning outcomes:** Students should be able to use of spectral data to deduce the structures of organic/inorganic molecules
employ a range of instrumental and non-instrumental laboratory techniques for the measurement of physical parameters

**Prerequisite**: No

**Assignments**:

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
1.Molecular Spectroscopy;
2. UV-visible spectroscopy: (th and Pr)
3.Atomic-Absorption Spectroscopy (AAS): (th and Pr)
4. NMR spectroscopy, Infra-Red spectroscopy (IR), Mass spectroscopy, Electron Spin Resonance spectroscopy (ESR): (th and Pr)
5.Mössbauer spectroscopy

**Mode of Assessment**: End semester exam (Theory) – 70%
End semester exam (Practical) – 10%
Continuous assessments – 20%

**References**:
Holla, J.M., 2004. Modern Spectroscopy. Fourth edition, Wiley.

Banwell, C.N., McCash, E.M., 1994. Fundamentals of Molecular Spectroscopy. Fourth edition, Mcgraw-Hill College.

Ingle, J. D., Crouch S.R., 1988. Spectrochemical Analysis. First edition, Prentice Hall.

Atkins, P.W. and Paula, J.D., 2009. Physical Chemistry. Ninth edition. Oxford University Press.

**Course Unit No.**: **OCG3113** (2006-2018)

**Name of the Course Unit**: Ecology of Sensitive Marine and Coastal Ecosystems, Their Pollution & Environmental Conflicts

**Objectives:** This Course Unit aims to make the student understand community structure of sensitive coastal and marine ecosystems

**Learning Outcomes**: Students should be able to identify community structure of sensitive coastal and marine ecosystems
Describe anthropogenic impacts on coastal and marine ecosystems
Describe mitigation measures to reduce anthropogenic impacts on costal and marine ecosystems.
Describe impacts of climate change on coastal and marine ecosystems.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination Theory (2 hours duration) - (100%)

**Course Unit Contents**: [45 hrs Theory]

Sensitive marine and coastal ecosystems, their community structure (beaches, reefs, algal beds, sea grass beds, mangroves, lagoons & estuaries, salt marshes, deltas, mud flats, sand dunes), Impacts of coastal fluxes, Coastal constructions, shipping, tourism, aquaculture etc., Environmental concerns on sea dumping, Sedimentation due to deforestation, mining etc., Oil spills, Ballast water & invasive species, Climate change and its impacts sea level rise, ocean acidification and sea swelling

**References**:

**Course Unit No.**: **OCG3122** (2006-2018)

**Name of the Course Unit**: Ecological Surveys on Sensitive Coastal and Marine Ecosystems and Their Pollution Estimation

**Objectives:** This Course Unit aims to make the student understand procedures in EIA

**Learning Outcomes**: Students should be able to Design an EIA
Analyze marine pollutants
Identify anthropogenic impacts on a given coastal/ marine ecosystem

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Practical (2 hours duration) - (100%)

Reports

**Course Unit Contents**: [70hrs Practical]

Environmental Impact Assessments (EIA), Analytical techniques for marine pollutants, Identification of anthropogenic activities affecting selected sensitive coastal & marine ecosystems

**References**:

**Course Unit No**: OCG3132 (from 2019 as an OP for Aquaculture)

**Name of the Course Unit:** Hydrography and Navigation

**Course Unit Objectives:** To develop student's ability to operate various hardware and software components of a sea floor mapping system

**Curriculum learning outcomes:** Students should be able to describe the theory of operation and application of sea floor mapping technologies
plan an effective acoustic sea floor mapping survey based on specified deliverables and designed to answer a specific research question
operate each of the various hardware and software components of a sea floor mapping system involved in the acquisition, processing, analysis, and display on acquired data.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 75%
Practical reports - 25%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)

1.Introduction to Navigation and Basic Definitions,
2.Position And Direction on Earth's Surface, (th and Pr)
3. Unit of Measures, (th and Pr)
4. Charts and Projections, Bearings and Conversions, Chart Work and Fixing the Ship, Pilotage, Anchoring, Rule of the Road (ROR), (th and Pr)
5.International Maritime Law, International Signals

**References**:


- De. John, C.D., Lachapelle, C., Skone, S., and Elema, I.A., 2006. Hydrography. VSSD.
- Lurton, X., 2010. An introduction to underwater acoustics: Principles and applications. Second edition, Springer.
- Burch,D., 2013. Inland and Coastal Navigation. Second edition, Starpath Publications.

**Course Unit No**: OCG3142 (from 2019 to date)

**Name of the Course Unit:** Remote sensing and GNSS

**Course Unit Objectives:** To develop student's ability to explain the components and applications of Remote Sensing and Global Navigation Satellite Systems

**Curriculum learning outcomes:** Students should be able to explain the components and applications of Remote Sensing and Global Navigation Satellite Systems.

- have hands on experience of image processing and analysis.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessments - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)

- 1.Introduction to Navigation and Basic Definitions,
- 2.Position And Direction on Earth's Surface, (th and Pr)
- 3. Unit of Measures, (th and Pr)
- 4. Charts and Projections, Bearings and Conversions, Chart Work and Fixing the Ship, Pilotage, Anchoring, Rule of the Road (ROR), (th and Pr)
- 5.International Maritime Law, International Signals

**References**: Jensen, J.R., 2007. Remote Sensing of the Environment: An Earth Resource Perspective. Second edition, Pearson Publication.

**Course Unit No:** OCG31A1 (from 2019 to date as an Optional course)

**Name of the Course Unit:** Introduction to Socio-economics

**Course Unit Objectives** To develop student's ability to understand the interrelationships between the social and the environment

**Curriculum learning outcomes:** Students should be able to understand the interrelationships between the social and the physical environment and their impact on the coastal ecosystems.

- appreciate the various components of the environment and how these could be maintained to ensure sustainable development.
- to demonstrate skills of processing, interpreting and disseminating information with respect to sustainable development.
- to understand the role of socio economic development in natural resource management.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 75%
Practical reports - 25%

**Course Unit Contents**: (12 hrs Theory, 9hrs Practical)

1.Benefits from coastal ecosystems,

2.Direct use benefits, Indirect use benefits,

3. Livelihood associated with coastal ecosystems (fishing, tourism, coral mining, ornamental fish collecting, etc),

4.Socio-economic status of coastal communities who depend on coastal ecosystems, Community participation in coastal resource management, (th and social survey)

5.Role and responsibility of genders in coastal resources utilization and management, Traditional knowledge, attitudes and community awareness regarding the importance of coastal ecosystems, Resource users' and their responsibilities with respect to conservation and management of coastal ecosystems, (th and social survey)

6. Environmental valuation

**References**: Szirmai, A., 2005. The Dynamics of Socio-Economic Development: An Introduction. Second edition, Cambridge University Press.

**Course Unit No**: OCG31B1 (from 2019 to date as an OP for Fisheries)

**Name of the Course Unit:** Marine Mammalian Biology

**Course Unit Objectives:** To develop student's ability to describe origin of the marine mammal, evolution and taxonomy.

**Curriculum learning outcomes:** At the end of this course unit students should be able to,
describe origin of the marine mammal, evolution and taxonomy.
explain evolutionary relationships of cetaceans.
explain their ecology and trophic level interactions.
describe conservation laws, applications and status of key species.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: end semester exam (75%), continuous Assessment (25%)

**Course Unit Contents**: (15 hrs Theory)
Marine Mammal evolution,
Marine mammal diversity and classification,
Adaptations,
Ecology and status of Mysticeti, Odontoceti, Pinnipeds, Sirenians, Dolphins, Otters, Polar bears,
Threats and conservation of marine mammals.

**References**:

**Course Unit No**: OCG31C2 (from 2019 to date as an optional course)

**Name of the Course Unit:** Marine and Coastal Ecosystems

**Objectives:** To develop students ability to

- identify ecological interactions in shallow, coastal marine ecosystems.
- identify ecological drivers in different marine ecosystems.
- describe impacts of anthropogenic processes on shallow, coastal marine ecosystem.
- device appropriate sampling techniques to survey different marine ecosystems.

**Curriculum learning outcomes:** At the end of this course unit students should be able to,
explain biological and ecological characteristics of the marine and coastal ecosystems.
describe coastal ecosystems processes and interpret the interactions between biological components and their environment.
find the causes of marine and coastal ecosystem degradation. Students should be able to understand biological and ecological characteristics of the marine and coastal ecosystems.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 75%
Continuous Assessments - 25%

**Course Unit Contents**: Ecosystems (24 hrs Theory, 18hrs Practical)

1. Sea shores, Rocky/sandy/muddy, Mangrove, Lagoons and estuaries, Sea grass beds Sea weed beds, Sand dunes, Mud flats.
2. Marine and Coastal eco-systems in Sri Lanka
3. Practical and field work

**References**: Mann K.H., 2000. Ecology of Coastal Waters: With Implications for Management. Second edition, Wiley-Blackwell.

## Courses for Level 3, Semester II

**Course Unit No.**: **FDN3211 (ND from 2019 to date), FDN 3220 (2006-2018)**

**Name of the Course Unit**: **ADVANCED ENGLISH II**

**Objectives:** This Course Unit aims to make the student understand mechanics of scientific writing

**Learning Outcomes**: Students should be able to handle reading texts at research level, and be familiar with the mechanics of writing an undergraduate thesis, and delivering a presentation

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End Semester exam (Theory) - 100 %

**Course Unit Contents**: (15 hrs Theory) 1.Reading: Reading selected texts from scientific journals,
2.Writing: Advanced practice in paraphrasing and summarizing, mechanics of writing an undergraduate research thesis,
3. writing references and rules pertaining ,
4.Speaking: Delivering a presentation

**References**:

Murphy, R., 1989. Grammar in Use: Reference & Practice for Intermediate Students of English. Cambridge University Press.

**Course Unit No.**: **AQU3212 (2006-to date)**

**Name of the Course Unit**: Aquaculture III: Propagation

**Objectives:** To develop student's ability to
distinguish methods of brood stock management and induced breeding, physiological mechanisms for propagation and larval rearing techniques
**Learning Outcomes**: At the end of this course unit students should be able to,
discuss the methods for brood stock management of the aquatic animals.
describe the principles of the reproductive cycle of cultured aquatic animals.
describe the mechanism of physiological processes for the success in propagation of aquatic animals
describe the techniques used in induced breeding of cultured aquatic animals.
identify different techniques involved in larval rearing of aquatic animals
solve problems related to induced breeding of fish Students should be able to describe the methods involved in best management practices of broodstock farming of the aquatic animals.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical 930%)

**Course Unit Contents**: [25hrs Theory, 15 hrs Practical]

Husbandry of aquaculture broodstock, Reproductive cycles of cultured aquatic animals, Broodstock management, Spawning induction, Larval rearing of finfish/shellfish

**References**:

**Course Unit No.**: **FAQ3211 (2006-2018),**

**Name of the Course Unit**: Advanced Molecular Genetics Applicable to Fisheries & Aquaculture

**Objectives:** This Course Unit aims to make the student understand techniques in Molecular Genetics Applicable to Fisheries & Aquaculture

**Learning Outcomes**: Students should be able to use techniques in Molecular Genetics Applicable to Fisheries & Aquaculture

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Course Unit Contents**: [12hrs Theory, 9 hrs Practical]

Genetic aspects of stock improvement-selective breeding, sex manipulation, chromosome manipulation, hybridisation

**References**:

**Course Unit No.**: **FAQ 3222 (from 2019 to date)**

**Name of the Course Unit**: Advanced Molecular Genetics Applicable to Fisheries & Aquaculture

**Objectives:** This Course Unit aims to make the student understand techniques in Molecular Genetics Applicable to Fisheries & Aquaculture

**Learning Outcomes**: Students should be able to use techniques in Molecular Genetics Applicable to Fisheries & Aquaculture

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Course Unit Contents**: [12hrs Theory, 9 hrs Practical]

Genetic aspects of stock improvement-selective breeding, sex manipulation, chromosome manipulation, hybridisation

**References**:

**Course Unit No.**: AQU3222 **(2006-2018)**

**Name of the Course Unit**: Methods for Aquaculture I (for Tropical fin-fish species)

**Objectives:** This Course Unit aims to make the student understand on Methods for Aquaculture

**Learning Outcomes**: Students should be able to Identify the species belonging to each group that are important in aquaculture

Identify different stages of their lifecycle

Identify different types of grow-out structures used for each species

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Course Unit Contents**: [23hrs Theory, 21 hrs Practical]

Tilapia, Indian carps, Chinese carps, & Ornamental fish

**References**:

**Course Unit No: FAQ3213 (2019 to date)**

**Course Unit Name:** Fish pathology and parasitology

**Course Unit Objectives** To develop student's ability to identify clinical symptoms, parasites and signs of parasitic infections

**Curriculum Learning Outcomes**
At the end of this course, students should be able to Define the technical terms, principles related to fish pathology and parasitology

Identify the clinical symptoms, parasites and signs of parasitic infections

identify important morphological features of external and internal parasites of fish

Describe different investigation procedures, clinical symptoms, signs and investigation results

Carryout a pathological survey in fish to find the health status of fish

Describe prevention, protection and appropriate treatment procedures

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Course Unit Contents**: **(**36hrs Theory, 27 hrs Practical)

Tilapia, Indian carps, Chinese carps, & Ornamental fish

**References**:

**Course Unit No: FAQ3231 (2019 to date)**

**Course Unit Name:** Advanced Histological Techniques

**Course Unit Objectives:** To develop student's ability to use Histological Techniques

**Curriculum Learning Outcomes:** At the end of this course unit students should be able to use Histological Techniques in the laboratory

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination practical (100%)

**Course Unit Contents**: **(**45 hrs Practical)

**References**:

**Course Unit No: FAQ3241 (2019 to date)**

**Course Unit Name:** Scientific writing, presentation and research ethics

**Objectives:** To develop student's ability to **use** Scientific writing, presentation and research ethics

**Curriculum Learning Outcomes**
At the end of this course, students should be able to apply Scientific writing, presentation and research ethics

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (100%)

**Course Unit Contents**: **(**15 hrs Theory)

**References**:

**Course Unit No: FAQ3252 (2019 to date)**

**Course Unit Name:** Statistics for Aquatic Sciences

**Objectives:** Select appropriate experimental units, sampling size and statistical tests for scientific research in biology

**Curriculum Learning Outcomes**

At the end of this course unit students should be able to,

select the appropriate experimental units and sampling sizes for research

realize the importance of data recording, handling, accuracy of data and exploratory data analysis

design experiments and field surveys in a way to analyse scientifically

compare and contrast various experimental designs and statistical tests

select appropriate parametric or non-parametric tests for data analysis

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Course Unit Contents**: **(**20 hrs Theory, 30hrs practical)

Introduction for statistics in biological sciences

Experimental units in aquaculture

Sampling, data collection, data accuracy and exploratory data analysis

Basics of hypothesis formulation and testing

Experimental designs and analysis of variance (ANOVA)

Regression, co-relation and covariant analysis

Non parametric tests

**References**: Bhujel, R.C. 2008. Statistics for Aquaculture. Wily-Blackwell Science

- R. Mead, RN Curnow and AM Hasted. 2003. Statistical methods in agriculture and experimental biology, Chapman and Hall/CRC

**Course Unit No: AQU3222 (2019 to date)**

**Course Unit Name:** Methods for Aquaculture II for tropical shell fish and other organisms)

**Objectives:** To develop student's ability to
compare and contrast different culture methods applied for different shell fish species

**Curriculum Learning Outcomes:**

At the end of this course, students should be able to Identify the species belonging to each group that are important in aquaculture

Identify different stages of their lifecycle

Identify different types of grow-out structures used for each species

Describe the different culture methods used for grow-out phase in the farming of above organisms

Describe the management aspects (e.g. feeding, water quality) and the methods of harvesting and processing, wherever applicable

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (75%)

Practical - (25%)

**Course Unit Contents**: **(**24hrs Theory, 18hrs Practical)
Culture of bivalves
Crabs and Lobster farming
Crocodile farming
Frog culture
Shrimp and Prawn Farming
Sea weed culture

**References**:

**Course Unit No: AQU3232 (2019 to date)**

**Course Unit Name:** Aquaculture Management

**Objectives:** To develop student's ability to
understand the importance of maintaining proper water quality in culture environments

understand the management procedures adopted for different aquaculture practices and systems

**Curriculum Learning Outcomes:** At the end of this course unit students should be able to,
interpret water quality parameters in different aquatic systems, bio filters and bio floc systems
identify Aquatic weeds and predators

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (75%)

Practical (25%)

**Course Unit Contents**: **(**25hrs Theory, 15hrs theory)
Water quality management in fish ponds (Ammonia, nitrite, nitrate, DO, Algal blooms)
Importance of Aeration of fish ponds
*B*io filter management
Biofloc system
Use of chemicals in aquaculture,
Aquatic weed management and Predators in aquaculture

**References**:


- SRAC sheets on aquaculture management
- Aquaculture: Principles and Practices ( T. V. R. Pillay & M. N. Kutty)

**Course Unit No.**: LIM 3212 (2006-2018 as an optional course)

**Name of the Course Unit**: Hydrology and Hydrography

**Objectives:** This Course Unit aims to make the student understand theories of hydrology and hydrography

**Learning Outcomes**: At the end of this course unit students should be able to, use hydrology parameters to explain different processes

**Prerequisite**: No

**Assignments**: No ?..

**Mode of Assessment**:

1. Practical - (30%)

2. End-of-semester examination (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [24 hrs Theory and 21 hrs Practical]

Special properties of water, [***** hrs]

Atmospheric & soil chemistry, [***** hrs]

Metrological parameters & their measurements, [***** hrs]

Runoff, infiltration, porosity, permeability & aquifers, [***** hrs]

Flow measurements of ground water [***** hrs]

**References**:

Dingman, S.L., 2008. Physical Hydrology. Second edition, Waveland press.

**Course Unit No.**: LIM 3221 (2006-2018 as an optional course)

**Name of the Course Unit**: Hydrological Applications

**Objectives:** This Course Unit aims to make the student understand on applications of hydrology

**Learning Outcomes**: Students should be able to make hydrology maps using mathematical models

**Prerequisite**: Hydrology and Hydrography

**Assignments**: No

**Mode of Assessment**:

1. Continuous assessment - (30%)

2. End-of-semester examination (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [12 hrs Theory and 09 hrs Practical]

Impact of artificial structures (damming) & irrigation on aquatic systems, [***** hrs]

Status of world irrigation, [***** hrs]

Effects of rain-fall, floods, [***** hrs]

Earth quakes & landslides on reservoirs, [***** hrs]

Modeling & management [***** hrs]

**References**:

Dingman, S.L., 2008. Physical Hydrology. Second edition, Waveland press.

**Course Unit No.**: LIM 3231 (2006-2018 as an optional course)

**Name of the Course Unit**: Surveying & Leveling

**Objectives:** This Course Unit aims to make the student understand principles in surveying and levelling

**Learning Outcomes**: Students should be able to take measurements for surveying and levelling

Make calculations for measurements

Make levelling maps

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

1. Continuous assessment - (30%)

2. End-of-semester examination theory(1 1/2 hours duration) - (70%)

**Course Unit Contents**: [10 hrs Theory and 15 hrs Practical]

Principals & applications in surveying & levelling, [***** hrs]

Use of instruments in surveying & levelling [***** hrs]

**References**:

Basak, N.N., 2008. Surveying and Levelling. Tata Macgrow Hill.

**Course Unit No.**: LIM 3241 (2006-2018)

**Name of the Course Unit**: Applications of GIS & Remote Sensing for Freshwater Systems

**Objectives:** This Course Unit aims to make the student understand on use of tools of GIS for relevant applications

**Learning Outcomes**: Students should be able to use of tools of GIS for relevant applications

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

1. Continuous assessment - (30%)

2. End-of-semester examination (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [10 hrs Theory and 15 hrs Practical]

Principals of GIS (Geographical Information Systems), [***** hrs]

Remote sensing techniques used for aquatic ecosystems, [***** hrs]

Application of GIS & remote sensing for preparation of zonal plans and to classify freshwater systems [***** hrs]

**References**:

**Course Unit No.**: LIM 3251 (2006-2018 as an optional course)

**Name of the Course Unit**: Ecological Perspectives

**Objectives:** This Course Unit aims to make the student understand on perspectives of ecology

**Learning Outcomes**: Students should be able to propose perspectives of ecology

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

1. Practical - (30%)

2. End-of-semester examination (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [10 hrs Theory and 15 hrs Practical]

Comparisons of ecosystem productivity, [***** hrs]

Internal structure of communities & recent ecological concepts, [***** hrs]

Empirical models, [***** hrs]

Anthropogenic disturbances to ecosystems, [***** hrs]

Restoration of disturbed freshwater systems [***** hrs]

**References**:

**Course Unit No.**: LIM 3261 (2006-2018 as an optional course)

**Name of the Course Unit**: Statistical Hydrology

**Objectives:** This Course Unit aims to make the student understand relevant statistical data for hydrology

**Learning Outcomes**: Students should be able to use relevant statistical data for hydrology

**Prerequisite**: LIM 3212 Basic Hydrology, LIM 3221 Hydrological Applications

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs Theory

Hydrologic data series, Frequency analysis, Hydrologic statistics, Hydrologic designs, Hydrologic modelling

**References**:

**Course Unit No**: **LIM3213 (from 2019 to date)**

**Name of the Course Unit:** Principles and Applications of Hydrology

**Curriculum learning outcomes:** Students should be able to
Describe hydrological cycle,
measure hydrological parameters,
interpret hydrological data

**Prerequisite**: LIM 3212 Basic Hydrology, LIM 3221 Hydrological Applications

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 85%
Continuous Assessment (Practical) - 15%

**Course Unit Contents**: (38 hrs Theory, 21 hrs Practical)
Hydrologic cycle, meteorological and hydrological parameters and their measurements, Flow measurement and hydrograph analysis, Hydrologic data series and statistical analysis, Hydrological modelling.

**References**:

Dingman, S.L., 2008. Physical Hydrology. Second edition, Waveland press.

**Course Unit No**: **LIM3231 (from 2019 to date as an optional course)**

**Name of the Course Unit:** Hydrogeology

**Objectives:** To develop student's ability to understand on basic methods for Hydrogeology Modeling

**Curriculum learning outcomes:** Students should be able to use methods in modeling water flow measurement structures

**Prerequisite**: **Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: (15 hrs Theory)
1.Groundwater hydrology,
2.development of subsurface sources,
3.well losses and specific capacity, aquifers and non-equilibrium formulas,
4.measurements of groundwater yields,
5.well exploration techniques,
6.modeling Steady flow with basic methods, Modeling transient well hydraulics, computer assisted flow modeling: Occurrence Flow measurement structures; weirs, flumes, Flow

**References**:

**Course Unit No**: **CHM3211** (from 2019 to date as an optional course)

**Name of the Course Unit:** Radiochemistry (15 hrs Theory)

**Objectives:** To develop student's ability to
explain the basic concepts related to radiochemistry and describe the radioactive decay processes and nuclear reactions

**Curriculum learning outcomes:** Students should be able to explain reasons types of radio activity
draw radioactive decay energy diagrams.
explain nuclear reactions and energy gaps
explain nuclear reactions beneficial for human being.

**Prerequisite**: **Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 100%

**Course Unit Contents**: (15 hrs Theory)
1.Radioactivity: instability of nucleus, chart of the nuclides, modes of radioactive decay, decay energy diagrams,
2.measurements and units in radioactivity, decay laws, mass to activity relationship,
3. Origin of radionuclide through nucleo-synthesis and cosmic processes, non-primordial radionuclide, Nuclear fission and fusion,
4. Civil and military nuclear cycles,
5. Reprocessing of nuclear fuel and nuclear waste disposal strategies, Natural radiological hazards, Nuclear accidents, Incidents and environmental leaks,
6. Methods of determination, Radionuclide behaviour in the environment, Radiocarbon applications, U-series disequilibria and dating (snow),
7. Impulse radiometric dating methods, Radionuclide as tools in aquatic and terrestrial environmental studies.

**References**:

Ehmann, W.D. and Vance, D.E., 1991. Radiochemistry and Nuclear Methods of Analysis. Wiley-Interscience.
Michael, F., 2012. Hand book of Radioactivity analysis. CRC press.

**Course Unit No.**: **OCG3212** (2006-2018)

**Name of the Course Unit**: Earth Materials and Structure

**Objectives:** This Course Unit aims to make the student understand on Earth Materials and Structure

**Learning Outcomes**: Students should be able to explain structure of the earth and its materials

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

Practical - (30%)

End-of-semester examination theory (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [24 hrs Theory and 18 hrs Practical]

Introduction to crystallography , Properties of Minerals , Rock forming minerals , Rock cycle , Sedimentary rock formation, Sedimentary rock classification , metamorphism , metamorphic rocks, Formation of intrusive and extrusive igneous rocks, igneous rock classification . Geological Structures and Field Geology

**References**:

**Course Unit No.**: **OCG3222** (2006-2018)

**Name of the Course Unit**: Paleo-oceanography and Marine Archaeology

**Objectives:** This Course Unit aims to make the student understand on

**Learning Outcomes**: Students should be able to explain Paleo-oceanography and Marine Archaeology

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

Practical - (30%)

End-of-semester examination theory (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [24 hrs Theory and 18 hrs Practical]

Archaeology: Techniques to identify historic events oceans, $C^{14}$ method, Studies on oozes & animal bones to gather historic information, Fossil evidence for origin and evolution of marine organisms and for sea floor spreading, Paleo-magnetism to study the formation of sediment layers

Marine Archaeology: World maritime history with respect to marine fisheries and maritime activities, Maritime archaeological techniques, Nautical archaeology, Management of coastal heritage, Geophysical and topographic surveys in the coastal and inter-tidal zones using of remote sensing techniques and processing of images using computer technique, Use of Geographic Information Systems (GIS), which is an essential tool in the building of sites and monuments records and facilitating heritage management, Underwater recording of areas and structures with archaeological, importance, Analyses of animal bones to gather historic information, Analyses of ceramics and lithic material key dating information on the wrecks in which they are found.

**References**:

**Course Unit No.**: OCG3231**(2006-2018)**

**Name of the Course Unit**: Coastal and Marine Living & Non Living Resource Management & Relevant Socio Economics

**Objectives:** This Course Unit aims to make the student understand on marine Living & Non Living Resources

**Learning Outcomes**: Students should be able to describe uses of Marine Living & Non Living Resources

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

Practical - (30%)

End-of-semester examination theory (1 1/2 hours duration) - (70%)

**Course Unit Contents**: [12 hrs Theory and 9 hrs Practical]

Benefits from coastal ecosystems, Direct use benefits, Indirect use benefits, Livelihood associated with coastal ecosystems (fishing, tourism, coral mining, ornamental fish collecting, etc), Socio-economic status of coastal communities who depend on coastal ecosystems, Community participation in coastal resource management, Role and responsibility of genders in coastal resources utilization and management, Traditional knowledge, attitudes and community awareness regarding the importance of coastal ecosystems, Resource users' and their responsibilities with respect to conservation and management of coastal ecosystems, Environmental valuation.

**References**:

**Course Unit No.**: OCG3241 **(2006-2018)**

**Name of the Course Unit**: Hydrography of Coastal and Marine Environments

**Objectives:** This Course Unit aims to make the student understand on Hydrography of Coastal and Marine Environments

**Learning Outcomes**: Students should be able to make maps on Hydrography of Coastal and Marine Environments

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**:

Practical - (30%)

End-of-semester examination theory (1 hour duration) - (70%)

**Course Unit Contents**: [10 hrs Theory and 15 hrs Practical]

How to carry out a hydrographical survey on selected coastal & marine environments, Use of hydrographic equipment, Preparation of hydrographic map of a selected coastal ecosystem

**References**:

**Course Unit No**: OCG 3241 (from 2019 to date as an optional course)

**Name of the Course Unit:** Introduction to Meteorology

**Objectives:** To develop student's ability to use Meteorology data for weather monitoring and forecasting

**Curriculum learning outcomes:** Students should be able to explain
atmospheric dynamics and weather system and
weather monitoring and forecasting

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End Semester Exam (Theory) - 75%
Continuous Assessments - 25%

Practical - (30%)

End-of-semester examination theory (1 hour duration) - (70%)

**Course Unit Contents**: (12 hrs Theory, 9hrs Practical) Atmospheric structure, Heat, Temperature and Circulation, Basics of Dynamic Meteorology, Tropical Weather Systems, Weather Monitoring, Analysis and Forecasting

**References**:

Lutgens, F.K.,Tarbuck,E.j., Tasa, D.G., 2012. The Atmosphere: An Introduction to Meteorology. Twelfth edition, Prentice Hall.

**Course Unit No**: OCG 3251 (from 2019 to date as an optional course)

**Name of the Course Unit:** Law of the Sea

**Course Unit Objectives:** To develop student's ability to understand maritime law

**Curriculum learning outcomes:** Students should be able to have sound knowledge on UNCLOS

- have thorough understanding on Annex II and Sri Lanka's claim to extend the continental shelf
- be conversant on International maritime treaties relevant to Sri Lanka

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End Semester Exam (Theory) - 80 %
Continuous assessment - 20 %

**Course Unit Contents**: (15 hrs Theory)

An introduction to UNCLOS, Territorial sea and contiguous zone, Exclusive economic zone,

Continental shelf, High Seas, The Area, Marine Scientific research, Continental Shelf claim of Sri Lanka. Application of international treaty to domestic laws. Other International/ multinational/ bilateral treaties.

**References**: United Nations Conventions on the Law of the Sea

**Course Unit No**: OCG 3261 (from 2019 to date as an optional course)

**Name of the Course Unit:** Indian Ocean and Bengal Fan

**Course Unit Objectives:** To develop students ability to explain properties, processes and resources of the Indian Ocean

**Curriculum learning outcomes:** Students should be able to have a sound knowledge on features, properties, processes and resources of the Indian Ocean

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End Semester Exam (Theory) - 100 %

**Course Unit Contents**: (15 hrs Theory)

1.Indian Ocean: Evolution, physiography and tectonics, current and circulation,

2 ocean chemistry,

3.diversity of macro and micro fauna and flora,

4. living and non-living resources.
5. Bengal fan: morphology, geometry, stratigraphy, and processes

**References** This course is based on research articles

**Course Unit No**: **OCG32A1 (from 2019 to date as an Optional course)**

**Name of the Course Unit:** Coral Ecology

**Course Unit Objectives:** To develop student's ability to understand on the key processes underlying patterns of recruitment, abundance, and community diversity on coral reefs

**Curriculum learning outcomes:** Students should be able to familiar with the key processes underlying patterns of recruitment, abundance, and community diversity on coral reefs.

- understand the link between resources and environmental stressors at the level of the organism and demographic processes.
- develop insight into the role of species interactions in the dynamics, diversity and resilience of coral reefs.
- develop an understanding of the interactions between different types of environmental disturbances and the responses of coral reef systems.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

**Course Unit Contents**: (12 hrs Theory, 9hrs Practical)

1.Types of reefs, Reef distribution,
2. Biodiversity of coral reefs, (th and Practical)
3. interactions among reef dwelling organisms, (th and Practical)
4.Reef fish diversity, (th and Practical)
5. Environmental stress on reef forming organisms and associates, reefs and their conservation, coral transplanting and establishment of artificial reefs. (th and Practical)
6. Global Circulation models, Visualization using MathLab. (th and Practical)

**References**

Sheppard, C.R.C., Davy, S.K., and Graham M. P., 2009. The biology of coral reefs. Oxford University Press.

**Course Unit No**: **OCG32B1 (from 2019 to date as an Optional course)**

**Name of the Course Unit:** Satellite Oceanography

**Course Unit Objectives** To develop student's ability to explain physical concepts used in satellite oceanography

**Curriculum learning outcomes:** Students should be able to explain physical concepts used in satellite oceanography
handle the satellite data for information extraction through analysis.

**Prerequisite**: No

**Assignments**:

**Mode of Assessment**: End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

**Course Unit Contents**: (12 hrs Theory, 9hrs Practical)
1.The general principles of remote sensing of the sea,
2. Pre-processing, Positional registration and Oceanographic sampling for "sea truth",
3.Sea Surface Temperature (SST) mapping
4., Basic principles of satellite altimetry, Sea Surface Roughness, Microwave scatterometer, Synthetic
5.Aperture Radar,Basic principles of satellite measurements of ocean color,
6.Chlorophyll and photosynthesis, Estimation of phytoplankton biomass from satellite ocean color observations

**References**
Seelye M., 2004 . An Introduction to Ocean Remote Sensing, Cambridge University Press.

## Level IV, Semester I

**Course Unit No.**: FSC4113 (2006-2019)

**Name of the Course Unit**: Statistics for Fisheries & Aquatic Sciences

**Objectives:** This Course Unit aims to make the student understand on statistics and data handling

**Learning Outcomes**: Students should be able to handle data for statistical analysis

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (70%)

End-of-semester examination (Practical) 1 1/2 hours duration - (30%)

**Course Unit Contents**: (Theory, 30 hrs; Practical, 45 hrs)

Introduction, Distribution patterns, Parameters of a normal distribution, testing for differences; t-test for comparing two groups, ANOVA for comparing many groups. Finding associations; (Correlation and Regression) dealing with categorical data (Chi squared test), selecting tests; Experimental designing. Usage of SPSS in statistical analysis. Nonparametric approach; Cluster analysis, Multi Dimensional Scaling (MDS) and Principal Component Analysis (PCA), Introduction to 'Primer' and its usage.

**References (Recommended Textbooks)**:

**Course Unit No.**: FSC4121 (2006-2019)

**Name of the Course Unit**: Information Literacy & Library Research Skills

**Objectives:** This Course Unit aims to make the student understand on use of Information Literacy & Library Research Skills for the degree courses

**Learning Outcomes**: Students should be able to use of Information Literacy & Library Research Skills for the degree courses; research project

**Prerequisite**: No

**Mode of Assessment**:

End-of-semester examination (Theory) 1 1/2 hours duration - (70%)

End-of-semester examination (Practical) 1 1/2 hours duration - (30%)

**Course Unit Contents**: **(**Theory, 11 hrs; Practical, 6 hrs)
Introduction to libraries and information sources,
Planning Library Research,
Information Retrieval
Evaluating information for credibility currency and contest,
5 Understand how copyright laws apply to you
6, Understanding plagiarism,
7Citation styles and compiling reference lists,
Effective presentation skills, communicant channels.

**References (Recommended Textbooks)**:

**Course Unit No.**: FSH4112 (2006-2019)

**Name of the Course Unit**: Fisheries Management

**Objectives:** This Course Unit aims to make the student understand on acts and law in Fisheries Management

**Learning Outcomes**: Students should be able to explain strategies for fisheries management under the relevant legal framework

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [24hrs Theory, 18 hrs Practical]

Management of renewable and non renewable natural resources, Fisheries management and planning objectives, strategies and methods, Fishery regulations

**Course Unit No.**: **AQU4112 (2006-2019)**

**Name of the Course Unit**: Methods for Aquaculture II (for Tropical shellfish & other organisms)

**Objectives:** This Course Unit aims to make the student understand on Methods for culturing Tropical shellfish & other organisms

**Learning Outcomes**: Students should be able to explain and practice on Methods for culturing Tropical shellfish & other organisms

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Contents (Theory, 24 hrs; Practical, 18 hrs)**

Shrimp & Prawn farming, Mollusc farming, Crab & lobster-farming & fattening, Crocodile culture, Frog culture, Sea weed

**References**:

**Course Unit No.**: **AQU 4123 (2006-2019)**

**Name of the Course Unit**: Aquaculture Management

**Objectives:** This Course Unit aims to make the student understand on management procedures adopted for different aquaculture practices and systems

**Learning Outcomes**: Students should be able to Understand the importance of maintaining proper water quality in culture environments

Understand the management procedures adopted for different aquaculture practices and systems

Understand the importance of biofilter management

Understand the functioning of biofloc systems

Understand the procedures adapted in fish handling and transport

**Prerequisite**: No

**Assignments**: yes

**Mode of Assessment**:
End-of-semester examination Theory (2 hours duration) - (75%)
Practical (11/4 hr duration practical paper + continuous assignment report )

**Contents (Theory, 38 hrs; Practical, 12 hrs)**
Aquatic weed management, Predators in aquaculture, Water quality management ($NH_3$, $NO_2$, $NO_3$) in fish ponds, Aeration in fish ponds, Use of chemicals in aquaculture systems, Aquaculture equipment Biofilter systems, Biofloc systems , Fish handling and transport,

**References**:


1. Aquaculture: Principles and Practices ( T. V. R. Pillay & M. N. Kutty)
2. SRAC: Publications on above topics

**Course Unit No.**: **FSH 4122 (2006-2019)**

**Name of the Course Unit**: Fish Post Harvest Technology and Quality Assurance of Fishery Products

**Objectives:** This Course Unit aims to make the student understand on Fish Post Harvest Technology and Quality Assurance of Fishery Products

**Learning Outcomes**: Students should be able to practice Fish Post Harvest Technology and use Quality Assurance of Fishery Products

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Contents (Theory, 22 hrs; Practical, 21 hrs)**
Processing plant lay-out; Product profile; Raw & cooked products, By-products; Food technology, Food microbiology; Quality control & assurance; HACCP (Hazard analysis & critical control point) for food safety management, Biological/pathogenic hazards (Bacterial, Viral, Parasitic), Chemical & physical hazards, Processing narration.

**References**:

**Course Unit No:** FSH4112 (from 2019 to date)

**Course Unit Name:** Fish Post Harvest Technology and Quality Assurance of Fishery Products

**Course Unit Objectives:** To develop student's ability to understand on Fish Post Harvest Technology and Quality Assurance of Fishery Products

**Curriculum Learning Outcomes:** At the end of this course, students should be able to practice Fish Post Harvest Technology and Quality Assurance of Fishery Products

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (70%)

Practical (30%)

**Contents (Theory, 22 hrs; Practical, 21 hrs)**

Processing plant lay-out; Product profile; Raw & cooked products, By-products; Food technology, Food microbiology; Quality control & assurance; HACCP (Hazard analysis & critical control point) for food safety management, Biological/pathogenic hazards (Bacterial, Viral, Parasitic), Chemical & physical hazards, Processing narration.

**References**:

**Course Unit No:** FSH4132 (from 2019 to date)

**Course Unit Name:** Fisheries Management and Acts

**Course Unit Objectives** To develop student's ability to understand on legal framework in fisheries Management

**Curriculum Learning Outcomes:**

At the end of this course unit, students should be able to explain law and acts practice in Fisheries Management

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (75%)

Practical report (25)

**Contents (24** hrs Theory and 18 hrs Practical)

**References**:

**Course Unit No:** AQU4111 (from 2019 to date as an optional course)

**Course Unit Name:** Immunology

**Curriculum Learning Outcomes:** At the end of this course unit students should be able to,

identify the different types of immune organs present in fish

describe the mechanism of innate immunity of fish with respect to their cellular immunity and humoral immunity

describe the involvement of the antigen and antibody for regulating the adaptive immunity of fish and T cell & B cell mediated immunity response of fish

describe the crustacean immunity regarding the haematopoiesis and haemocytes, The proPO system, Coagulation

**Prerequisite**: No

**Assignments**: No

**Contents (24** hrs Theory and 18 hrs Practical)

History, Immune organs of fish
Innate immunity system of fish; cellular sensing and humoral sensing method, cellular and humoral effectors ( hrs)
Adaptive immunity system of fish; Antigen and antibody specificity, Antigen presenting and recognition, Antigen processing and development of effector cells, T cell and B cell mediated immunity response of fish
Crustacean immunity; haematopoiesis and haemocytes, The proPO system, Coagulation

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (75%)

Practical (25%)

**References**:

Zaccone, G., 2009. *Fish Defenses*. Science Publishers.

**Course Unit No:** AQU4121 (from 2019 to date)

**Course Unit Name:** Aquaculture Technology- Equipment & Machinery

**Course Unit Objectives:** To develop student's ability to
categorize different machineries required for different steps in aquaculture

**Curriculum Learning Outcomes**
At the end of this course unit students should be able to,

value different machineries required in different steps in aquaculture

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (75%)

Practical (25%)

**Contents (12** hrs Theory and 09 hrs Practical)
Equipment /machinery used in pumping, harvesting and aeration
Fish graders
Machineries for feed manufacturing and feeding
Equipment/machinery for transportation of live fish
Complementary equipment

**References**:

**Course Unit No.**: FAQ4123 (2006-2019)

**Course Unit Name:** Fish Pathology and Parasitology

**Objectives:** This Course Unit aims to make the student understand on fish pathology and fish parasites

**Learning Outcomes**: Students should be able

to identify fish parasites

to suggest prevention measures and for fish pathology

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination Theory (1 1/2 hours duration) - (75%)

Practical (25%)

**Contents (Theory, 37 hrs; Practical, 24 hrs)**
Principles of fish health & environmental conditions, Symptoms & diagnosis of diseases, appropriate treatments/procedures

**References**:

**Course Unit No.**: LIM4112/LIM 4111 (2006-2019)

**Name of the Course Unit**: Inland Ecosystem Management and Conservation

**Objectives:** This Course Unit aims to make the student understand on Inland Ecosystems, their Management and Conservation strategies

**Learning Outcomes**: Students should be able to explain importance of inland ecosystems

To discuss management and conservation strategies

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

1. Continuous assessment - (30%)

2. End-of-semester examination (1 hour duration) - (70%)

**Course Unit Contents**: [12 hrs Theory and 09 hrs Practical]

Fresh and brackish-water ecosystem management;
Indigenous knowledge in aquatic ecosystem management;
Concepts of '*wewa*' and its revolution;
Conservation of sensitive aquatic ecosystems;
International conventions and strategies to anthropogenic activities on freshwater aquatic ecosystems.

**References**:

**Course Unit No.**: LIM 4121(2006-2019)

**Name of the Course Unit**: Geological and Geographical Aspects Related to Aquatic Systems

**Objectives:** This Course Unit aims to make the student understand on Geological and Geographical Aspects Related to Aquatic Systems

**Learning Outcomes**: Students should be able to explain Geological aspects of Aquatic Systems

Use Geographical data to describe Aquatic Systems

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

1. Continuous assessment - (30%)

( if any, for example Assignments -30%;Requirement to pass continuous assessment: [Assignments Marks out of 30] □ 15%)

2. End-of-semester examination (3 hours duration) - (70%)

**Course Unit Contents**: [12 hrs Theory and 09 hrs Practical]

Effects of geological implications and chemical aspects of soil on quality of water, [***** hrs]

Effect of geographical location on quality and biodiversity of aquatic systems [***** hrs]

**References**:

**Course Unit No.**: LIM 4131 (2006-2019)

**Name of the Course Unit**: Water Resources Management

**Course Unit Objectives:** To develop student's ability to understand on Water Resources and Management

**Learning Outcomes**: Students should be able to describe water as a resource and assessment

describe stream gauging

Study recurrence and recurrence interval

Study flow duration curves

Calculate runoff using HEC

explain droughts, floods and water management techniques

Study water economics and irrigation

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs Theory]

Water resources assessment,
drought and flood management,
effect of catchment development
runoff, water use and demand management,
Economics of water resources development
Sustainable irrigation management

**References**:


- Booth,C.A. and Charlesworth, S.M., 2014.Water Resources in the Built Environment: Management Issues and Solutions. Wiley.

**Course Unit No**: LIM 4112 (from 2019 to date as an optional course)

**Name of the Course Unit:** Irrigation

**Course Unit Objectives:** To develop student's ability to explain irrigation systems in Sri Lanka

**Curriculum learning outcomes:** Students should be able to design proper irrigation systems to get the maximum benefit of available water.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)

1. Irrigation engineering and hydraulic structures,
2. Concepts of Irrigation and Irrigation Water Management,
3. Crop water requirements and irrigation scheduling,
4. Guidelines for the preparation of technical drawings,
5. Surface irrigation systems, Sprinkler irrigation systems, Localized irrigation systems, Irrigation equipment for pressurized systems,
6. Financial and economic appraisal of irrigation projects,
7. Construction of irrigation schemes, ancient irrigation systems of Sri Lanka.

**References**: Raghunath, H.M., 2013.Irrigation Engineering.Wiley.

**Course Unit No**: LIM 4122 (from 2019 to date as an optional course)

**Name of the Course Unit:** Water Resource Management

**Course Unit Objectives:** To develop student's ability to
understand on Water Resources and Management

**Curriculum learning outcomes:** At the end of this course unit students should be able to,
describe water as a resource and assessment

describe stream gauging

explain recurrence and recurrence interval

describe flow duration curves

Calculate runoff using HEC

explain droughts, floods and water management
discuss water economics and irrigation

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
Water resources assessment,
2. drought and flood management,
3. effect of catchment development
4., runoff, water use and demand management,
5. rainwater harvesting,
6. Economics of water resources development.

**References**:

Booth,C.A. and Charlesworth, S.M., 2014.Water Resources in the Built Environment: Management Issues and Solutions. Wiley.

**Course Unit No**: LIM 4151 (from 2019 to date as an optional course)

**Name of the Course Unit:** Water Governance and Policy (15 hrs Theory)

**Course Unit Objectives**: To develop student's ability to understand on Water Governance and Policy

**Curriculum learning outcomes:** At the completion of this course unit student should be able to

explain local and international law and policies regarding water and remedial strategies for water related problems.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 80%
Continuous Assessment (Theory) - 20%

**Course Unit Contents**: (15 hrs Theory)
1.Water policies and governance, Nature-society,
2.Water conflict and cooperation, Developmental and environmental issues,
3.International Environmental Law,
4.Water and climate change, Water and agriculture, International Climate Politics and Justice,
5.World Water Assessment Programme, Water poverty and health,
6.The Helsinki Rules, the UN Watercourses Convention and the Berlin Rules: Perspectives on International Water Law

**References**:
David, G., 2008. Water Law in Nutshell.
West Academic Publishing.

**Course Unit No**: LIM 4161 (from 2019 to date)

**Name of the Course Unit:** Environmental Impact Assessment

**Course Unit Objectives:** To develop student's ability to understand on Environmental Impact Assessment

**Curriculum learning outcomes:** Students should be able to prepare EIA and SEA reports.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: End semester exam (Theory) - 100%

**Course Unit Contents**: (15 hrs Theory)

1. Principles of Environmental Assessment and Management,
2. Procedures and Methods of EIA, Strategic Environmental Assessment (SEA), guidelines for EIA,
3. ecologically sustainable development, impact evaluation in terms of environmental and socio-economic criteria,
4. future directions, Critical examination of the assumptions,
5. Historical evolution of impact assessment in selected parts of the world.

**References**:

Anjaneyulu, Y. and Valli, M., 2011.Environmental Impact Assessment Methodologies. CRC Press.

**Course Unit No**: LIM 4171 (from 2019 to date)

**Name of the Course Unit:** Surveying and Levelling

**Course Unit Objectives:** To develop student's ability to understand on methods in Surveying and Levelling

**Curriculum learning outcomes:** Students should be able to use surveying and levelling methods

conduct surveys relevant to hydrological applications.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:
End semester exam (Theory) - 65%
Continuous assessment (Practical) - 35%

**Course Unit Contents**: (10hrs Theory, 15 hrs Practical)
1.Principals and definitions,
2.linear and angular measurements,
3.levelling and contouring,
4.setting out drawings,
5.plane-table surveying,
6. field applications, modern levelling apparatus. Graphical Interpretation of surveying data

**References**:
Basak, N.N., 2008. Surveying and Levelling. Tata Macgrow Hill.

**Course Unit No**: LIM 4191 (OP for WST)

**Name of the Course Unit:** Nanotechnology (15 hrs Theory)

**Course Unit Objectives:** To develop student's ability to understand on use of Nanotechnology

**Curriculum learning outcomes:** Students should be able to discuss the various applications of Nanotechnology and environmental impacts of nano materials.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester exam (Theory) - 100%

**Course Unit Contents**: (15 hrs Theory)

1.Introduction to nanotechnology,
2. Atomic, molecular and crystal structure,
3. associated length scales,
4. material properties and the effects of decreased dimensions,
5. useful applications, fabrication methods,
6. characterisation methods, bio-molecular motors,
7. environmental impact of Nano materials

**References**:

Hornyak,G.L. et al., 2008. Fundamentals of Nanotechnology. CRC Press.

**Course Unit No**: CHM4112 (from 2019 to date)

**Name of the Course Unit:** Biochemistry

**Course Unit Objectives:** To develop student's ability to
describe the chemistry of biomolecules and apply the knowledge to identify different biological phenomena.

**Curriculum learning outcomes:** Students should be able to explain concepts and specific reaction pathways in biochemistry

- define structure of biologically important compounds and biosynthetic precursor molecules.
- apply knowledge of chemistry to solve problems in biology

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:
End semester exam (Theory) - 80%
End semester exam (Practical) - 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
1.Proteins, Enzymes, Protein purification,
2.Carbohydrates,
3.Nucleic acids, Phosphorus in biology, Relationship between DNA, RNA and proteins,
4.Structure, function and replication of DNA,
5.human genome and DNA Sequencing, RNA and Protein synthesis,
6.Energy and cellular metabolism, glycolysis, TCA cycle, oxidative phosphorylation, gluconeogenesis, metabolism of glycogen, fat, amino acid and alcohol .

**References**:

Garrett, R.H. and Grisham, C.M., 2012. Biochemistry. Fifth edition, Brooks/Cole.

**Course Unit No**: CHM4121 (from 2019 to date)

**Name of the Course Unit:** Green Chemistry

**Course Unit Objectives:** To develop student's ability to
identify and explain the applications of green chemical technology related to aquatic sciences.

**Curriculum learning outcomes:** Students should be able to discuss on low carbon and low energy utilization technologies relevant to aquatic sciences.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:
End semester exam (Theory) - 100%

**Course Unit Contents**: (15 hrs Theory)
1.Principles of green chemistry,
2. Applications of green chemical technology in aquatic sciences and in naval industry.
3. Llow carbon and low energy utilization technologies

**References**:

Arma, S. K., 2015. Green Chemistry for Dyes Removal from Waste Water: Research Trends and Applications. First edition, Wiley-Scrivener.

**Course Unit No**: CHM4132 (from 2019 to date )

**Name of the Course Unit:** Natural product Chemistry

**Course Unit Objectives:** To develop student's ability to
apply the basic knowledge of natural product chemistry in other desired fields of study.

**Curriculum learning outcomes:** At the completion of this course unit student should be able to

identify the major classes of natural products.

describe the processes associated with extraction, isolation and characterization of natural products.

demonstrate basic extraction and isolation methods of natural products.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:
End semester exam (Theory) - 80%
Continuous Assessment- 20%

**Course Unit Contents**: (24 hrs Theory, 18hrs Practical)
1.Alkaloids, Terpinoieds, Flevanoides, Steriodes, Saponins,
2. Drug development, Extraction, Isolation, and
3.Characterization of Natural products

**References**:


- Bulugahapitiya,V.P., 2013, Plants Based Natural products Extraction, Isolation and Phytochemical screening methods. First edition,
- Natural Product Chemistry at a Glance, Dr. Stephen P. Staforth, School of Applied Science, Northbumbaria University.

**Course Unit No.**: **OCG4112 (2006-2019)**

**Name of the Course Unit**: Earth Process and Morphometric Analysis

**Objectives:** This Course Unit aims to make the student understand on Earth Process and Morphometric Analysis

**Learning Outcomes**: Students should be able to explain Earth Process and Morphometric Analysis

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs Theory, 30 hrs practical]

Physical and chemical weathering, Fluvial, wind and coastal processes and their landforms , glacial landforms, Earth's surface features as functions of geological structures , processes and time, Landform analysis using topographic maps and some stereographic aerial photos. Trigonometry , introductions to surface mapping and modeling, Surface geometry, Watersheds and drainage.

**References**:

**Course Unit No.**: **OCG4122 (2006-2019)**

**Name of the Course Unit**: Hydrocarbons and mineral resources

**Objectives:** This Course Unit aims to make the student understand on Hydrocarbons and mineral resources

**Learning Outcomes**: Students should be able to describe Hydrocarbons and mineral resources

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs Theory, 30 hrs practical]

Physical and chemical properties of petroleum, Generation and Migration, Reservoirs, Traps and seals , Sedimentary basins and petroleum systems , Hydrocarbon exploration methods, gas hydrates, off shore and coastal mineral resources, Sea bed and coastal mining and processing.

**References**:

**Course Unit No:** OCG4132 (2006-2019)

**Course Unit Name:** Integrated Coastal Zone Management

**Course Unit Objectives:** To develop students ability to understand on Integrated Coastal Zone Management

**Curriculum Learning Outcomes:** At the completion of this course unit student should be able to
explain the importance and benefits of an Integrated Coastal Management for socio-economic development.
design ICM projects to resolve identified coastal management issues.

**Prerequisite**: No

**Assignments**: No

**Course Unit Contents**: **(21** hrs Theory, 24 hrs Practical)

1 The need for ICZM, Definition of ICZM and Fundamental concepts
2, The evolution of global perceptions for Integrated management of oceans and coasts,
3 Earth summit implementation: Growth in capacity in ocean and coastal management,
4 Setting the stage for Integrated coastal zone management, Intergovernmental, Institutional, legal and financial consideration,

4 Informing the ICZM process: Building the Science and Information base,
5 Formulation and approval of an ICM program, Implementation,
6 Operation and evaluation of ICZM programs, Lessons learnt, Case study (Sri Lanka)

**Mode of Assessment**: theory (75%), continuous assessment (25%)

**References**

Cicin-Sain, B., and Knecht, R.W., 1998. Integrated Coastal Management: Concepts and Practices. Fourth edition, Island Press.

**Course Unit No.**: **OCG4141(2006-2019)**

**Name of the Course Unit**: Navigation and International Signals

**Objectives:** This Course Unit aims to make the student understand on Navigation and International Signals

**Learning Outcomes**: Students should be able to describe importance of international signals

Explain principles in Navigation

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs Theory]

Introduction to Navigation and Basic Definitions, Position And Direction on Earth's Surface, Unit of Measures, Charts and Projections, Bearings and Conversions, Chart Work and Fixing the Ship, Pilotage, Anchoring, Rule of the Road (ROR), International Maritime Law, International Signals

**References**:

**Course Unit No.**: **OCG4151 (2006-2019)**

**Name of the Course Unit**: Snorkelling and Life Saving

**Objectives:** This Course Unit aims to make the student understand theories on Snorkelling and Life Saving methods

**Learning Outcomes**: Students should be able to practice Snorkelling and Life Saving methods

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [15 hrs Theory, Practical ]

Basic skills of snorkelling, diving and life saving, snorkelling gears, diving gears, diving hazards, snorkelling and diving ethics

**References**:

**Course Unit No.**: **OCG4162 (2014-2019)**

**Name of the Course Unit**: Stratigraphy and Sedimentology

**Objectives:** This Course Unit aims to make the student understand Stratigraphy and Sedimentology

**Learning Outcomes**: Students should be able to explain theories in Stratigraphy

Describe principles in Sedimentology

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [24 hrs Theory, 18hrs Practical ]

Weathering and Soils, Transport and Deposition of Siliciclastic Sediment, Sedimentary Textures, Sedimentary Structures , Continental (Terrestrial) Environments, Marginal-Marine Environments, Siliciclastic Marine Environments, Carbonate and Evaporite Environments. Basic stratigraphic principles, lithostratigraphy, biostratigraphy, seismic stratigraphy, sequence stratigraphy, chronostratigraphy, Basin analysis

**References**:

**Course Unit No.**: **OCG 4171 (2014-2019)**

**Name of the Course Unit**: Geophysics for Ocean Sciences

**Objectives:** This Course Unit aims to make the student understand Geophysics for Ocean Sciences

**Learning Outcomes**: Students should be able to describe physics in Ocean Sciences

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

2. End-of-semester examination (1 1/2 hours duration) - (100%)

**Course Unit Contents**: [12 hrs Theory, 9hrs Practical]

Sea bed imaging by SONAR and LIDAR, marine seismic exploration, Marine Gravity Survey, Marine Magnetic Survey, Electrical and Radiometric methods.

**References**:

**Course Unit No**: OCG4132 (from 2019 to date)

**Name of the Course Unit:** Integrated Coastal Management

**Course Unit Objectives:** To develop students ability to understand on Integrated Coastal Management

**Curriculum learning outcomes:** Students should be able to explain the importance and benefits of an Integrated Coastal Management for socio-economic development.
design ICM projects to resolve identified coastal management issues.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End Semester Exam (Theory) - 75%
Continuous Assessments - 25%

**Course Unit Contents**: (24 hrs Theory,18 hrs Practical)
Introduction to Integrated Coastal Management Concept (Theory 3hrs)
Principles of Integrated Coastal Management (Theory 4 hrs)
Tools for implementing ICM (Theory 4hrs)
Coastal project development (Theory 3hrs, Practical 6 hrs)
evaluation and management (Theory 2hrs, Practical 3hrs)
Coastal management in Sri Lanka (Theory 8 hrs, Practical 3 hrs))
Case studies (Practical 6hrs)

**References**: Cicin-Sain, B., and Knecht, R.W., 1998. Integrated Coastal Management: Concepts and Practices. Fourth edition, Island Press.

**Course Unit No**: **OCG 4141 (from 2019 to date)**

**Name of the Course Unit:** Climate change and Oceans

**Course Unit Objectives:** To develop student's ability to understand on Climate change and effects on Oceans

**Curriculum learning outcomes:** Students should get a descriptive knowledge on effects of climate change on oceans

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End Semester Exam (Theory) - 50 %
Continuous Assessments - 50%

**Course Unit Contents**: (15 hrs Theory,)

**References**:

Research paper based class

**Course Unit No**: OCG4162 (from 2019 as an optional course)

**Name of the Course Unit:** Advanced Physical Oceanography
**Course Unit Objectives:** To develop student's ability to
apply basic physical principles to develop an understanding of specific ocean phenomena and processes in the ocean
calculate oceanic heat and salt budgets using observational and numerical model data
calculate oceanic indexes related to physical oceanography
analyse oceanic phenomena/processes/data using computer programming languages

**Curriculum learning outcomes:** At the completion of this course unit students should be able to

describe specific ocean phenomena and physical process in the coastal and deep ocean
quantitatively determine the physical process in the ocean
apply data quality control, processing, and analysis techniques
apply computer programming skills to solve problems related to physical oceanography

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End Semester Exam (Theory) - 60 %
Practical Assessments - 20%
Continuous assessments - 20 %

**Course Unit Contents**: 24 hrs Theory,18 hrs Practical)
Ocean Mixing: (Theory – 3hrs)
Oceanic Salt Budget: (Theory – 4h, Practical - 3h)
Oceanic Heat Budget: (Theory – 4h, practical - 6h)
Equatorial Processes: (Theory - 4h, practical - 3h)
Tides: (Theory – 3h, practical – 3h)
Special topics, data quality control, processing and analysis: (Theory – 4h, Practicals – 3h)
Estuarine oceanography: (Theory - 2h)

**References**Talley, L.D., Pickard, G.L., Emery, W.J., and Swift, J.H., 2011. Descriptive physical Oceanography: An Introduction. Sixth edition, Academic Press.

**Course Unit No**: OCG4172 (from 2019 to date)

**Name of the Course Unit:** Marine & Coastal Biodiversity Conservation and Management

**Course Unit Objectives:** To develop students ability to understand on Marine & Coastal Biodiversity Conservation

**Curriculum learning outcomes:** Students should be able to
cite the scientific evidence for biodiversity change in the modern era and detail the contemporary ca uses of diversity loss.
explain ecological, social, and economic impacts of diversity loss.
apply management and conservation principles and tools that are used to conserve diversity.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester Exam (Theory) - 75%
Practical reports - 25%

**Course Unit Contents**: (24 hrs Theory,18 hrs Practical)
1.The Need for marine biodiversity Conservation.
2. Biodiversity in coastal and marine ecosystems around Sri Lanka.
3.Threatened and sensitive species and habitats.
4. Impacts of human activities on ecosystem composition, Structure and function.
5.Application of science to biodiversity conservation and management,
6.Sampling and recording, Selection, Design and management of marine protected areas, Assessing likely impacts and monitoring change,
7.Recovery, restoration and replacement of habitats and species.

**References** Hiscock, K., 2014. Marine Biodiversity Conservation: A practical approach. Routledge.

**Course Unit No**: **OCG 4182* (from 2019 to date as an optional course)**

**Name of the Course Unit:** Wetland Management

**Course Unit Objectives:** To develop students ability to understand on Wetland Management

**Curriculum learning outcomes:** Students should be able to explain wetland hydrology and biogeochemistry, flora and fauna, and functional attributes.
evaluate important issues to consider for wetland management, conservation, and restoration.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End semester Exam (Theory) - 75%
Practical reports - 25%

**Course Unit Contents**: 24 hrs Theory,18 hrs Practical)
Physical, chemical and biological characteristics of wetlands, including hydrology, soils, vegetation and wildlife, Wetland classification and rating, Wetland functions and assessment of functions, Setting management objectives, Selection management strategies, creating zones, Reviewing and adjusting Monitoring, Artificial wetlands.

**References** Mitsch, W.J. andGosselink, J.G., 2015. Wetlands. Fifth edition, wiley.

**Course Unit No**: **OCG 4191** (from 2019 to date as an optional course)

**Name of the Course Unit:** Coastal Hazards and Mitigation

**Course Unit Objectives:** To develop students ability to understand on Coastal Hazards and Mitigation

**Curriculum learning outcomes:** Students should be able to explain wetland hydrology and biogeochemistry, flora and fauna, and functional attributes.
evaluate important issues to consider for wetland management, conservation, and restoration.

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

End Semester Exam (Theory ) - 100%

**Course Unit Contents**: 15 hrs Theory
**1.T**sunamis, Cyclones, Coastal Flooding,
2. Hydrologic hazards Coastal erosion and sedimentation,
3. Coastal dune hazards,
4. Coastal marine Pollution,
5. remote sensing hazards, Identification of past events their intensity.
6. Calculation of recurrence intervals,
7. Hazard preparedness.

**References** Finkl, C.W., 2012. Coastal Hazards. Springer.

## Courses for Level 4, Semester II

**Course Unit No:** AQU4216 (previous AQU 4b16) / FSH4216 (previous FSH 4b16), **LIM4216, OCG 4216 (2006-2019)**

**Name of the Course Unit:** Research Project, Thesis Writing and Viva-voce

**Course Unit Objectives:** To develop students ability to carry out independent research project

**Learning Outcomes**: Students should be able to design a research project

Able to complete research project within the stipulated time

Able to write project report (thesis) on the given format and criteria

Able to carry out presentation of the research project

**Course Unit Outline**: Literature survey, initial presentation, research work, thesis writing, final presentation

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

Research proposal presentation: 10%

Thesis: 70%

Final presentation: 20%

**Course Unit Contents**:

Not defined

**References**: depend on the research area

**Course Unit No:** AQU4218 / FSH4218, **(from 2020 onwards)**

**Name of the Course Unit:** Research Project, Thesis Writing and Viva-voce

**Objectives:** to make the student for designing a research project to complete within the limited time frame

**Learning Outcomes**: Students should be able to carry out a scientific research in his/her chosen field with minimum supervision

- report the research finding in a systematic manner
- defend his/ her research work in front of a panel of examiners and scholarly audience.

**Course Unit Outline**: Literature survey, initial presentation, research work, thesis writing, final presentation

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

Research proposal presentation: 10%

Thesis: 70%

Final presentation: 20%

**Course Unit Contents**:

An 8-credit project on specialization subject or the degree programmes is required. The purpose of the project should be to provide in depth knowledge of application of science and technology. Time for experimentation is limited and considerable emphasis should be placed on the analysis, interpretation and discussion of the experimental results obtained.

**References**:

**Course Unit No:** FSH 4222 (previous FSH 4112)/ AQU4222 (previous AQU 4112), LIM 4222, OCG4222 (2006-2019)

**Name of the Course Unit**: Essays & Seminars

**Objectives:** The aim of the course Course Unit is to improve skills of students to interpret published research to gather new knowledge

**Learning Outcomes**: Students should be able to understand research papers

Able to interpret research papers

Able to write essay on given topic based on research papers

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**:

Essay writing paper end semester: 100%

**Course Unit Contents**: subjects relevance

**References**: depend on the subjects

**Course Unit No:** FSH 4230 (previous FSH 4220)/AQU4230 (previous AQU 4220). LIM4230, OCG 4230 (2006-2019)

Revised by introducing two credits for each unit (FSH 4232, AQU4232) (2020 onwards)

**Name of the Course Unit:** Industrial or field training (Report/logbooks to be submitted)

**Objectives:** To aware the students in process, function, and management of relevant industries, authorities or Bureau in Sri Lanka

**Learning Outcomes**: Students should be able to, practice better management at self-entrepreneurs

Able to follow good practice at the training authorities

Able to aware Sri Lankan standards and accreditations for different process

**Prerequisite**: No

**Assignments**: No

**Mode of Assessment**: log books and interview (pass or fail)

**Report and the interview**

**Course Unit Contents**:

Human Resource Management, Concept of green economy, Waste management, Quality control, industrial specific practices,

**References**: