BScHons in Marine and Freshwater Sciences in Water Sciences and Technology

Course Units for Level I Semester I

Course Unit No: **LIM1112**

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

Intended Learning Outcomes: At the completion of this course unit students should be able to,
ILO1: define basic terms in Limnology

ILO2: classify inland aquatic systems

ILO3: apply scientific methods for understanding aquatic systems

ILO4: 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

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

Intended Learning Outcomes: At the completion of this course unit student should be able to,
ILO 1: explain characteristics of freshwater fauna
ILO 2: compare biology and adaptations of freshwater fauna
ILO 3: describe importance of the freshwater fauna in different ecosystems
ILO 4: classify freshwater fauna into taxonomic groups

Prerequisite: No

Assignments: class tests

Mode of Assessment:

End semester exam (Theory) – 80%
End semester exam (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**

Name of the Course Unit: Principles in Chemistry

Objectives: to develop student's ability to

- apply basic concepts in Chemistry in other subject areas

Intended Learning Outcomes: At the completion of this course unit student should be able to
ILO1: explain fundamentals in Chemistry.
ILO2: define the structure of the atom based on atomic structure models.
ILO3: compare different types of intra and inter molecular bonding.
ILO4: evaluate molecular geometry. to develop student's ability to

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**

Name of the Course Unit: Analytical Chemistry –I

Objectives: To develop student's ability to

- apply laboratory techniques associated with different analytical methods

Intended Learning Outcomes: At the completion of this course unit student should be able to

ILO 1. use laboratory safety and handling techniques.
ILO 2. apply different quantitative analytical techniques.
ILO 3. design and demonstrate experiments based on volumetric analysis.
ILO 4. record and analyze the results of volumetric analysis.
ILO 5. solve quantitative based problems related to volumetric analyses.

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.: **OCG 1111**

Name of the Course Unit: Introduction to Oceanography

Objectives: To develop student's ability to

- explain the theories of Oceanography

Intended Learning Outcomes: At the completion of this course unit student should be able to
ILO 1: describe fundamentals in oceanography
ILO 2: summarize developments in oceanography
ILO 3: explain ocean structure and processes

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) 70 %,
Assignments (2) - 30 %

Course Unit Contents: [15 hrs Theory]

Definition for oceanography (1hr), History of oceanography (1hr), major oceanographic expeditions and their findings (2hrs), international oceanographic research institutions (1hr), ocean basins (2hrs), water and ocean structure (2hr), 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**

Name of the Course Unit: Earth History, origin and evolution of life

Objectives: To develop students ability to

- understand different hypotheses on the evolution of earth and life on the earth.
- attain basic knowledge on fossils.

Intended Learning Outcomes: At the completion of this course unit student should be able to
ILO 1: describe how the universe has been formed, different hypotheses on formation of the universe
ILO 2: explain how the elements, stars and solar systems have been formed
ILO 3: explain the origin of the sun, earth and other planets in the solar system
ILO 4: explain plate tectonic theory and geology of the earth

ILO 5: explain the theories on origin and evolution of life on earth

Prerequisite: No

Assignments: No

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

Course Unit Contents: Theory (24hrs):

Origin & evolution of earth (4hrs), geological time scale (2hrs), Numerical dating 2hrs), early life and its patterns (3hrs), earliest Palaeozoic history (2hrs), major tectonic geological and climatic events and evolution of life through the geological history (8hrs), fossils and fossilization (3 hrs).

Practical (18hrs): for above topics

References:

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

Course Unit No.: OCG1132

Name of the Course Unit: Earth Material

Objectives: To develop student's ability to identify and classify rocks and minerals

Intended Learning Outcomes: At the completion of this course unit student should be able to
ILO 1: explain formation of rocks and minerals
ILO 2: classify rocks and minerals

Course Unit Outline: Introduction of earth material, their formation and classification

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 80%
Practical reports - 20%

Course Unit Contents:

24 hrs Theory,

Introduction to crystallography (2 hrs), Properties of minerals (2 hrs), rock forming minerals (3 hrs), rock cycle (3hrs), sedimentary rock formation (3hrs), sedimentary rock classification (3hrs), metamorphism (2 hrs), metamorphic rocks (2hrs), formation of intrusive and extrusive igneous rocks (2hrs), Igneous rock classification (2 hrs)

18 hrs Practical: Identification and classification of different mineral and rock types

References:

Hefferan, K. and O'Brien, J., 2010. Earth materials, Wiley-Blackwell.

Course Unit No.: FAQ1131

Name of the Course Unit: Cell Biology

Objectives: To develop student's ability to

- explain structure and function of the cell

Intended Learning Outcomes: At the completion of this course unit student should be able to,
ILO 1: explain the structure and function of the cell.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) – 85%
End semester exam (Practical) – 15%

Course Contents:

[13 hrs Theory]

Biology of cells of higher organisms: Structure, function, and biosynthesis of cellular membranes and organelles (5 hrs); cell growth and oncogenic transformation; transport, receptors, and cell signalling (4hrs); the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis (4hrs)

6hrs Practical: different cell types, microscopic measurements, staining techniques

References:

George, P., 2014. Principles of Cell Biology. Second edition, Jones and Bartlett Learning.

Course Unit No: OCG1141

Name of the Course Unit: Mathematics I

Objectives: To develop student's ability to use of different mathematics for solving problems

Intended Learning Outcomes: At the end of the Course Unit students should be able to,
ILO 1: use of mathematics, Algebra, Calculus, and geometry
ILO 2: apply above braches of mathematics to solve problems

Prerequisite: No

Assignments: No

Mode of Assessment:

Final examination (Theory) - 70%
Tutorials - 30 %

Course Contents: [15 hrs Theory]

Sets and inequalities (2hrs), Liner and quadratic equation (2hrs), Function and graphs (2hrs), Trigonometric function Exponential and logarithmic function (2hrs), Differential calculus (2hrs), Integral calculus (2hrs), Matrices and determinants (3hrs)

References:

Lang, S., 1998 Basic Mathematics, Springer

Course Unit No: FDN 1111

Name of the Course Unit: Preliminary English - I

Objectives: To develop student's ability to

- communicate orally in their field of study.
- comprehend and extract the required information from chosen text and/ or general reading material.
- produce ideas related to the relevant field of study in an acceptable written form.
- enhance accuracy in the use of language through an exposure to the frequently used rules in English grammar.This Course Unit aims to make the student competent with reading, writing, and speaking in English

Intended Learning Outcomes: At the completion of this course unit student should be able to

ILO 1: explain simple passages in English,

ILO 2: write simple sentences correctly, be familiar with the rudiments of capitalization and punctuation and understand simple listening passages.
ILO 3: perform English in their interactions with other students and teachers relating to general situations**.**

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) – 100%

Course Unit Contents: [15 hrs Theory]

Reading: Reading comprehension skills, reading notices, vocabulary building, (5hrs)
Writing: capitalization, punctuation, guided writing, writing invitations, simple dictation, understanding announcements, answering questions to listening passages (teacher's voice and recorded voice), understanding the story of a film (5hrs).
Speaking: Introductions and greetings, spontaneous speech, prepared speech. Grammar: Simple sentences, the simple present, prepositions of time, prepositions of place, the passive voice, adjectives and adverbs, articles and nouns (5hrs).

References:

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

Course Unit No: FDN1121

Name of the Course Unit: Computer Literacy -I

Objectives: To develop student's ability to use word processing and spreadsheet applications wherever necessary in the degree

Intended Learning Outcomes: At the completion of this course unit student should be able to
ILO 1: apply 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.
ILO 2: apply basic and selected intermediate features of presentation applications such as MS Power Point - fonts, colors, slide animation and navigation, transition

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) 60%
Continuous Assessment (practical) 40%

Course Unit Contents: [15 hrs Theory]

- Basic Concepts of Software and Hardware (2hr)
- Windows Operating Systems (Windows XP) (2hrs)
- Word Processing (MS-Word) (2 hrs)
- Presentation Tools (MS-PowerPoint) (2 hrs)
- Spreadsheet Application (MS-Excel) (3 hrs)
- Database Management Systems- I (MS-Access) (2 hrs)
- Computer Programming Fundamentals (C-Language) (2 hrs)

References:

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

Course Unit No: FDN1131 (optional Course)

Name of the Course Unit: Snorkelling and Life saving

Objectives: To develop students ability to

- gain basic swimming and snorkeling skills

Intended Learning Outcomes: At the completion of this course unit student should be able to,
ILO 1: use skills, safety, and the proper use and care of the equipment used in snorkeling
ILO 2: use field skills to study marine and near-shore environmentsStudents should be able to

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 60 %
Continuous assessment (Practical) - 40 %

Course Unit Contents: [9 hrs Theory, 18 hrs Practical]

Basic skills of snorkelling, diving and lifesaving, snorkelling gears, diving gears, diving hazards, snorkelling and diving ethics, underwater photography, maintenance of snorkelling and diving gear, and underwater photographic equipment.

References:

Steven, M, B., 1999. A simple guide to snorkelling fun, Best Publishing Company.

Courses for Level 1, Semester II

Course Unit No: LIM1212

Name of the Course Unit: Physical and Chemical Limnology

Objectives: This Course Unit aims to make the student understand to analyse physical and chemical properties of lake ecosystem.

Intended Learning Outcomes: At the end of the course unit Students should be able to
ILO 1: explain the physical and chemical properties of water, and how those properties change lake ecosystem.

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).

18 hrs Practical

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

Name of the Course Unit: Freshwater Flora

Objectives: This Course Unit aims to make the student identify morphological variation of algae for further studies

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: identify freshwater flora,
ILO 2: describe biology and distribution patterns of freshwater flora in the relevant aquatic environment.
ILO 3: Classify freshwater flora based on morphology
ILO 4: Describe ecological and economical importance

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents:

[24 hrs Theory]

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 (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

Name of the Course Unit: Inorganic Chemistry

Objectives: This Course Unit aims to make the student to analyse chemistry of selected elements under different conditions

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the chemistry of selected elements
ILO 2: describe their behaviour under different conditions
ILO 3: synthesise coordination and organometalic compounds.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents:

24 hrs Theory:

Selected topics on chemistry of s, p, d and f block elements (5 hrs): Electron configurations (3hrs), Oxidation states (2hrs), Physical properties (3 hrs), Allotropes, Organometallic chemistry and coordination chemistry (6hrs), An elementary course on radio chemistry (3 hrs)

18 hrs Practical:

References

Selected topics on chemistry of s, p, d and f block elements: Electron configurations, Oxidation states, Physical properties, Allotropes, Organometallic chemistry and coordination chemistry, An elementary course on radio chemistry
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: FAQ1222

Name of the Course Unit: Fundamentals of fish Genetics

Objectives: This Course Unit aims to make the student understand use of molecular biological techniques practiced in fisheries & aquaculture

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe the principles of Mendelian inheritance
ILO 2: describe non Mendelian inheritance
ILO 3: dentify 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 exam (Theory) – 75%
Continuous Assessment (Practical) – 25%

Course Unit Contents:

24 hrs Theory,

History and major terms of genetics (2 hrs). Mendel's law (2 hrs), Variations to Mendel's law; incomplete dominance and co-dominance (3 hrs), gene interactions (7 hrs) Sex linked genes, sex limited traits and sex influenced factors (3 hrs), 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

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

References:
Robert B. 2014. Genetics, Analysis and Principles. Fifth edition, McGraw-Hill.

Hartwell L. et al, 2010. Genetics: From Genes to Genomes. Fourth edition, McGraw-Hill.

Course Unit No: OCG1222

Name of the Course Unit: Marine Biology – Invertebrate Fauna

Objectives: This Course Unit aims to make the student identify different marine invertebrates, understand their biology and use of their classification

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe the diversity of invertebrate organisms
ILO 2: explain their evolutionary origin and diversification.
ILO 3: investigate invertebrates in laboratory and field conditions, and identify major taxonomic groups.
ILO 4: communicate the major evolutionary innovations in invertebrate groups
ILO 5: describe the functional significance of associated morphologies and behaviours.

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]

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.

Practical on above topics

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

Course Unit No: OCG1242

Name of the Course Unit: Introduction to Geospatial Analysis

Objectives: This Course Unit aims to make the student understand on Geospatial Analysis

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: follow methods of spatial analysis
ILO 2: modeling techniques that are provided within currently available and widely used geographic information systems (GIS) and associated software.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 80%
Practical reports - 20%

Course Unit Contents: [24 hrs Theory,

Introduction and terminology, Basic Primitives, Spatial Relationships, Spatial Statistics, Building Blocks of Spatial Analysis Spatial and Spatio-temporal Data Models and Methods Geometric and Related Operations, Queries, Computations and Density Distance Operations.

18 hrs Practical: on above topics

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

Name of the Course Unit: Statistics for Experimental Analysis

Objectives: This Course Unit aims to make the student understand on statistical methods

Intended Learning Outcomes: At the end of the course unit students should be able to,
ILO 1: explain statistical methods
ILO 2: use suitable experimental analysis

Course contents: (Theory 24 hrs, Practical 18 hrs)
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

Prerequisite: No

Assignments:

Mode of Assessment:

Theory: 11/2 hours, Practical 11/2 hours

References:

Course Unit No: FDN1211

Name of the Course Unit: Preliminary English - II

Objectives: This Course Unit aims to make the student understand English in connection with their chosen field of study,

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: read and understand English in connection with their chosen field of study,
ILO 2: write simple essays, both general, and in relation to their academic subjects,
ILO 3: listen to and understand lectures, and participate appropriately in informal group discussions.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: [15 hrs 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

Name of the Course Unit: Computer Literacy–II

Objectives: This Course Unit aims to make the student understand data base management systems those are important for successful completion of computer based courses

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: 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: [10 hrs Theory, 15 hrs Practical]

- Database Management Systems- I (MS-Access)

References

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

Courses for Level 2 Semester I

Course Unit No.: LIM 2111

Name of the Course Unit: Physics of Water

Objectives: This Course Unit aims to make the student understand theoretical and quantitative Physical properties of water

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

ILO 1: explain Physical properties of water

Prerequisite: No

Assignments: No

Mode of Assessment:

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

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

Steam and water as a function of pressure, Density, Viscosity, Surface tension, Thermodynamics, Thermal conductivity Molar volumes and expansion coefficients, behaviour of sound in water, electrical conductivity of water, fluid dynamics, Applications of supercritical water.

References:

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

Course Unit No.: LIM 2123

Name of the Course Unit: Theoretical Ecology and Ecological Modelling

Objectives: This Course Unit aims to make the student understand the relationships between aquatic organisms and their environment for ecosystem management

Intended Learning Outcome: At the end of the Course Unit students should be able to
ILO 1: explain relationships between aquatic organisms and their environment
ILO 2: to design ecological research

Prerequisite: No

Assignments: group presentation based on the subtopics of each field visit (10minutes for each student)

Mode of Assessment:

End semester exam (theory) – 80%
End semester exam (practical) – 20%

Course Unit Contents: 37 hrs Theory

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

24 hrs Practical: on above topics

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: LIM2132

Name of the Course Unit: Microbial Quality of Water

Objectives: This Course Unit aims to make the student to analyse microbial quality of water

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: describe microbiological principles
ILO 2: apply principles to manage freshwater systems

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (theory) – 80%
End semester exam (practical) – 20%

Course Unit Contents: 24 hrs Theory

Microorganisms and potable water, Origin of microorganisms of public health significance, Characteristics, types, metabolism, multiplication, survival, Health problems caused by polluted drinking water, Epidemiology of drinking water infections, Risk assessment methods, Microorganisms in sewage treatment, pathogens in sewage, Disinfection of effluent, International regulations and WHO guidelines on pool and spa management, Transmission of infections as a result of chemical quality of pool water, occupational health & safety in the pools.

18hrs Practical

References:

Gabriel, B., 2014. Microbiology of Drinking Water Production and Distribution, Wiley-Blackwell.

Helen B. 2013. Waterborne Pathogens: Detection Methods and Applications, Academic Press.

Course Unit No: LIM2141

Name of the Course Unit: Biodiversity and Evaluation Strategies

Objectives: This Course Unit aims to make the students understand biodiversity and the estimation methods at different ecosystems

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: design diversity estimation methods at different ecosystems
ILO 2: Calculate the diversity using the relevant indices with appropriate modifications
ILO 3: describe use of indicator species and evaluate ecosystems

Prerequisite: No

Assignments: Field reports

Mode of Assessment:

End semester exam (theory) – 80%
End semester exam (practical) – 20%

Course Unit Contents: 12 hrs Theory

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

09hrs Practical

Data collection for Diversity estimation on the field and analyse the data

References:

……..

Course Unit No: CHM2111

Name of the Course Unit: Analytical Chemistry II

Objectives: This Course Unit aims to make the student understand on principles in analytical chemistry

Intended Learning Outcomes: At the end of the Course Unit students should be able to

ILO 1: explain principles of electrochemistry and various electroanalytical techniques
ILO 2: apply the electroanalytical techniques for quantitative analytical applications
ILO 3: describe and explain the principles of separation techniques and operation of modern chromatographic instruments.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (theory) – 85%
Presentation – 15%

Course Unit Contents: 12 hrs Theory

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

06hrs Practical on above topics

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: CHM2122

Name of the Course Unit: Organic Chemistry

Objectives: This Course Unit aims to make the student understand on identification and classification of organic molecules

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: identify, classify, analyze, and draw structures of organic molecules.
ILO 2: define and recognize regioselective, stereoselective and stereospecific reactions.
ILO 3: demonstrate proficiency in organic chemical laboratory techniques.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: 24 hrs Theory

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.

18hrs Practical

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

Course Unit No: OCG2111

Name of the Course Unit: Tectonics and Ocean Basins

Objectives: This Course Unit aims to make the student understand on Tectonics and Ocean Basins

Intended Learning Outcomes: At the end of the Course Unit students should able to
ILO 1: explain plate tectonics
ILO 2: describe development of ocean basins by plate tectonics.
ILO 3: describe features at the ocean basins and how they are being developed.

Prerequisite: No

Assignments: No

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

Name of the Course Unit: Marine Biology–Flora

Objectives: This Course Unit aims to make the student understand on biology of marine flora

Intended Learning Outcomes: At the end of the Course Unit students should able to
ILO 1: demonstrate the knowledge of marine flora, marine environment and its biological and physical properties and processes.

Prerequisite: No

Assignments: No

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

Course Unit Contents: 24 hrs Theory

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

15 hrs practical

References:

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

Course Unit No: OCG1242

Name of the Course Unit: Marine Biology – Vertebrate Fauna

Objectives: This Course Unit aims to make the student understand on biology of vertebrate fauna

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

ILO 1: identify taxonomic characteristics of major classes and families of marine vertebrates, their behaviour, and habitats.

Prerequisite: No

Assignments: No

Mode of Assessment:11/2 hours theory, 11/2 hrs practical

Course Unit Contents: 24 hrs Theory,

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

18 hrs Practicals on above topics

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

Course Unit No: FDN2111

Name of the Course Unit: Intermediate English -I

Objectives: This Course Unit aims to make the student understand on commands in English

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: use 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 Semester exam (Theory) - 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: FDN2121

Name of the Course Unit: Computer Literacy III

Objectives: This Course Unit aims to make the student understand computer-programming languages

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain C programming language for simple programming - language syntax, compile and run time errors, variable declarations, operators, conditional statements, loops, arrays.
ILO 2: 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: 10 hrs Theory

Computer Programming Fundamentals (C-Language)

15hrs Practical:…….

References:

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

Level II semester II

Course Unit No: LIM2212

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

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

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: describe ecological functions and 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: 24 hrs Theory

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.

18hrs Practical:…….

References:

William J. M., 2015. Wetlands. Fifth edition, Wiley.

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

Course Unit No: LIM2222

Name of the Course Unit: Aquatic Toxicology and Human Health Risk

Objectives: This Course Unit aims to make the student understand numerical evaluation of toxicity for the environment, and for human health

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: define the toxicity and key words used in toxicology
ILO 2: explain the toxicity of any substance on a given aquatic organisms Numerically.
ILO 3: Explain the dose response relationships.
ILO 4: use local scenarios for understanding on toxicants in aquatic environments, their risk for human health and mitigatory measures.

Prerequisite: No

Assignments: study local scenarios at student's hometown as group work to submit reports

Mode of Assessment:

End semester exam (Theory) – 85%
End semester exam (Practical + report) – 15%

Course Unit Contents: 24 hrs Theory

Fundamentals of toxicity, Types of toxicants and toxicities, quantification of toxicity, transport and biochemical transformation mechanisms, dose-response relationships, bioaccumulation, bio availability of toxicants, Evaluation of environmental & human health risk, hazard identification, exposure assessment, dose-response assessment, risk characterization, quantitative risk measurements.

18hrs Practical: on above topics

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: CHM2212

Name of the Course Unit: Physical Chemistry I

Objectives: This Course Unit aims to make the student understand on Physical Chemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain concepts and facts in physical chemistry
ILO 2: analyze and solve advanced problems with critical thinking
ILO 3: employ a range of instrumental and non-instrumental laboratory techniques for the measurement of physical parameters.

Prerequisite: No

Assignments:

Mode of Assessment:

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

Course Unit Contents: 26 hrs Theory

Colligative properties, chemical thermodynamics, gaseous state of matter,
Chemical Kinetics, photochemistry,
surface & colloidal chemistry

12hrs Practical:

References:

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

Course Unit No: OCG2222

Name of the Course Unit: Geomorphology and Morphometric Analysis

Objectives: This Course Unit aims to make the student understand on Geomorphology and Morphometric Analysis

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain earth shaping processes
ILO 2: to simulate those processes through computer modelling

Prerequisite: No

Assignments:

Mode of Assessment:

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

Course Unit Contents: 24 hrs Theory

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

18hrs Practical:…….

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

Course Unit No: OCG2233

Name of the Course Unit: Chemical Oceanography

Objectives: This Course Unit aims to make the student understand on Chemical Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: Explain conservative, non conservative and trace elements and their behaviour in the oceans
ILO 2: Describe biogeochemical cycles of the major nutrients within the oceans.
ILO 3: Discuss the behaviour of dissolved gases and their impact on ocean anoxia and carbonate chemistry.

Prerequisite: No

Assignments:

Mode of Assessment:

End Semester exam (Theory)- 50%
Continuous Assessments - 15%
End Semester Exam (Practical) - 35%

Course Unit Contents: 30 hrs Theory

Major, minor, and trace elements, micronutrients, and organic matter in the ocean, carbonate system, dissolved gases, ionic interactions, atmospheric chemistry and ocean.

45hrs Practical:…….

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

Course Unit No: OCG2243

Name of the Course Unit: Physical Oceanography

Objectives: This Course Unit aims to make the student understand on Physical Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: discuss the physical processes of the ocean
ILO 2: explain observational methods and instrumentation used by physical oceanographers.

Prerequisite: No

Assignments:

Mode of Assessment:

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

Course Unit Contents: 30 hrs Theory

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.

45hrs Practical:…….

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

Course Unit No: OCG2253

Name of the Course Unit: Biological Oceanography

Objectives: This Course Unit aims to make the student understand on Biological Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the basic principles of biological oceanography of the pelagic ecosystem.

Prerequisite: No

Assignments: No

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

Course Unit Contents: 30 hrs Theory

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.

45 hrs practical
……

References:

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

Course Unit No: FDN2211

Name of the Course Unit: Intermediate English -II

Objectives: This Course Unit aims to make the student understand on extended texts containing complex language

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: read and understand extended texts containing complex language, write passages using a variety of complex structures, to understand the content of a formal meeting, and prepare a general presentation
ILO 2: discuss the physical processes of the ocean

Prerequisite: No

Assignments:

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: 15 hrs Theory

Reading: Practice in complex reading passages, both general and academic,
Writing summarizing skills, writing C.V.s and applications, Listening:filling in blanks in songs, note-taking skills and familiarization with native voice, Grammar: Conditionals, reported speech, questions, the –ing form.

References:
Murphy, R., 1989. Grammar in Use: Reference & Practice forIntermediate Studentsof English. Cambridge University Press.

Course Unit No: FDN2221

Name of the Course Unit: Computer Literacy IV

Objectives: This Course Unit aims to make the student understand on procedural languages

Intended Learning Outcomes: At the end of this course students should be able to
ILO 1: confident about using MATLAB for their own project work, and should feel more prepared to tackle other procedural languages such as C++ or Visual Basic for model building.

Prerequisite: No

Assignments:

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assessments - 25

Course Unit Contents: 15 hrs Theory

Introduction to Programming, Programming Environment, Graph Plots, Procedures and Functions, Control Statements, Manipulating Text, GUI Interface, Model Building.

References:
Holzbecher, E., 2012. Environmental Modelling: Using MATLAB. Second edition, Springer.

Courses for Level 3 Semester I

Course Unit No.: **LIM3112**

Name of the Course Unit: Hydraulics

Objectives: This Course Unit aims to make the student understand on Hydraulics

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain principles and operation of basic hydraulic systems
ILO 2: use flow meters and pressure gauges to measure valves and make adjustments
ILO 3: Interpret schematics and troubleshoot both open and closed centre hydraulic systems.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: [24 hrs Theory and 18 hrs Practical]

Physical Fluid Properties, Hydrostatic Pressure - Pressure Forces on Plane and Submerged Surfaces, Fluids in Motion - Laminar and Turbulent Flow, Bernoulli's Equation, Flow in Pipes - The Darcy-Weisbach Equation, Determining Discharge, Determining Head Loss, Head Distribution along Pipelines, Open Channel Flow - Characteristics, Steady Uniform Flow, Manning's Equation, Specific Energy and Critical Depth, Supercritical and subcritical Flow, Non-uniform Flow, Gradually and rapidly varied non-uniform Flow

References:

Qin, Z., 2013. Basics of Hydraulic systems, CRC press.

Chanson,H., 2004. Environmental Hydraulics for open channel flows. First edition, Butterworth-Heinemann.

Course Unit No.: LIM 3121

Name of the Course Unit: Geochemistry

Objectives: This Course Unit aims to make the student understand on Geochemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain how geochemistry can be applied to understand Earth processes.
ILO 2: To apply geochemical knowledge to solve environmental and health issues

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester exam (Theory)- 100%

Course Unit Contents: [30 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

Name of the Course Unit: Aquatic Pollution

Objectives: This Course Unit aims to make the student understand on Aquatic Pollution

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe the sources and types of water pollution.
ILO 2: explain biological and chemical analytical techniques for the measurement and control of aquatic pollution.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: [24 hrs Theory

Sources, and types of aquatic pollutants, their fate and transport mechanism, chemical methods and biological indices for estimation of aquatic pollution.

18 hrs Practical:……..

References:

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

Course Unit No.: LIM 3142

Name of the Course Unit: Water Treatment Technology

Objectives: This Course Unit aims to make the student understand on Water Treatment Technology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the major physical, chemical and biological characteristics of clean fresh water, and their importance for aquatic organisms
ILO 2: discuss the standard processes for producing potable water
ILO 3: describe issues of nitrates, trace organics, and fluoridation that can be dealt with potable water supply.
ILO 4: suggest methods of occurrence of saltwater, utilization of salt water, methods and economics of desalinization

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 60%
Continuous Assessment (Theory) - 20%
Continuous Assessment (Practical) - 20%

Course Unit Contents: 24 hrs Theory

Established water quality standards for different purposes and discharge, different techniques of Water treatment for Drinking, Industrial and other purposes.

18 hrs Practical]:

References:

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

Course Unit No.: LIM3152

Name of the Course Unit: Wastewater Treatment Technology

Objectives: This Course Unit aims to make the student understand on Wastewater Treatment Technology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the suitable techniques for treatment of wastewater considering quality, quantity, source and economy.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 60%
Continuous Assessment (Theory) - 20%
Continuous Assessment (Practical) - 20%

Course Unit Contents: 24 hrs Theory

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.

18 hrs Practical

References:

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

Course Unit No.: **LIM3161**

Name of the Course Unit: Quality Assessment of aquatic systems

Objectives: This Course Unit aims to make the student understand Quality Assessment of aquatic systems

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

ILO 1: conduct a complete water quality assessment for a given water body

Prerequisite: No

Assignments: group work on water quality assessment and report writing

Mode of Assessment:

End semester exam (Theory) - 80%
Continuous Assessment (group work and the report) - 20%

Course Unit Contents: 12hrs Theory

Strategies for water quality assessment, Selection of water quality variables, Hydrological variables, General variables, Nutrients, Organic matter, Major ions, inorganic variables, Metals, Organic contaminants, Microbiological indicators, Selection of variables, Data handling and presentations

9 hrs Practical:

References:

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

Course Unit No.: CHM3112

Name of the Course Unit: Advanced Aquatic Chemistry

Objectives: This Course Unit aims to make the student understand

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

ILO 1: explain molecular level interactions in aquatic systems.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: [10 hrs Theory and 15 hrs Practical]

Atmosphere-water interactions, precipitation and Dissolution, solid-solution interface and kinetics at the interface, adsorption, inter particle interactions; trace metal cycling regulation and biological role, kinetics of redox processes, photochemical processes.

References:

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

Course Unit No.: CHM3122

Name of the Course Unit: Physical Chemistry II

Objectives: This Course Unit aims to make the student understand on Physical Chemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: use of spectral data to deduce the structures of organic/inorganic molecules
ILO 2: 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: 24 hrs Theory

Molecular Spectroscopy; UV-visible spectroscopy: Atomic-Absorption Spectroscopy (AAS), NMR spectroscopy, Infra-Red spectroscopy (IR), Mass spectroscopy, Electron Spin Resonance spectroscopy (ESR):
Mössbauer spectroscopy

18 hrs Practical

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.: OCG3112 (OP)

Name of the Course Unit: Mineralogy

Objectives: This Course Unit aims to make the student understand on Mineralogy

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: get a detailed theoretical knowledge on crystallography, chemical and physical properties of minerals
ILO 2: identify major rock forming minerals

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Practical reports - 25%

Course Unit Contents: 24 hrs Theory

Crystallography, Physical Properties, Optical Mineralogy, Chemical analysis of Minerals, Neso silicate, Sorosilcate, Chain silicates, Phyllo silicates, Framework silicates, Sulphide Minerals, Carbonate minerals, Oxide Minerals.

18 hrs Practical

References:

Cornelis, K. and Cornelius,S. H.1993. Manual of Mineralogy. Twenty first edition, Wiley.

Course Unit No.: OCG3132

Name of the Course Unit: Hydrography and Navigation

Objectives: This Course Unit aims to make the student understand Hydrography and Navigation

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: describe the theory of operation and application of sea floor mapping technologies
ILO 2: plan an effective acoustic sea floor mapping survey based on specified deliverables and designed to answer a specific research question
ILO 3: 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

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
Crystallography, Physical Properties, Optical Mineralogy, Chemical analysis of Minerals, Neso silicate, Sorosilcate, Chain silicates, Phyllo silicates, Framework silicates, Sulphide Minerals, Carbonate minerals, Oxide Minerals.

18 hrs Practical ……..

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

Name of the Course Unit: Remote sensing and GNSS

Objectives: This Course Unit aims to make the student understand on Remote sensing and GNSS

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: explain the components and applications of Remote Sensing and Global Navigation Satellite Systems.
ILO 2: use image processing and analysis.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 80%s
Continuous Assessments - 20%

Course Unit Contents: 24 hrs Theory

Introduction to Remote Sensing, Remote Sensing Basics, Satellite Remote Sensing Systems, Introduction to Aerial Photography, Visual Image Interpretation Introduction to digital image processing, Applications of Remote Sensing, Introduction to Global Navigation Satellite Systems.

18 hrs Practical ……..

References:

Jensen, J.R., 2007. Remote Sensing of the Environment: An Earth Resource Perspective. Second edition, Pearson Publication.

Course Unit No.: OCG3152

Name of the Course Unit: Statistics for Experimental Analysis II

Objectives: This Course Unit aims to make the student understand on Statistics for Experimental Analysis

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: use multivariate and time series analysis for scientific research.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: 21 hrs Theory

Multiple regression, MANOVA, Cluster analysis, Principal component analysis, discriminant analysis, Time series analysis

27 hrs Practical ……..

References:

Quinn, G.P., and Keough, M.J., 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press.

Course Unit No.: OCG3162

Name of the Course Unit: Sedimentology

Objectives: This Course Unit aims to make the student understand

Intended Learning Outcomes: At the end of the Course Unit students should be able to
ILO 1: evaluate physical, chemical and biological processes that lead to sedimentary rock formation and their subsequent diagenesis under different environmental conditions.
ILO 2: conversant with the principal environments in which sediments are deposited and be able to identify these in the geological record on the basis of their distinguishing features.
ILO 3: use hand specimens and the petrological and microscope to identify minerals and assess the significance of textures processes of formation in selected suites of sedimentary rocks.
ILO 4: construct, correlate and interpret measured sections through a variety of rock successions to enable spatial and temporal variations to be identified and appropriately evaluated.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester exam (Theory) - 60%
Practical reports - 20%
Continuous assessments - 20%

Course Unit Contents: 24 hrs Theory

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.

18 hrs Practical ……..

References:

Boggs, S. 2011. Principles of Sedimentology and Stratigraphy. Fifth edition, Prentice Hall.

Course Unit No.: OCG3172

Name of the Course Unit: Mathematics II

Objectives: This Course Unit aims to make the student understand

Intended Learning Outcomes: At the end of this course unit students should be able to
ILO 1: Identify sections in mathematics, Algebra, calculus, and geometry
ILO 2: apply above branches to solve problems in earth science

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assessment - 25%

Course Unit Contents: 24 hrs Theory

Partial derivatives application, Introduction to vectors, Linear combination, Liner dependence and independence, Bases and dimensions, Scalar product, Triple scalar product, Triple vector product, Solution of vector equations involving products, Cylindrical polar coordinates, Spherical polar coordinates

18 hrs Practical ……..

References:
Aitken, M., Broadhurst, B, 2009. Mathematics for biological scientists. Garland Science.

Course Unit No.: OCG31A1 (OP)

Name of the Course Unit: Introduction to Socio-economics

Objectives: This Course Unit aims to make the student understand on principles in Socio-economics

Intended Learning Outcomes: At the end of the course unit students should be able to ,
ILO 1: explain interrelationships between the social and the physical environment and their impact on the coastal ecosystems.
ILO 2: describe various components of the environment and how these could be maintained to ensure sustainable development.
ILO 3: demonstrate skills of processing, interpreting and disseminating information with respect to sustainable development.
ILO 4: discuss role of socio economic development in natural resource management.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assessment - 25%

Course Unit Contents: 12 hrs Theory

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.

9 hrs Practical ……..

References:
Szirmai, A., 2005. The Dynamics of Socio-Economic Development: An Introduction. Second edition, Cambridge University Press.

Course Unit No.: OCG31C2 (OP)

Name of the Course Unit: Marine and Coastal Ecosystems

Objectives: This Course Unit aims to make the student understand

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain biological and ecological characteristics of the marine and coastal ecosystems.
ILO 2: learn coastal ecosystems processes and interpret the interactions between biological component and their environment
ILO 3: examine the causes of marine and coastal ecosystem degradation and develop strategies to restore ecosystem balance and prevent further degradation.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assessment - 25%

Course Unit Contents: 24 hrs Theory

Sea shores, Rocky/sandy/muddy, Mangrove, Lagoons and estuaries, Sea grass beds Sea weed beds, Sand dunes, Mud flats. Marine and Coastal eco-systems in Sri Lanka

18 hrs Practical ……..

References:
Mann K.H., 2000. Ecology of Coastal Waters: With Implications for Management. Second edition, Wiley-Blackwell.

Course Unit No.: **AQU3112 (OP)**

Name of the Course Unit: Aquaculture I

Objectives: This Course Unit aims to make the student understand on history of aquaculture and commonly used aquaculture production systems

Intended Learning Outcomes: At the end of the course unit should be able to,
ILO 1: explain the role of aquaculture in natural resource management, human food supply and global economy

ILO 2: describe the different production systems with their advantages and disadvantages

ILO 3: discuss the various factors considered in site selection and species selection in aquaculture

ILO 4: illustrate the process of selecting suitable site for pond culture and design ponds

ILO 5: practice different aquaculture production systems

Course Unit Outline: History, present status, scope and role of aquaculture, Different aquaculture systems, species selection and site selection, pond construction, environmental impacts of aquaculture

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (theory) – 80%
End semester exam (practical) – 20%

Course Unit Contents: 24 hrs Theory

History, present status, scope and role of aquaculture (3 hrs), Different aquaculture systems (4 hrs), species selection and site selection (7 hrs), pond construction (8 hrs), environmental impacts of aquaculture (2 hrs)

18 hrs Practical

Identification of different aquaculture systems and commonly cultured species using the models and specimens available in the laboratory, soil analysis for selecting suitable sites for pond aquaculture, summations for pond construction

References:
John, S.L. and Southgate, P.C.2012., Aquaculture: Farming Aquatic Animals and Plants. Second edition, Wiley-Blackwell.

Course Unit No.: **AQU3123 (OP)**

Name of the Course Unit: Aquaculture II Food and Nutrition

Objectives: This Course Unit aims to make the student understand on Food and Nutrition in fish

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: to evaluate Food and Nutritional aspects of different aquaculture production systems

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (theory) – 65%
End semester exam (practical) – 35%

Course Unit Contents: 30 hrs Theory

Major Nutrients, Nutrient requirements of fish , Artificial feed formulation, preparation, evaluation, Feeding strategies, Nutritional fish pathology; Culture of live feed
Aquaculture principles & practices, Scope and role of aquaculture, History & present status, Different type of aquaculture systems, Species selection, Site selection, Environmental demands; Pond construction.

45 hrs Practical ……..

References:
Jean, G. and Kaushik, S.,2001. Nutrition and Feeding of Fish and Crustaceans. Springer.

Course Unit No.: **FDN3111 (ND)**

Name of the Course Unit: Advanced English I

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

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

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester exam (Theory) - 100 %

Course Unit Contents: 15 hrs Theory

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**

Name of the Course Unit: Information literacy and Library Skills

Objectives: This Course Unit aims to make the student understand on Information literacy and Library Skills

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: determine the extent of information needed and locate appropriate sources.
ILO 2: evaluate information and its sources critically
ILO 3: 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%
End Semester Exam (Practical)-20%

Course Unit Contents: 24 hrs Theory

Introduction to Information Literacy,
Organization of knowledge, Information search and retrieval, Evaluating information sources, legal and ethical use, Copyright and plagiarism, effective communication.

18 hrs practical:…….

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

Course Units for level III, Semester II

Course Unit No.: **LIM3213**

Name of the Course Unit: Principles and Applications of Hydrology

Objectives: This Course Unit aims to make the student understand on Principles and Applications of Hydrology

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: Describe hydrological cycle,
ILO 2: measure hydrological parameters,
ILO 3: interpret hydrological data

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 85%
Continuous Assessment (Practical) - 15%

Course Unit Contents: 38 hrs Theory

Hydrologic cycle, meteorological and hydrological parameters and their measurements, Flow measurement and hydrograph analysis, Hydrologic data series and statistical analysis,Hydrological modelling.

21 hrs practical:…….

References:
Dingman, S.L., 2008. Physical Hydrology. Second edition, Waveland press.

Course Unit No.: LIM3222

Name of the Course Unit: Hydrologic Control Structures and Reservoirs

Objectives: This Course Unit aims to make the student understand on Hydrologic Control Structures and Reservoirs

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: Justify and Identify the need of constructing different hydrologic control structures
ILO2: Make decisions on selection of structure types according to the needs, source and economical factors.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 85%
Continuous Assessment (Practical) - 15%

Course Unit Contents: 24 hrs Theory

Flow measurement structures; weirs, flumes, Flow regulating structures; intakes, pumps, gates, spillways, canals, division boxes, turnouts, checks
Water storage structures; dams, anicuts; Types of reservoirs, Storage zones of a reservoir, relation of inflow-outflow and storage of a reservoir, Hydraulic reservoir routing methods, sedimentation and clearance

18 hrs practical:…….

References:
Pierre, D., 2007.Essentials of Reservoir Engineering. Editions Technip.

Course Unit No.: **LIM3231**

Name of the Course Unit: Hydrogeology

Objectives: This Course Unit aims to make the student understand on Hydrogeology

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: describe hydrogeology at different environment

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: 15 hrs Theory

Groundwater hydrology, development of subsurface sources, well losses and specific capacity, aquifers and non-equilibrium formulas, measurements of groundwater yields, well exploration techniques, 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.: **LIM3241**

Name of the Course Unit: Scientific Communication and Research Ethics

Objectives: This Course Unit aims to make the student understand on Scientific Communication and Research Ethics

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: carry out genuine research with good code of conduct
ILO 2: make effective presentations
ILO 3: prepare publications avoiding violations of research ethics.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: 15 hrs Theory

Introduction to Scholarly Information Sources, copyright laws, plagiarism prevention techniques. Citation styles and compiling reference lists. Effective presentation skills and communication channels.

References:
Shamoo, A.E. and Resnik, D.B., 2009. Responsible Conduct of Research. Second edition. Oxford University Press.

Course Unit No.: **LIM3252**

Name of the Course Unit: Groundwater Exploration and Extraction

Objectives: This Course Unit aims to make the student understand on Groundwater Exploration and Extraction

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: Describe groundwater exploration and detection techniques
ILO2: detect groundwater sources using relevant drilling and exploration tools

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 85%
Continuous Assessment (Practical) - 15%

Course Unit Contents: 24 hrs Theory

Importance of groundwater and role of geology in order to understand and manage hidden water resources, Hydro-stratigraphy, Aquifer tests, Wells and well design, Groundwater quality and contamination, Groundwater hydrology, Development of subsurface sources, well losses and specific capacity, aquifers and non equilibrium formulae, measurements of groundwater yields, modeling Steady flow with basic methods, Modeling transient well hydraulics , computer assisted flow modeling

18 hrs Practical:……..

References:
Robert, A.B. and Jey, H.L., 2004. Modern Groundwater Exploration. Wiley-Interscience.

Course Unit No.: **CHM3211**

Name of the Course Unit: Radiochemistry

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

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: explain reasons types of radio activity
ILO 2: draw radioactive decay energy diagrams.
ILO 3: explain nuclear reactions and energy gaps
ILO 4: explain nuclear reactions beneficial for human being.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: 15 hrs Theory

Radioactivity: instability of nucleus, chart of the nuclides, modes of radioactive decay, decay energy diagrams, measurements and units in radioactivity, decay laws, mass to activity relationship, Origin of radionuclide through nucleo-synthesis and cosmic processes, non-primordial radionuclide, Nuclear fission and fusion, Civil and military nuclear cycles, Reprocessing of nuclear fuel and nuclear waste disposal strategies, Natural radiological hazards, Nuclear accidents, Incidents and environmental leaks, Methods of determination, Radionuclide behaviour in the environment, Radiocarbon applications, U-series disequilibria and dating (snow), 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.: OCG 3212(OP)

Name of the Course Unit: Petrology

Objectives: This Course Unit aims to make the student understand on Petrology

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: conversant on rock forming processes
ILO 2: distinguish different textures of all three rock types
ILO 3: identify and classify different rock types and name them.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Course Unit Contents: 24 hrs Theory

Igneous Minerals and Textures, Chemistry and Classification of Igneous Rocks, Volcanism, Origin and Crystallization of Magmas, Igneous rocks of different crustal settings, Occurrence of Sedimentary Rocks, Classification of clastic and carbonate sedimentary rocks, Common sedimentary rocks, Metamorphism, Macroscopic Properties of Metamorphic Rocks, Metamorphism of Mafic and Ultramafic Igneous Rocks, Aluminous Clastic Rocks and Calcareous Rocks.

18hrs Practical:……..

References:
Blatt, H., Tracy, R., and Owens, B., 2005. Petrology: Igneous, Sedimentary and Metamorphic. Third edition, W. H. Freeman.

Course Unit No.: OCG 3223(OP)

Name of the Course Unit: Structural and Field geology

Objectives: This Course Unit aims to make the student understand on Structural and Field geology

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: explain ductile and brittle structures and
ILO 2: explain tectonic forces responsible for their formation and mechanism
ILO 3: identify these structures in the field and map large scale structures to make geological maps.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Course Unit Contents: 30 hrs Theory

Fundamentals of tectonic forces and deformation, Brittle structures, ductile structures, Whole-Earth Structure and Plate Tectonics, Rifting, Seafloor Spreading, and Extensional Tectonics, Convergence and Collision Fold-Thrust Belts, Strike-Slip Tectonics, Regional tectonics.Field equipment, Field safety, Keeping field records,, Recording structural and textural information of various rocks, Making geological maps, Geological sampling.

45hrs Practical:……..

References:
Pluijm, B. A., and Marshak, S., 2003. Earth Structure: An Introduction to Structural Geology and Tectonics. Second edition, W. W. Norton & Company.

Course Unit No.: OCG 3232(OP)

Name of the Course Unit: Coastal processes and Morphology

Objectives: This Course Unit aims to make the student understand on Coastal processes and Morphology

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: explain Coastal Processes and coastal morphologies with especial emphasis on Sri Lanka.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Course Unit Contents: 24 hrs Theory

Waves, , Surf zone circulation, Coastal Sediment transport, Beach and near shore, Fluvial, wave and tide dominated environments, Rocky and coral coasts, sand dunes, Barrier system, sea level variability and coastal landforms, Coastal morphology of Sri Lanka.

18hrs Practical:……..

References:
Masselink, G., Hughes, M., andKnight, J., 2011. Coastal processes and Geomorphology. Second Edition, Routledge.

Course Unit No.: OCG 3241(OP)

Name of the Course Unit: Introduction to Meteorology

Objectives: This Course Unit aims to make the student understand on Meteorology

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: explain atmospheric dynamics and weather system and
ILO 2: weather monitoring and forecasting

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Course Unit Contents: 12hrs Theory

Atmospheric structure, Heat, Temperature and Circulation, Basics of Dynamic Meteorology, Tropical Weather Systems, Weather Monitoring, Analysis and Forecasting

9hrs Practical:……..

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 (OP)

Name of the Course Unit: Law of the Sea

Objectives: This Course Unit aims to make the student understand on Law of the Sea

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: explain UNCLOS thorough understanding on Annex II and Sri Lanka's claim to extend the continental shelf
ILO 2: conversant on International maritime treaties relevant to Sri Lanka

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 80 %
Continuous assessment - 20 %

Course Unit Contents: 15hrs 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.: FDN3211 (ND)

Name of the Course Unit: Advanced English –II

Objectives: This Course Unit aims to make the student understand on texts at research level

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: 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: 15hrs Theory

Reading: Reading selected texts from scientific journals, Writing: Advanced practice in paraphrasing and summarizing, mechanics of writing an undergraduate research thesis, writing references and rules pertaining , Speaking: Delivering a presentation

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

Courses for Level 4, Semester I

Course Unit No.: LIM 4112

Name of the Course Unit: Irrigation

Objectives: This Course Unit aims to make the student understand on Irrigation

Intended Learning Outcomes: At the end of this Course Unit student should be able to
ILO 1: 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

Irrigation engineering and hydraulic structures, Concepts of Irrigation and Irrigation Water Management, Crop water requirements and irrigation scheduling, Guidelines for the preparation of technical drawings, Surface irrigation systems, Sprinkler irrigation systems, Localized irrigation systems, Irrigation equipment for pressurized systems, Financial and economic appraisal of irrigation projects, Construction of irrigation schemes, ancient irrigation systems of Sri Lanka.

18 hrs Practical]

References:

Raghunath, H.M., 2013.Irrigation Engineering.Wiley.

Course Unit No.: LIM 4122

Name of the Course Unit: Water Resource Management

Objectives: This Course Unit aims to make the student understand on management strategies of water resources

Intended Learning Outcomes: At the end of the Course unit students should be able to

ILO 1: explain methods in natural water resources management and able to evaluate different management strategies

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: 24 hrs Theory

Water resources assessment, drought and flood management, effect of catchment development, runoff, water use and demand management, rainwater harvesting, Economics of water resources development.

18 hrs Practical: …….

References:

Booth,C.A. and Charlesworth, S.M., 2014.Water Resources in the Built Environment: Management Issues and Solutions. Wiley.

Course Unit No.: LIM 4131

Name of the Course Unit: Water Economics

Objectives: This Course Unit aims to make the student understand on Water Economics

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

ILO 1: analyse economic value of water

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: [15 hrs Theory]

Role of economics in water resource management, Economic solutions, Assessing benefits for environmental decision making, cost analysis in water, modeling the market process, Green accounting

References:

Griffin, R.C., 2005. Water Resource Economics: The Analysis of Scarcity, Policies, and Projects. The MIT Press.

Course Unit No.: LIM 4142

Name of the Course Unit: Pipe bourn Water Transport and Distribution

Objectives: This Course Unit aims to make the student understand on Pipe bourn Water Transport and Distribution

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

ILO 1: calculate water demand based on population forecasting

ILO 2: Describe the use of valves and pumps in water distribution

ILO 3: trouble shoot issues related to Pipe bourn water transport and safe distribution.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 85%
Continuous Assessment (Practical) - 15%

Course Unit Contents: [26 hrs Theory]

Water Demand - Categories, patterns, calculation and forecasting, Hydraulics of Pressurized Flows, single pipe calculation, branched and looped networks, system and pump characteristics, pressure related demand, Hydraulics of storage and pumps, Main Components of Hydraulic Design, pipe materials, valves and other equipment, Pumps and Mechanical Equipment, Network construction, Operation and Maintenance.

12 hrs Practical:

References:

Ratnayaka,D.D. et al., 2009. Water Supply. Sixth edition, Butterworth-Heinemann.

Course Unit No.: LIM 4151

Name of the Course Unit: Water Governance and Policy

Objectives: This Course Unit aims to make the student understand

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

ILO 1: 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]

Water policies and governance, Nature-society, Water conflict and cooperation, Developmental and environmental issues, International Environmental Law, Water and climate change, Water and agriculture, International Climate Politics and Justice, World Water Assessment Programme, Water poverty and health, 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 (OP)

Name of the Course Unit: Environmental Impact Assessment

Objectives: This Course Unit aims to make the student understand on Environmental Impact Assessment

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

ILO 1: prepare EIA and SEA reports.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: [15 hrs Theory]

Principles of Environmental Assessment and Management, Procedures and Methods of EIA, Strategic Environmental Assessment (SEA), guidelines for EIA, ecologically sustainable development, impact evaluation in terms of environmental and socio-economic criteria, future directions, Critical examination of the assumptions, 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 (OP)

Name of the Course Unit: Surveying and Levelling

Objectives: This Course Unit aims to make the student understand on methods in Surveying and Levelling

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

ILO 1: 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: [10 hrs Theory]

Principals and definitions, linear and angular measurements, levelling and contouring, setting out drawings, plane-table surveying, field applications, modern levelling apparatus. Graphical Interpretation of surveying data.

15 hrs Practical

References:

Basak, N.N., 2008. Surveying and Levelling. Tata Macgrow Hill.

Course Unit No.: LIM 4182

Name of the Course Unit: Disaster Analysis and Management

Objectives: This Course Unit aims to make the student understand on Disaster Analysis and Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: Analyse any type of disaster situations
ILO 2: Predict risk
ILO 3: Suggest Management measures

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Course Unit Contents: [20 hrs Theory]

Introduction to Hazards, Vulnerabilities and Disasters, Disaster Risk Reduction and Development Planning, Disaster Response and Post-Disaster Recovery

30 hrs Practical

References:

Brian D. et al., 2014.Blackstone's Emergency Planning, Crisis, and Disaster Management. Oxford University press.

Course Unit No.: LIM 4191 (OP)

Name of the Course Unit: Nanotechnology

Objectives: This Course Unit aims to make the student understand on uses of Nanotechnology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: discuss the various applications of Nanotechnology and environmental impact of nano materials.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Course Unit Contents: [15 hrs Theory]

Introduction to nanotechnology, Atomic, molecular and crystal structure, associated length scales, material properties and the effects of decreased dimensions, useful applications, fabrication methods, characterisation methods, bio-molecular motors, environmental impact of Nano materials

References:

Hornyak,G.L. et al., 2008. Fundamentals of Nanotechnology. CRC Press.

Course Unit No.: CHM4112

Name of the Course Unit: Biochemistry

Objectives: This Course Unit aims to make the student understand on Biochemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1:explain concepts and specific reaction pathways in biochemistry
ILO 2: define structure of biologically important compounds and biosynthetic precursor molecules.
ILO 3: 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]

Proteins, Enzymes, Protein purification,
Carbohydrates, Nucleic acids, Phosphorus in biology, Relationship between DNA, RNA and proteins, Structure, function and replication of DNA, human genome and DNA Sequencing, RNA and Protein synthesis, Energy and cellular metabolism, glycolysis, TCA cycle, oxidative phosphorylation, gluconeogenesis, metabolism of glycogen, fat, amino acid and alcohol .

18 hrs Pratical:

References:

Garrett, R.H. and Grisham, C.M., 2012. Biochemistry. Fifth edition, Brooks/Cole.

Course Unit No.: CHM4121

Name of the Course Unit: Green Chemistry

Objectives: This Course Unit aims to make the student understand on Green Chemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: 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%

Contents : 15 hrs Theory

Principles of green chemistry, Applications of green chemical technology in aquatic sciences and in naval industry. Llow carbon and low energy utilization technologies

References:

Harma, S. K., 2015. Green Chemistry for Dyes Removal from Waste Water: Research Trends and Applications. First edition, Wiley-Scrivener.

Course Unit No: CHM4132

Name of the Course Unit: Natural product Chemistry

Objectives: This Course Unit aims to make the student understand on Natural product Chemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the chemistry of natural products
ILO 2: extract products from natural substances

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents : 24 hrs Theory

Alkaloids, Terpinoieds, Flevanoides, Steriodes, Saponins, Drug development, Extraction, Isolation, and Characterization of Natural products

18 hrs Practical:……

References:

…….

Course Unit No: OCG4132(OP)

Name of the Course Unit: Integrated Coastal Management

Objectives: This Course Unit aims to make the student understand on Integrated Coastal Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the importance and benefits of an Integrated Coastal Management for socio-economic development.
ILO 2: design ICM projects to resolve identified coastal management issues.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
Continuous Assessments - 25%

Contents : 24 hrs Theory

Introduction to Integrated Coastal Management Concept, Principles of Integrated Coastal Management, Tools for implementing ICM, Coastal project development, evaluation and management.

18 hrs Practical:……

References:

Cicin-Sain, B., and Knecht, R.W., 1998. Integrated Coastal Management: Concepts and Practices. Fourth edition, Island Press.

Course Unit No: OCG4141 (OP)

Name of the Course Unit: Climate change and Oceans

Objectives: This Course Unit aims to make the student understand on Climate change and Oceans

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: evaluate anthropogenic and natural mechanisms of climate change,
ILO 2: evaluate Impacts of climate change
ILO 3: discuss management of climate change

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 50 %
Continuous Assessments - 50%

Contents : 15 hrs Theory

Ocean acidification, Sea level changes, Melting of polar ice caps, Impact on the global conveyer belt, Effect on marine and coastal organisms and coral reefs, Extreme weather events, adaptations and mitigations, Intergovernmental panel on climate change.

References:

Research paper based class

Course Unit No: OCG 4172(OP)

Name of the Course Unit: Marine & Coastal Biodiversity Conservation and Management

Objectives: This Course Unit aims to make the student understand on Marine & Coastal Biodiversity Conservation and Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO1:cite the scientific evidence for biodiversity change in the modern era and detail the contempor ary causes of diversity loss.
ILO 2: explain ecological, social, and economic impacts of diversity loss.
ILO 3: 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%

Contents: 24hrs Theory

The Need for marine biodiversity Conservation. Biodiversity in coastal and marine ecosystems around Sri Lanka. Threatened and sensitive species and habitats. Impacts of human activities on ecosystem composition, Structure and function. Application of science to biodiversity conservation and management, Sampling and recording, Selection, Design and management of marine protected areas, Assessing likely impacts and monitoring change, Recovery, restoration and replacement of habitats and species.
18 hrs Practical…….

References:

Hiscock, K., 2014. Marine Biodiversity Conservation: A practical approach. Routledge

Courses for Level 4, Semester II

Course Unit No.*: LIM 4218*

Name of the Course Unit*: Research Project, Thesis Writing and Viva-voce*

Objectives: *This Course Unit aims to make the student for designing a research project to complete within the limited time frame*

Intended 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*: pre discussion with the academic staff members, research proposal presentations, carryout the research, Maintaining of the log book, progress meeting, submission of two copies of soft bound thesis, final presentation, submission of hard bound copy for releasing final results*

Prerequisite*: No*

Assignments*:*

Mode of Assessment*:*

Proposal presentation: 10%
Thesis - 70%
Final presentation-Viva-voce - 20%

Course Unit Contents*: [15 hrs Theory]*

An 8 credit project specific to limnology or water science and technology programmes is required. The purpose of the project will be to provide in depth knowledge of application of science and technology. Time for experimentation is limited and considerable emphasis will be placed on the analysis, interpretation and discussion of the experimental results obtained.

References*:*

J.M. Elyet &Wetzel

Heppner,P.P. and Heppner, M.J., 2003. Writing and Publishing Your Thesis, Dissertation, and Research: A Guide for Students in the Helping Professions. Cengage Learning.

Course Unit No: LIM4222

Name of the Course Unit: Industrial &/or Field Training

Objectives: Aim to aware the students in process, function, and management of relevant industries, authorities or Bureau in Sri Lanka

Intended Learning outcome: At the end of the course unit students should be able to,

ILO 1: practice better management at self-entrepreneurs

ILO 2: to follow good practice at the training authorities

ILO 3: to aware Sri Lankan standards and accreditations for different process

Mode of assessment: Students have to maintain the log books and the signatures of relevant officers should be on each page

Final report of the training should be submitted to the faculty and the coordinator and the evaluation panel of the Course Unit will conduct viva-voce

Contents: Human Resource Management, Concept of green economy, Waste management, Quality control, industrial specific practices,

Note: all Units bearing LIM code are compulsory for those who specialize in Water Sciences and Technology

Level III, Semester I (specialize in Oceanography and Marine Geology)

Course Unit No: OCG3112

Name of the Course Unit: Mineralogy

Objectives: This Course Unit aims to make the student understand on Mineralogy

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain crystallography, chemical and physical properties of mineral
ILO 2: identify major rock forming minerals

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 75%
Practical reports - 25%

Contents: 24 hrs Theory

Crystallography, Physical Properties, Optical Mineralogy, Chemical analysis of Minerals, Neso silicate, Sorosilcate, Chain silicates, Phyllo silicates, Framework silicates, Sulphide Minerals, Carbonate minerals, Oxide Minerals

18hrs Practical……..

References:

Cornelis, K. and Cornelius,S. H.1993. Manual of Mineralogy. Twenty first edition, Wiley.

Course Unit No: OCG3122

Name of the Course Unit: Geophysics for Marine Science

Objectives: This Course Unit aims to make the student understand on Geophysics for Marine Science

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain different geophysical techniques available for marine geology, data acquiring, and processing.
ILO 2: Discuss different techniques suitable for subsurface studies and exploration.
ILO 3: interpret geophysical data.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 75%
Practical reports - 25%

Contents: 24 hrs Theory

Sea bed imaging by sonar and lidar, marine seismic exploration, Marine gravity surveying, marine magnetic surveying, Investigating sea floor using electrical and radiometric methods. Ground penetration radar.

18hrs Practical……..

References:

Lowrie, W, 2007. Fundamentals of Geophysics. Second edition, Cambridge University Press.

Course Unit No: OCG3132

Name of the Course Unit: Hydrography and Navigation

Objectives: This Course Unit aims to make the student understand on Hydrography and Navigation

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe the theory of operation and application of sea floor mapping technologies
ILO 2: plan an effective acoustic sea floor mapping survey based on specified deliverables and designed to answer a specific research question
ILO 3: 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%

Contents: 24 hrs Theory

Introduction, Echo sounding systems and principles, Positioning at sea, Planning and quality control for ocean mapping, Modern Survey and mapping techniques, General and Nautical Cartography. 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

18hrs Practical……..

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

Name of the Course Unit: Remote sensing and GNSS

Objectives: This Course Unit aims to make the student understand on Remote sensing and GNSS

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the components and applications of Remote Sensing and Global Navigation Satellite Systems.

ILO 2: practice image processing and analysis.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 80%s
Continuous Assessments - 20%

Contents: 24 hrs Theory

Introduction to Remote Sensing, Remote Sensing Basics, Satellite Remote Sensing Systems, Introduction to Aerial Photography, Visual Image Interpretation Introduction to digital image processing, Applications of Remote Sensing, Introduction to Global Navigation Satellite Systems.

18hrs Practical……..

References:

Jensen, J.R., 2007. Remote Sensing of the Environment: An Earth Resource Perspective. Second edition, Pearson Publication.

Course Unit No: OCG3152

Name of the Course Unit: Statistics for Experimental Analysis II

Objectives: This Course Unit aims to make the student understand Statistics for Experimental Analysis

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: use multivariate and time series analysis for scientific research.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Contents: 24 hrs Theory
Multiple regression, MANOVA, Cluster analysis, Principal component analysis, discriminant analysis, Time series analysis.

18hrs Practical……..

References:

Quinn, G.P., and Keough, M.J., 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press.

Course Unit No: OCG3162

Name of the Course Unit: Sedimentology

Objectives: This Course Unit aims to make the student understand on Sedimentology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: evaluate physical, chemical and biological processes that lead to sedimentary rock formation and their subsequent diagenesis under different environmental conditions.

ILO 2: conversant with the principal environments in which sediments are deposited and be able to identify these in the geological record on the basis of their distinguishing features.

ILO 3: use hand specimens and the petrological and microscope to identify minerals and assess the significance of textures processes of formation in selected suites of sedimentary rocks.

ILO 4: construct, correlate and interpret measured sections through a variety of rock successions to enable spatial and temporal variations to be identified and appropriately evaluated.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester exam (Theory) - 60%
Practical reports - 20%
Continuous assessments - 20%

Contents: 24 hrs Theory
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.

18hrs Practical……..

References:

Boggs, S. 2011. Principles of Sedimentology and Stratigraphy. Fifth Edition, Prentice Hall.

Course Unit No: OCG3172 (OP)

Name of the Course Unit: Mathematics II

Objectives: This Course Unit aims to make the student understand

Intended Learning Outcomes: At the end of the course unit student should be able to
ILO 1: Identify sections in mathematics, Algebra, calculus, and geometry
ILO 2: apply above branches to solve problems in earth science

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assessment - 25%

Contents: 24 hrs Theory
Partial derivatives application, Introduction to vectors, Linear combination, Liner dependence and independence, Bases and dimensions, Scalar product, Triple scalar product, Triple vector product, Solution of vector equations involving products, Cylindrical polar coordinates, Spherical polar coordinates

18hrs Practical……..

References:

Aitken, M., Broadhurst, B, 2009. Mathematics for biological scientists. Garland Science.
.

Course Unit No: OCG3181 (OP)

Name of the Course Unit: Marine Chemistry

Objectives: This Course Unit aims to make the student understand Marine Chemistry

Intended Learning Outcomes: At the end of the course unit students should be able
ILO 1: conversant on pathways of marine sediment
ILO 2: explain on chemistry of marine sediment and its control

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents: 15 hrs Theory
Sources of materials the fluvial pathway, atmospheric pathway, hydrothermal pathway, relative flux magnitudes, Material Sinks**;** Marine sediments and its composition, sediment interstitial waters and digenesis.

References:

Chester, R., Jickells,T.D.,2012. Marine Geochemistry. Third edition, Wiley-Blackwell.
.

Course Unit No: OCG3191 (OP)

Name of the Course Unit: Earth system Physics

Objectives: This Course Unit aims to make the student understand on Earth system Physics

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain relevant physical phenomenon of the earth processes.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents: 15 hrs Theory

Wave dynamics, Earth gravity and Magnetic fields

References:

Stacy, D.F., Davis, P.M., 2008. Physics of the Earth. Fourth edition, Cambridge University Press.

Course Unit No: OCG31A1(OP)

Name of the Course Unit: Introduction to Socio-economics

Objectives: This Course Unit aims to make the student understand on Socio-economics

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

ILO 1: explain interrelationships between the social and the physical environment and their impact on the coastal ecosystems.
ILO 2: appreciate the various components of the environment and how these could be maintained to ensure sustainable development.
ILO 3: demonstrate skills of processing, interpreting and disseminating information with respect to sustainable development.
ILO 4 describe role of socio economic development in natural resource management.

Prerequisite: No

Assignments: No

Mode of Assessment:

Practical reports - 25%
End semester exam (Theory) - 100%

Contents: 12 hrs Theory
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.

9 hrs Practical……

References:

Szirmai, A., 2005. The Dynamics of Socio-Economic Development: An Introduction. Second edition, Cambridge University Press.

Course Unit No: OCG31B1 (OP)

Name of the Course Unit: Marine Mammalian Biology

Objectives: This Course Unit aims to make the student understand Marine Mammalian Biology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: Describe origin of the marine mammal, evolution and taxonomy.
ILO 2: Explain evolutionary relationships of cetaceans.
ILO 3: explain their ecology and trophic level interactions.
ILO 4: describe conservation laws, applications and status of key species.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assessments - 25%

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:
Parsons E.C.M. et al.2013. An Introduction to Marine Mammal Biology and Conservation. Jones & Bartlett Learning.

Course Unit No: OCG31C2 (OP)

Name of the Course Unit: Marine and Coastal Ecosystems

Objectives: This Course Unit aims to make the student understand on functions of Marine and Coastal Ecosystems

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe biological and ecological characteristics of the marine and coastal ecosystems.

ILO 2: explain coastal ecosystems processes and interpret the interactions between biological component and their environment

ILO 3: discuss the causes of marine and coastal ecosystem degradation and develop strategies to restore ecosystem balance and prevent further degradation.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 75%
Continuous Assesments - 25%

Contents: 24 hrs Theory
Sea shores, Rocky/sandy/muddy, Mangrove, Lagoons and estuaries, Sea grass beds Sea weed beds, Sand dunes, Mud flats. Marine and Coastal eco-systems in Sri Lanka

18 hrs Practical:…

References:
Mann K.H., 2000. Ecology of Coastal Waters: With Implications for Management. Second edition, Wiley-Blackwell.

Course Unit No: OCG31D2 (OP)

Name of the Course Unit: Paleontology and Micropaleontology

Objectives: This Course Unit aims to make the student understand on Paleontology and Micropaleontology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: interpret fossils of various kinds in light of function and adaptation.
ILO 2: discuss dating fossils and establishing time sequences.
ILO 3: discuss microfossils and their geological applications.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) -80 %
Continuous assessment (Practical) -20 %

Contents: 24 hrs Theory
The Nature of the Fossil Record, Growth and Form, Populations and Species, Systematics. Evolutionary Morphology, Biostratigraphy, Evolutionary Rates and Trends, Global Diversity and Extinctions, Paleoecology and Paleobiogeography, Applied micropaleontology, Organic walled microfossil, inorganic world microfossil

18 hrs Practical:…

References:

Foote, M., and Miller, A.I., 2006. Principles of Paleontology. Third edition, W. H. Freeman.

Course Unit No: LIM3112 (OP)

Name of the Course Unit: Hydraulics

Objectives: This Course Unit aims to make the student understand on principles of Hydraulics

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain principles and operation of basic hydraulic systems
ILO 2: use flow meters and pressure gauges to measure valves and make adjustments
ILO 3: Interpret schematics and troubleshoot both open and closed center hydraulic systems.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) -80 %
Continuous assessment (Practical) -20 %

Contents: 24 hrs Theory
Physical Fluid Properties, Hydrostatic Pressure - Pressure Forces on Plane and Submerged Surfaces, Fluids in Motion - Laminar and Turbulent Flow, Bernoulli's Equation, Flow in Pipes - The Darcy-Weisbach Equation, Determining Discharge, Determining Head Loss, Head Distribution along Pipelines, Open Channel Flow - Characteristics, Steady Uniform Flow, Manning's Equation, Specific Energy and Critical Depth, Supercritical and subcritical Flow, Non-uniform Flow, Gradually and rapidly varied non-uniform Flow

18 hrs Practical:…

References:

Qin, Z., 2013. Basics of Hydraulic systems, CRC press.

Chanson,H., 2004. Environmental Hydraulics for open channel flows. First edition, Butterworth-Heinemann.

Course Unit No: LIM3121 (OP)

Name of the Course Unit: Geochemistry

Objectives: This Course Unit aims to make the student understand on Geochemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain how geochemistry can be applied to understand Earth processes.
ILO 2: apply geochemical knowledge to solve environmental and health issues

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) -100 %

Contents: 30 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: LIM3132

Name of the Course Unit: Aquatic Pollution

Objectives: This Course Unit aims to make the student understand on Aquatic Pollution

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe the sources and types of water pollution.
ILO 2: explain biological and chemical analytical techniques for the measurement and control of aquatic pollution.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Contents: 24 hrs Theory

- describe the sources and types of water pollution.
- explain biological and chemical analytical techniques for the measurement and control of aquatic pollution.

18hrs Practical:……..

References:

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

Course Unit No: LIM3161 (OP)

Name of the Course Unit: Quality Assessment of aquatic systems

Objectives: This Course Unit aims to make the student understand on Quality Assessment of aquatic systems

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1:conduct a complete water quality assessment for a given water body

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Contents: 12 hrs Theory
Strategies for water quality assessment, Selection of water quality variables, Hydrological variables, General variables, Nutrients, Organic matter, Major ions, inorganic variables, Metals, Organic contaminants, Microbiological indicators, Selection of variables, Data handling and presentations

9hrs Practical:……..

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

Course Unit No: CHM3112 (OP)

Name of the Course Unit: Advanced Aquatic Chemistry

Objectives: This Course Unit aims to make the student understand on Aquatic Chemistry for its perspectives

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain molecular level interactions in aquatic systems.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Contents: 30 hrs Theory
Atmosphere-water interactions, precipitation and Dissolution, solid-solution interface and kinetics at the interface, adsorption, inter particle interactions, trace metal cycling regulation and biological role, kinetics of redox processes, photochemical processes.

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

Course Unit No: FSH3121 (OP)

Name of the Course Unit: Fisheries Oceanography

Objectives: This Course Unit aims to make the student understand Fisheries Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain oceanographic characteristics deciding the behaviour and distribution of economically important fish species.

Prerequisite: No

Assignments: No

Mode of Assessment:

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

Contents: 12 hrs Theory
Effect of physicochemical and biological parameters of oceans on the biology, behaviour and distribution of economically important fish species, effects of upwelling and underwater currents on fish migration and recruitment,Operation of fishing gear and crafts in relation to the oceanographicconditions, Possible impacts of climate change,Harmful algal blooms, coral bleaching, ocean acidification and hypoxia on global fisheries.

9hrs practical:

References:

Ross,D., 2000. TheFisherman's Ocean: How Marine Science Can Help You Find and Catch More Fish.Stackpole Books.

Harrison, P.J. and Parsons, T.R., 2001. Fisheries Oceanography (Fish and Aquatic Resources).Wiley-Blackwell.

Course Unit No: FDN3111 (ND)

Name of the Course Unit: **Advanced English I**

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

Intended 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, write essays, reports and articles, and prepare presentations

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents: 15 hrs Theory
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: FDN3111 (ND)

Name of the Course Unit: **Advanced English I**

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

Intended 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, write essays, reports and articles, and prepare presentations

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents:

Level III, Semester II

Course Unit No: OCG 3212

Name of the Course Unit: Petrology

Objectives: This Course Unit aims to make the student understand on Petrology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: conversant on rock forming processes
ILO 2: distinguish different textures of all three rock types
ILO 3: identify and classify different rock types and name them.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Contents: 24 hrs Theory
Igneous Minerals and Textures, Chemistry and Classification of Igneous Rocks, Volcanism, Origin and Crystallization of Magmas, Igneous rocks of different crustal settings, Occurrence of Sedimentary Rocks, Classification of clastic and carbonate sedimentary rocks, Common sedimentary rocks, Metamorphism, Macroscopic Properties of Metamorphic Rocks, Metamorphism of Mafic and Ultramafic Igneous Rocks, Aluminous Clastic Rocks and Calcareous Rocks.

18hrs Practical

References:

Blatt, H., Tracy, R., and Owens, B., 2005. Petrology: Igneous, Sedimentary, and Metamorphic. Third edition, W. H. Freeman.

Course Unit No: OCG3223

Name of the Course Unit: Structural and Field geology

Objectives: This Course Unit aims to make the student understand on Structural and Field geology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain ductile and brittle structures and
ILO 2: explain tectonic forces responsible for their formation and mechanism
ILO 3: identify these structures in the field and map large scale structures to make geological maps

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Contents: 30 hrs Theory
Fundamentals of tectonic forces and deformation, Brittle structures, ductile structures, Whole-Earth Structure and Plate Tectonics, Rifting, Seafloor Spreading, and Extensional Tectonics, Convergence and Collision Fold-Thrust Belts, Strike-Slip Tectonics, Regional tectonics.Field equipment, Field safety, Keeping field records,, Recording structural and textural information of various rocks, Making geo logical maps, Geological sampling.

45hrs Practical

References:

Pluijm, B. A., and Marshak, S., 2003. Earth Structure: An Introduction to Structural Geology and Tectonics. Second edition, W. W. Norton & Company.

Course Unit No: OCG3232

Name of the Course Unit: Coastal processes and Morphology

Objectives: This Course Unit aims to make the student understand on Coastal processes and Morphology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe coastal Processes and coastal morphologies with special emphasis on Sri Lanka.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Contents: 24 hrs Theory
Waves, , Surf zone circulation, Coastal Sediment transport, Beach and near shore, Fluvial, wave and tide dominated environments, Rocky and coral coasts, sand dunes, Barrier system, sea level variability and coastal landforms, Coastal morphology of Sri Lanka.

18hrs Practical

References:

Masselink, G., Hughes, M., and Knight, J., 2011. Coastal processes and Geomorphology. Second edition, Routledge.

Course Unit No: OCG3241

Name of the Course Unit: Introduction to Meteorology

Objectives: This Course Unit aims to make the student understand on Meteorology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain atmospheric dynamics and weather system
ILO 2: explain weather monitoring and forecasting methods

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
Continuous Assessments - 25%

Contents: 12 hrs Theory
Waves, , Surf zone circulation, Coastal Sediment transport, Beach and near shore, Fluvial, wave and tide dominated environments, Rocky and coral coasts, sand dunes, Barrier system, sea level variability and coastal landforms, Coastal morphology of Sri Lanka.

9hrs Practical

References:

Lutgens, F.K.,Tarbuck,E.j., Tasa, D.G., 2012. The Atmosphere: An Introduction to Meteorology. Twelfth edition, Prentice Hall.

Course Unit No: OCG3251

Name of the Course Unit: Law of the Sea

Objectives: This Course Unit aims to make the student understand on Law of the Sea

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe UNCLOS 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: No

Mode of Assessment:

End Semester Exam (Theory) - 80 %
Continuous assessment - 20 %

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: OCG3261

Name of the Course Unit: Indian Ocean and Bengal Fan

Objectives: This Course Unit aims to make the student understand on Indian Ocean and Bengal Fan

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe features, properties, processes and resources of the Indian Ocean

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 100 %

Contents: 15 hrs Theory

Indian Ocean: Evolution, physiography and tectonics, current and circulation, ocean chemistry, diversity of macro and micro fauna and flora, living and non-living resources. Bengal fan: morphology, geometry, stratigraphy, and processes

References:

This course is based on research articles

Course Unit No: OCG3272 (OP)

Name of the Course Unit: Paleoceanography and Paleoclimatology

Objectives: This Course Unit aims to make the student understand Paleoceanography and Paleoclimatology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: use of Paleo-oceanographic proxies and techniques
ILO 2: describe the driving forces of global climate
ILO 3: discuss the major climate events of the earth history

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Practical) - 20 %
End Semester Exam (Theory) - 50%
Class presentations - 15%
Term paper - 15 %

Contents: 20 hrs Theory
Proxies in paleoceanograhy and Paleoclimatology, Geochronology,
Reconstruction of paleo-ocean, land and atmospheric conditions, Tectonic scale climate change, Orbital scale climate change, Cenozoic climate, Holocene climate variability, Abrupt climate events. Sea level changes, Evolution and variability of Indian Monsoons. Sea Level changes in the Indian Ocean.

30hrs Practical

References:

Fisher, G. andWefer, G., 1999. Use of Proxies in Paleoceanography: Examples from the South Atlantic. Springer.

Cronin, T.M., 2009. Paleoclimates: Understanding Climate Change Past and Ptresent. Columbia University Press.

Course Unit No: OCG3281 (OP)

Name of the Course Unit: Marine Archaeology

Objectives: This Course Unit aims to make the student understand Marine Archaeology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: recognize archeologically important sites in the sea and their management.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) : 75 %
Continuous Assessments - 25%

Contents: 12 hrs Theory
World maritime history with respect to marine fisheries and maritime activities, Maritime archaeological techniques, Nautical archaeology, Management of coastal heritage, Use of Geographic Information Systems (GIS), 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.

9hrs Practical

References:
Catsambis, A., Ford, B., and Hamilton, D.L., 2013. The Oxford Handbook of Maritime Archaeology. Reprint edition, Oxford University Press.

Course Unit No: OCG3292 (OP)
Name of the Course Unit: Ocean Modelling

Objectives: This Course Unit aims to make the student understand on Ocean Modelling

Intended Learning Outcomes: At the end of the course unit students should be able to,
ILO 1: explain concept of mathematical models,
ILO 2: build models to visualize ocean dynamics

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 60 %
Continuous assessment - 20%
Practical Project - 20%

Contents: 15 hrs Theory
Introduction to MathLab and Open Source Software, Fourier Transformation, Filtering, spectral analysis, Gridding, Integration of ODE and OD models, Building a model, Model analysis and optimization, Inverse methods and assimilation techniques, One dimensional model, Gyre models. Global Circulation models, Visualization using MathLab.

45hrs Practical

References:
Kampf, J, 2009, Ocean Modelling for Beginners: Using Open-Source Software. Springer.

Course Unit No: OCG32A1 (OP)

Name of the Course Unit: Coral Ecology

Objectives: This Course Unit aims to make the student understand on Coral Ecology

Intended Learning Outcomes: At the end of the course unit students should be able to,
ILO 1: explain key processes underlying patterns of recruitment, abundance, and community diversity on coral reefs.
ILO 2: explain the link between resources and environmental stressors at the level of the organism and demographic processes.
ILO 3: develop insight into the role of species interactions in the dynamics, diversity and resilience of coral reefs.
ILO 4: develop an understanding of the interactions between different types of environmental disturbances and the responses of coral reef systems.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Contents: 12 hrs Theory
Types of reefs, Reef distribution, Biodiversity of coral reefs, interactions among reef dwelling organisms, Reef fish diversity, Environmental stress on reef forming organisms and associates, reefs and their conservation, coral transplanting and establishment of artificial reefs.
Global Circulation models, Visualization using MathLab.

9hrs 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 (OP)

Name of the Course Unit: Satellite Oceanography

Objectives: This Course Unit aims to make the student understand on Satellite Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to,
ILO 1: explain physical concepts used in satellite oceanography
ILO 2: use the satellite data for information extraction through analysis.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
End Semester Exam (Practical) - 25%

Contents: 12 hrs Theory
The general principles of remote sensing of the sea, Pre-processing, Positional registration and Oceanographic sampling for "sea truth", Sea Surface Temperature (SST) mapping, Basic principles of satellite altimetry, Sea Surface Roughness, Microwave scatterometer, Synthetic Aperture Radar,Basic principles of satellite measurements of ocean color, Chlorophyll and photosynthesis, Estimation of phytoplankton biomass from satellite ocean color observations

9hrs Practical

References:
Seelye M., 2004 . An Introduction to Ocean Remote Sensing, Cambridge University Press.

Course Unit No: LIM3213

Name of the Course Unit: Principles and Applications of Hydrology

Objectives: This Course Unit aims to make the student understand on Principles and Applications of Hydrology

Intended Learning Outcomes: at the end of the course unit students should be able to,
ILO 1: describe hydrological cycle,
ILO 2: measure hydrological parameters,
ILO 3: interpret hydrological data

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 85%
Continuous Assessment (Practical) - 15%

Contents: 38 hrs Theory
Hydrologic cycle, meteorological and hydrological parameters and their measurements, Flow measurement and hydrograph analysis, Hydrologic data series and statistical analysis,Hydrological modelling.

21hrs Practical

References:

Dingman, S.L., 2008. Physical Hydrology. Second edition, Waveland press.

Course Unit No: LIM3241

Name of the Course Unit: Scientific Communication and Research Ethics

Objectives: This Course Unit aims to make the student understand on Scientific Communication and Research Ethics

Intended Learning Outcomes: At the end of the course unit students should be able to,
ILO 1: carry out genuine research with good code of conduct
ILO 2: make effective presentations
ILO 3: prepare publications avoiding violations of research ethics.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents: 15 hrs Theory
Introduction to Scholarly Information Sources, copyright laws, plagiarism prevention techniques. Citation styles and compiling reference lists. Effective presentation skills and communication channels.

References:

Shamoo, A.E. and Resnik, D.B., 2009. Responsible Conduct of Research. Second edition. Oxford University Press.

Course Unit No: LIM3212

Name of the Course Unit: Radiochemistry

Objectives: This Course Unit aims to make the student understand on Radiochemistry

Intended Learning Outcomes: At the end of the Course Unit students should be able to,
ILO 1: explain reasons types of radio activity
ILO 2: draw radioactive decay energy diagrams.
ILO 3: explain nuclear reactions and energy gaps
ILO 4: explain nuclear reactions beneficial for human being.

Prerequisite: No

Assignments: No

Mode of Assessment:

End semester exam (Theory) - 100%

Contents: 30 hrs Theory
Radioactivity: instability of nucleus, chart of the nuclides, modes of radioactive decay, decay energy diagrams, measurements and units in radioactivity, decay laws, mass to activity relationship, Origin of radionuclide through nucleo-synthesis and cosmic processes, non-primordial radionuclide, Nuclear fission and fusion, Civil and military nuclear cycles, Reprocessing of nuclear fuel and nuclear waste disposal strategies, Natural radiological hazards, Nuclear accidents, Incidents and environmental leaks, Methods of determination, Radionuclide behaviour in the environment, Radiocarbon applications, U-series disequilibria and dating (snow), 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: FDN3211(ND)

Name of the Course Unit: **Advanced English –II**

Objectives: This Course Unit aims to make the student understand on English mechanics of writing

Intended Learning Outcomes: At the end of the course unit students should be able to,
ILO 1: 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%

Contents: 15 hrs Theory
Reading: Reading selected texts from scientific journals , Writing: Advanced practice in paraphrasing and summarizing, mechanics of writing an undergraduate research thesis, writing references and rules pertaining , Speaking: Delivering a presentation

References:

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

Level IV, Semester I

Course Unit No: OCG 4113

Name of the Course Unit: Introduction to Upstream Petroleum industry

Objectives: This Course Unit aims to make the student understand on Upstream Petroleum industry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: deliver detailed knowledge on hydrocarbons and their origin
ILO 2: describe hydrocarbon deposits and identification of them
ILO 3: explain extraction and production of hydrocarbon.

Prerequisite: No

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 50%
End Semester Exam (Practical) - 25%
Continuous Assessment- 25%

Contents: 45 hrs Theory
Basic hydrocarbon chemistry, Physical properties of petroleum, Formation of a petroleum system (Source, generation, migration and traps), Sedimentary Basin analysis, Seismic processing and interpretation (Basic steps of interpretation such as Horizons and Fault picking, mapping, depth conversion, direct hydrocarbon indications) Drilling for Oil and Gas, Introduction to Directional Drilling, Petrophysics, App HSE management in Oil and Gas industry Appraisal, Reservoir Development and Production.
15hrs Practical:……

References:
Selley, R.,2014. Elements of Petroleum Geology. Third edition, Academic Press.

Course Unit No: OCG4121

Name of the Course Unit: Coastal & Marine non-living resources

Objectives: This Course Unit aims to make the student understand on Coastal & Marine non-living resources

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe off shore and coastal minerals deposits
ILO 2: explain processes of forming them
ILO 3: discuss other off shore resources

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 100%

Contents: 15 hrs Theory
Terrigenous, volcanogenic, authigenic ,diagenetic, evaporitic, and biogenic mineral deposits; chemical compounds from the sea. Coastal and offshore mineral deposits around Sri Lanka.

References:
Cronan, D.S., 1999. Handbook of Marine Mineral Deposits. First edition, CRC Press.

Course Unit No: OCG4132

Name of the Course Unit: Integrated Coastal Management

Objectives: This Course Unit aims to make the student understand Integrated Coastal Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the importance and benefits of an Integrated Coastal Management for socio-economic development.
ILO 2: design ICM projects to resolve identified coastal management issues.

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 75%
Continuous Assessments - 25%

Contents: 24 hrs Theory
Introduction to Integrated Coastal Management Concept, Principles of Integrated Coastal Management, Tools for implementing ICM, Coastal project development, evaluation and management.

18hrs practical

References:

Cicin-Sain, B., and Knecht, R.W., 1998. Integrated Coastal Management: Concepts and Practices. Fourth edition, Island Press.

Course Unit No: OCG4141

Name of the Course Unit: Climate change and Oceans

Objectives: This Course Unit aims to make the student understand on Climate change and Oceans

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: describe anthropogenic and natural mechanisms of climate change,
ILO 2: describe Impacts of climate change
ILO 3: discuss management of climate change

Assignments: No

Mode of Assessment:

End Semester Exam(Theory) - 50 %
Continuous Assessments - 50%

Contents: 15 hrs Theory
Ocean acidification, Sea level changes, Melting of polar ice caps, Impact on the global conveyer belt, Effect on marine and coastal organisms and coral reefs, Extreme weather events, adaptations and mitigations,Intergovernmental panel on climate change.

References:

Research paper based class

Course Unit No: OCG4151 (OP)

Name of the Course Unit: Biogeochemistry

Objectives: This Course Unit aims to make the student understand on Biogeochemistry

Intended Learning Outcomes: At the end of he course unit students should be able to
ILO 1: describe organic matter and its journey to the ocean
ILO 2: explain fate of organic matter in the ocean.
ILO 3: use of biomarkers in paleoceanography

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 100 %

Contents: 15 hrs Theory
Chemical composition of organic matter, production preservation and degradation of organic matter, long term fate of the organic matter in the geosphere, chemical stratigraphic concepts

References:

Killops S., Killops, V., 2005. Introduction to Organic geochemistry. Second edition, Wiley-Blackwell.

Course Unit No: OCG4162 (OP)
Name of the Course Unit: Advanced Physical Oceanography

Objectives: This Course Unit aims to make the student understand on Physical Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: Identify and understand physical process in the ocean and estuaries
ILO 2: determine physical process in oceans

Assignments: No

Mode of Assessment:

End Semester Exam (Theory) - 60 %
Practical Assessments - 20%
Continuous assessments - 20 %

Contents: 24 hrs Theory
Ocean Mixing (large and small scale), up welling, down welling, longshore currents, permanent currents (gyres, eddies), boundary currents, oceanic heat budget, wind driven circulation. Tides, description of tides, tide-generating forces, main tidal periods, tidal classification, shape of the tidal wave, co-oscillation tides. Small scale processes, turbulence, skin layer dynamics, boundary layer dynamics, boundary layer height, Data quality control, processing and analysis, Estuarine oceanography.: Definition of an estuary, Flushing time of an estuary and methods of determining it, mixing of salt and freshwater, salt flux, salt balance and water exchange, tidal current, estuarine circulation

18hrs practical:……

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: OCG 4172*(OP)

Name of the Course Unit: Marine & coastal Biodiversity Conservation and Management

Objectives: This Course Unit aims to make the student understand on Marine & coastal Biodiversity Conservation and Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO1:cite the scientific evidence for biodiversity change in the modern era and detail the contempor ary causes of diversity loss.
ILO 2: explain ecological, social, and economic impacts of diversity loss.
ILO 3: apply management and conservation principles and tools that are used to conserve diversity.

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 75%
Practical reports - 25%

Contents: 24 hrs Theory
The Need for marine biodiversity Conservation. Biodiversity in coastal and marine ecosystems around Sri Lanka. Threatened and sensitive species and habitats. Impacts of human activities on ecosystem composition, Structure and function. Application of science to biodiversity conservation and management, Sampling and recording, Selection, Design and management of marine protected areas, Assessing likely impacts and monitoring change, Recovery, restoration and replacement of habitats and species.

18hrs practical:……

References:
Hiscock, K., 2014. Marine Biodiversity Conservation: A practical approach. Routledge.

Course Unit No: OCG 4182* (OP)

Name of the Course Unit: Wetland Management

Objectives: This Course Unit aims to make the student understand on Wetland Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain wetland hydrology and biogeochemistry, flora and fauna, and functional attributes.
ILO 2: evaluate important issues to consider for wetland management, conservation, and restoration.

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 75%
Practical reports - 25%

Contents: 24 hrs Theory
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.

18hrs practical:……

References:
Mitsch, W.J. andGosselink, J.G., 2015. Wetlands. Fifth edition, wiley.

Course Unit No: OCG 4191*(OP)

Name of the Course Unit: Coastal Hazards and Mitigation

Objectives: This Course Unit aims to make the student understand on Coastal Hazards and Mitigation

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain Coastal hazards and their mechanisms
ILO 2: Identify past events and understand variability
ILO 3: Mitigate the damage

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 100%

Contents: 15 hrs Theory
Tsunamis, Cyclones, Coastal Flooding, Hydrologic hazards Coastal erosion and sedimentation, Coastal dune hazards, Coastal marine Pollution, remote sensing hazards, Identification of past events their intensity. Calculation of recurrence intervals, Hazard preparedness.

References:
Finkl, C.W., 2012. Coastal Hazards. Springer.

Course Unit No: OCG 41A1(OP)

Name of the Course Unit: Ocean Tourism

Objectives: This Course Unit aims to make the student understand Ocean Tourism

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain potentials of coastal and marine environments for tourism
ILO 2: describe positive and negative impacts of the industry
ILO 3: discuss managing ocean tourism industry

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 100%

Contents: 15 hrs Theory
An introduction to coastal and marine tourism. The magnitude and economic importance of coastal tourism Sustainable tourism: tourism Growth vs. tourism development The main impacts and challenges, The need for planning, Rationale for tourism planning, Integrated tourism planning, Approaches to integrated tourism planning, Ecological Footprint The concept of tourism carrying capacity, Global issues and coastal tourism, Tourism management through Environmental Assessment

References:
Luck, M., 2008. The Encyclopedia of Tourism and Recreation in Marine Environments. CABI.

Course Unit No: OCG41B1 (OP)

Name of the Course Unit: Upstream Hydrocarbon Industry-Environment, Legal and Fiscal Regime

Objectives: This Course Unit aims to make the student understand on upstream Hydrocarbon Industry-Environment, Legal and Fiscal Regime

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain, fiscal regime of the country's petroleum industry
ILO 2: explain legal regime of the petroleum industry
ILO 3: environmental issues and their management

Assignments: No

Mode of Assessment:

End semester Exam (Theory) - 100%

Contents: 15 hrs Theory
Upstream Petroleum Fiscal Regimes, Fundamentals of Natural Gas, Basic Economic Principles and Financial Evaluation Techniques, Demand, Value Chain and Resource Base, Industry Structure and Oil Price,
Analysis of the Legal Regime pertaining to the Upstream Oil and gas sector in Sri Lanka. Classification of the Fiscal Regime related to upstream petroleum activities in Sri Lanka, Various concepts of Offshore Petroleum activities; Fundamentals of the Upstream Petroleum Agreements; Dispute Resolution

References:

Inkpen, A., Moffett, M.H., 2011. The Global Oil & Gas Industry: Management, Strategy and Finance. Pennwell corp.

Course Unit No: OCG41C1 (ND)

Name of the Course Unit: Special Topics in Oceanography

Objectives: This Course Unit aims to make the student understand on Oceanography

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: analyze a theme and report in his/her own words
ILO 2: discuss current science themes

Assignments: No

Mode of Assessment:

A report submitted at the end -50 %
Class project/presentation - 50 %

Contents: 15 hrs Theory
This unit will be conducted by an experton a theme decided by him/her. Course is based on research paper discussions.

References:
Based on research articles. Will be decided by lecturer.

Course Unit No: LIM4161 (OP)

Name of the Course Unit: Environmental Impact Assessments

Objectives: This Course Unit aims to make the student understand on Environmental Impact Assessments

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: prepare EIA and SEA reports.

Assignments: No

Mode of Assessment:

End semester exam (Theory) -100 %

Contents: 15 hrs Theory
Principles of Environmental Assessment and Management, Procedures and Methods of EIA, Strategic Environmental Assessment (SEA), guidelines for EIA, ecologically sustainable development, impact evaluation in terms of environmental and socio-economic criteria, future directions, Critical examination of the assumptions, 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:LIM4171 (OP)

Name of the Course Unit: Surveying and Leveling

Objectives: This Course Unit aims to make the student understand on Surveying and Leveling

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: conduct surveys relevant to hydrological applications.

Assignments: No

Mode of Assessment:

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

Contents: 10 hrs Theory
Basic Principals and definitions , linear and angular measurements, levelling and contouring, setting out drawings, plane-table surveying, field applications, modern levelling apparatus. Graphical Interpretation of surveying data.

15hrs Practical:

References:
Basak, N.N., 2008. Surveying and Levelling. Tata Macgrow Hill.

Course Unit No: LIM4182

Name of the Course Unit: Disaster Analysis and Management

Objectives: This Course Unit aims to make the student understand Disaster Analysis and Management

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: Analyse any type of disaster situations
ILO 2: Predict risk
ILO 3: Suggest Management measures

Assignments: No

Mode of Assessment:

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

Contents: 20 hrs Theory
Introduction to Hazards, Vulnerabilities and Disasters, Disaster Risk Reduction and Development Planning, Disaster Response and Post-Disaster Recovery

30hrs Practical:

References:

Brian D. et al., 2014.Blackstone's Emergency Planning, Crisis, and Disaster Management. Oxford University press.

Course Unit No: CHM4112

Name of the Course Unit: Biochemistry

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

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain concepts and specific reaction pathways in biochemistry
ILO 2: define structure of biologically important compounds and biosynthetic precursor molecules.
ILO 3: apply knowledge of chemistry to solve problems in biology

Assignments: No

Mode of Assessment:

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

Contents: 24 hrs Theory
Proteins, Enzymes, Protein purification,
Carbohydrates, Nucleic acids, Phosphorus in biology, Relationship between DNA, RNA and proteins, Structure, function and replication of DNA, human genome and DNA Sequencing, RNA and Protein synthesis, Energy and cellular metabolism, glycolysis, TCA cycle, oxidative phosphorylation, gluconeogenesis, metabolism of glycogen, fat, amino acid and alcohol .

18hrs Practical:

References:
Garrett, R.H. and Grisham, C.M., 2012. Biochemistry. Fifth edition, Brooks/Cole.

Course Unit No: FAQ4123 (OP)

Name of the Course Unit: Fish Pathology and Parasitology

Objectives: This Course Unit aims to make the student understand on Fish Pathology and Parasitology

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: conduct a complete fish parasitic survey, and suggest treatments and remedies to prevent outbreaks.

Assignments: No

Mode of Assessment:

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

Contents: 24 hrs Theory
Basics of fish health & suitable environmental conditions, Symptoms & diagnosis of diseases, bacterial, viral and fungal infections, external and internal parasites, non-infectious diseases and disorders, appropriate treatments and disease management procedures.

18hrs Practical:……..

References:
Roberts, R.J., 2012. Fish Pathology. Fourth edition. Wiley-Blackwell.

Course Unit No: CHM4132

Name of the Course Unit: Natural product chemistry

Objectives: This Course Unit aims to make the student understand on Natural product chemistry

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: explain the chemistry of natural product
ILO 2: extract product from natural substances using various methods

Assignments: No

Mode of Assessment:

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

Contents: 24 hrs Theory

Alkaloids, Terpinoieds, Flevanoides, Steriodes, Saponins, Drug development, Extraction, Isolation, and Characterization of Natural products

18hrs Practical:……..

References:

Level IV Semester II

Course Unit No: OCG4218

Name of the Course Unit: Research Project, Thesis Writing and Viva-voce

Objectives: This Course Unit aims to make the student understand on the processes of literature review, experimental design, data collection and interpretation of results

Intended Learning Outcomes: At the end of the course unit students should be able to
ILO 1: carry out a scientific research in his/her chosen field with minimum supervision
ILO 2: report the research finding in a systematic manner
ILO 3: defend his/he research work in front of a panel of examiners and scholarly audience.

Assignments: No

Mode of Assessment:

End semester report - 80%
End semester Viva-voce - 20%

Contents:
An 8 credit project specific to Oceanography and Marine Geology programme is required. The purpose of the project will be to provide in depth knowledge of application of science and technology. Time for experimentation is limited and considerable emphasis will be placed on the analysis, interpretation and discussion of the experimental results obtained.

References:
Heppner,P.P. and Heppner, M.J., 2003. Writing and Publishing Your Thesis, Dissertation, and Research: A Guide for Students in the Helping Professions.Cengage Learning.

Course Unit No: OCG4222

Name of the Course Unit: Industrial or field training

Objectives: This Course Unit aims to aware the students in process, function, and management of relevant industries, authorities or Bureau in Sri Lanka

Intended Learning Outcomes: at the end of the training students should be able to

ILO 1: practice better management at self-entrepreneurs

ILO 2: follow good practice at the training authorities

ILO 3: aware Sri Lankan standards and accreditations for different process

Assignments: No

Mode of Assessment:

Students have to maintain the log books and the signatures of relevant officers should be on each page

Final report of the training should be submitted to the faculty and viva-voce will be conducted by the coordinator of the Course Unit

Contents: Human Resource Management, Concept of green economy, Waste management, Quality control, industrial specific practices, Training on enterprenership

References: Not defined

.