POSTGRADUATE INSTITUTE OF SCIENCE
UNIVERSITY OF PERADENIYA

M.Sc. in Oceanography
2016/2017

1. INTRODUCTION

The M.Sc. Programme in Oceanography seeks to provide a sound theoretical and practical knowledge and comprehensive training in the application of scientific knowledge to understand the phenomena of the oceanic and coastal environments.

Sri Lanka is an island surrounded by sea with a 200 nautical mile Exclusive Economic Zone (EEZ) and legal continental margin extending to several hundreds of miles beyond the limits of this zone. Sri Lankan coastline is characterized by sandy beaches, extensive lagoons, estuaries, mangroves, coastal marshes and dunes. Seaward of the coastline, reefs of coral or sandstone and shallow beds of coastal and estuarine seagrass are found on the continental shelf. As far as the minerals are concerned the depletion of recoverable land resources has made mankind turn to oceans, estuaries, lagoons to satisfy the needs of the expanding world. For example, in the ocean lie large deposits of petroleum and other minerals adequate to cater to the needs of mankind for years to come. Also an understanding of sea water currents, tides, waves, salinity, temperature, dissolved gases as well as mathematical modeling of the sea and adjacent water bodies will be helpful to (a) locate suitable fishing grounds (b) predict the climate and take decisions on protecting the coastline of the country. However, the lack of expertise of the subject in the country is a great barrier to overcome in finding solutions to the above problems. In this programme, it is intended to give an opportunity for the students to get a better insight into the marine environment and eventually with perhaps aurther training to provide the required expertise to the country.

2. AIMS AND OBJECTIVES

The programme is designed with a view to:

1. Promoting and conducting research activities directed towards the identification, assessment, management and development of aquatic resources, particularly, the fields of marine and adjacent water bodies

2. Providing advisory and consultancy services on scientific, technological and legal matters relating to exploitation, research development, control and management of living and non living aquatic resources.

3. Ensuring the application and utilization of scientific and technological expertise for the implementation of the national development programmes on the subject of marine resources.

3. PROGRAMME ELIGIBILITY

Graduates in any scientific discipline are eligible for admission though it is desirable that candidates should have a strong background in at least one of the following subjects: geology, physics, chemistry, mathematics, engineering or biology.

Employed candidates who are eligible for admission should produce evidence of leave granted to follow the programme and a letter of release from the relevant Head of the Department/Institution.

4. PROGRAMME FEE

	M.Sc. programme fee
local candidates	Rs. 150000/-
SAARC countries	US $ 5000/-
other countries	US $ 10000/-

Programme fees shall be paid in two instalments *(50%- at registration and remaining 50% within six months from registration).* Other payments including registration fee, medical fee, library subscription, examination fee and deposits (science and library) should be paid according to the procedure stipulated by the PGIS.

5. THE PROGRAMME STRUCTURE AND DURATION

This is a full-time programme consisting of course work and a research project. Coursework will be conducted over a period of two semesters of 15 weeks each, during Fridays (if necessary), Saturdays and Sundays. The entire programme duration will be about 15-18 months inclusive of 3-6 months for the research project. Satisfactory completion of a minimum of 24 credits of course work (with a GPA of not less than 3.00) is required for the programme in addition to the six credits allocated for the full-time research project *(If the student obtains a GPA in the range 2.75 to 2.99, then he/she is eligible only for the award of the Diploma in Oceanography).* Continuous attendance is compulsory during the period of research work. After successful completion of the research project, the student is eligible for the award of the M.Sc. Degree. Based on the performance by students in the taught courses, PGIS may upgrade the registration of such students to M.Phil. or Ph.D. programmes.

Each candidate will be assigned an academic advisor, whose advice should be sought when planning the M.Sc. programme. The approval of the programme coordinator is necessary prior to the commencement of the programme. English will be the medium of instruction.

Programme Summary

Course Code	Course	Lecture Hrs.	Practical Hrs.	No. of Credits
Semester 1				
ES 561	Biological Oceanography	30	-	2
ES 562	Physical Oceanography	30	-	2
ES 563	Chemical Oceanography	30	-	2
ES 564	Oceanography Practical I	-	60	2
ES 565	Marine Geology and Geophysics	30	-	2
ES 566	Surveying, Sampling and Analytical Techniques with special reference to Coastal Areas	30	-	2
ES 567	Data Analysis using Statistical Software	30	-	2
Semester 2				
ES 576	Oceanography Practical II		60	2
ES 577	Computational Methods in Oceanography	30		2
ES 578	Estuarine and Coastal Oceanography	30	-	2
ES 579	Dynamic Oceanography *	30	-	2
ES 580	Physical and Inorganic Chemistry of Seawater *	30	-	2
ES 581	Marine Biodiversity and Conservation *	30	-	2
ES 582	Marine Geophysics *	30	-	2
ES 597	Seminar	-	15	-
ES 599	Research project (minimum of three months duration)			6

* *Optional Courses*

6. PROGRAMME CONTENTS

ES 561 : BIOLOGICAL OCEANOGRAPHY

Evolution of life – General description of the classification of living organisms: Overview of kingdoms and phyla – Comparison of the marine with the terrestrial environment – Sea as a biological environment: Effects of temperature, salinity, pressure and light on marine organisms – Division of marine environment and their characteristic flora and fauna: plankton, nekton and benthos – The seafloor –Salient features of rocky shores, sandy shores, estuaries and mangroves and coral ecosystems – Organic production in the sea: organic cycle, primary production, factors affecting primary production –Concepts of food chain, food web and ecological efficiencies – Methods and instruments used in biological oceanography: sampling of phytoplankton, zooplankton, benthos, fishing crafts and gears –Living resources: algae, arthropods, molluscs, echinoderms and fishes – Major oceanographic expeditions: Galathea, IIOE expeditions.

Reference books

Biological oceanography, 1999 - Lalli, C.M.
Biological Oceanography (1997) The Open University/Butterworth Heinemann
Oceanography: The past, 1980 - Sears, M. and Merimann, D. (Eds.)

Elements of ecology (3rd Edn.), 1982 - Tail, R.V.
An introduction to marine sciences, 1988 - Meadows, P.S. and Campbell, J.J.
Textbook of marine ecology, 1989 - Nair, N.B. and Thampy, D.M.
Marine biology, 1984 - Thurman, H.V. and Webber, H.H.
Methods in marine zooplankton ecology, 1984 - Omori, W. and Ikeda, T
Methods for the study of marine benthos, 1984 - Holme, N.A. and McIntyre, A.D.
The shore environment, 1980 - Irvine, J.H., Price, D.E.C. and Farnham, W.F.
Life between tidemark on rockey shores, 1972 - Stephenson, T.A. and Stephenson, A
The invertebrates (5th Edn.), 1986 - Barnes, R.D.

ES 562 : PHYSICAL OCEANOGRAPHY

Origin of the earth, its atmosphere and oceans -Composition of atmosphere, steady state or equilibrium, sources of gases in the atmosphere, reactivity of trace gases in the atmosphere, acid rain, ozone hole, chemistry of sea surface microlayer- Origin, thickness and collection of surface material, properties of the surface microlayer -Vertical extent of atmosphere - Atmospherictemperature - Temperature system and scales -Classification of atmosphere based on temperature and chemistry - Atmospheric humidity - Vapour pressure -Radiation balance : Solar energy, insolation, latitudinal zones, man's impact on the radiation balance, heat-flow mechanisms, global distribution of air temperatures - Atmospheric circulation: Barometric pressure and winds, Coriolis effect and geostrophic winds, meridional circulation, global patterns of circulation - tropical easterlies, westerlies, polarjet streams, polar easterlies and circumpolar low - Earth's motion and solar constant - Clouds: Formation of clouds - Fog: its formation, different types - Condensation and precipitation processes -Adiabatic processes and stability. Physical properties of seawater - Distribution of temperature, salinity and density in space and time -Sound in the sea: Propogation of sound in the sea -Light in the sea - Heat budget of the oceans - El Nino and Southern Oscillation - Coriolis force - Circulation: Wind-driven circulation and thermohaline circulation - Indian Ocean circulation - Upwelling -Water masses and currents in the oceans : Bottom water, deep water - Energy concept: wind, wave, and thermal energy - Antarctic intermediate water, central water - Waves: character, formation and types of waves, tsunamis - T.S.V. diagram - T.S. diagram -Oceanic fronts - Lagrangian and Eulerian methods for measuring currents - Tides: Types of tides and tidal currents.

Reference books

Principles of physical oceanography, 1966 - Pierson, W.J. and Newmann, G.S., Prentice Hall Inc., New Jersey, U.S.A.
Introduction to dynamic oceanography, 1983 - Pond, S. and Pickard, G.H., Pergamon Press, U.K.
Seawater, Its Composition, Properties and Behaviour, 1995–The Open University / Butterworth Heinemann

ES 563 : CHEMICAL OCEANOGRAPHY

Major and minor elements in seawater – Geochemical balance of the oceans, residence time, chemical speciation, constancy of relative ionic composition of seawater, conditions under which major elements may not be conservative, factors affecting the distribution of trace elements in the sea, interaction of trace elements with marine organisms, enrichment factor, conservative and non-conservative properties - Chlorinity and salinity: definition, significance and measurement, practical salinity scale – Radio activenuclides as tracers to study oceanic circulation pattern. Dissolved gases in seawater - Basic concepts:solubility of gases in seawater, air-sea gas exchange, processes affecting their distribution, dissolved oxygen in the ocean - Dissolved CO_2 in seawater - CO_2 equilibrium in seawater, pH, alkalinity and buffering capacity of oceans, components of CO_2 system in seawater - Percentage composition of inorganic carbon, calcium carbonate precipitation and dissolution phenomena - Lysocline and calcite compensation depth. Micronutrient elements (P, N and Si) in seawater -Forms in seawater, distribution and cycle, N:P ratios- Stoichiometry of the uptake and regeneration of the nutrient elements and of oxygen - Introduction to biogeochemical cycles and modeling - Chemistry of land-locked basins: hydrography, circulation, chemistry with examples (the Baltic and the Black Sea)- Reducing environments - Chemical oceanography of the seas around Sri Lanka.

Reference books

Ocean Chemistry and Deep Sea Sediments,1989 - The Open Universit Butterworth Heinemann
Millero, F.J. and Sohn, M.L., (1992), Chemical Oceanography. CRC Press
Introduction to marine chemistry, 1981 - Riley, R.P. and Chester,
Chemical oceanography (Vol. 1, 2 and 3), 1975 - Riley, J.P. and Skirrow, G.
Marine chemistry, 1969 - Horne, R.A,
Seawater: Its composition, properties and behaviour, 1989 - The Open University
Marine chemistry (Vol. 2), 1970 - Margin, D.F.
Chemical oceanography, 1982 - Broecker and Peng.
Marine geochemistry, 1990 - Chester
Chemical oceanography, 1992 - Millcro and Saha, M.L.
Dynamic processes in the chemistry of the upper ocean, 1986 - Burton et al, Plenum Press.
The chemistry of the atmosphere and oceans, 1978 - Holland, H.D.
An introduction to environmental chemistry, 1996 - Andrews et al, Blackwell Science
Environmental chemistry, 1994 - De A.K., Wiley-Eastern Ltd.

ES 564 : OCEANOGRAPHY PRACTICAL I

Practical relevant to ES 561, ES 562, ES 563 & ES 564

ES 565 : MARINE GEOLOGY & GEOPHYSICS

Size and shape of the ocean basins : Indian, Pacific and Atlantic - Morphology and structure of the seafloor - Origin and evolution of ocean basins -Continental drift, seafloor spreading and plate tectonics - Evolution of the Indian Ocean - Instruments for: position-fixing, Hydrographic survey,hydrographic chart, depth measurement, echo-sounder, side-scan sonar, sub-bottom profiler - Beach and beach profile, variations in beach morphology and its significance - Near-shore geological processes: Erosion, transportation and deposition - Law of the Sea Treaty - Marine mineral resources: Polymetallic nodules, Hydrothermal deposits(sulfides and metalliferous muds), phosphorites, carbonates, placers, petroleum and natural gas, gas hydrates - Magnetic, gravity and seismic methods of exploration: Principle, techniques and applications, interpretation of data - Sedimentary processes in the ocean basins - Structure and geological processes at continental margins - Marine sediments: sources, composition, distribution and classification, with special reference to near-shore areas – Marine Geochemistry (Elaboration possible from Goa Univ. syllabus) and geochemical cycle - Analysis of sedimentological data and interpretation - Marine sediments and paleoclimate: Proxies for various paleoclimatic and paleoceanographic (including sea level) changes with special emphasis on Quaternary.

Reference books

Introductory oceanography (5th Edn.), 1988 - Thurman, H.V., Mercill Publ. Co., Ohio
Oceanography (5th Edn.), 1990 - Grant Gross, M., Prentice Hall
Coastal and estuarine sediment dynamics, 1986 - Dyer K.R., John Wiley & Sons
Beach processes and sedimentation, 1976 - Komar, P.D., Prentice Hall
Beaches and coasts (2nd Edn.), 1972 - King, C.A.M., Edward Arnold
Introduction to marine micropaleontology, 1978 - Haq, B.U. and Boersma, A (Eds.), Elsevier Publ.
Introduction to geophysical prospecting, 1976 - Dobrin, M.B., McGraw-Hill
Gravity and magnetics in oil prospecting, 1976 - Nettleton, L.L., McGraw-Hill
The mineral sources of the sea, 1965 - Mcro, J.L., Elsevier, Amsterdam
Earth resources, 1969 - Skinner, B.J., Prentice Hall
Marine minerals: advances in research and resource assessment, 1987 - Teleki, P.G. et al, D. Reidel Dordrechart
The micropaleontology of oceans, 1971-Funnell, B.M. and Reidel, W.R., Cambridge Univ. Press, U.K.
Marine geology and oceanography of the Arabian Sea and coastal Pakistan, 1984 - Haq, B.U. and Milliman, J.D., Van Norstrand Reinhold Co.

ES 566 : SURVEYING, SAMPLING AND ANALYTICAL TECHNIQUES WITH SPECIAL REFERENCE TO COASTAL AREAS

Instruments used for meteorological studies - Psychometer, anemometer, radio sonde, sun photometer samplers - Instruments used for physical oceanographic studies: mechanical bathythermograph, expendable bathythermograph, reversing thermometer, CTD probe, current meters samplers - Instruments used in chemical oceanography samplers - Instruments for sampling: grabs, corers, dredges, rock core drill, water samplers - Surveying, sampling and laboratory techniques for the study of marine sediments samplers

ES 567 : DATA ANALYSIS USING STATISTICAL SOFTWARE

Review of statistical methods : comparison of 2 treatments, analysis of variance, regression and correlation. Use of MINITAB in data analysis. Use of SAS in data analysis. Both minivariate and multivariate procedures will be covered.

ES 576 : OCEANOGRAPHY PRACTICAL II

Practical from OC21, OC22 and OC23

ES 577 : COMPUTATIONAL METHODS IN OCEANOGRAPHY

Indices, logarithms, linear and parabolic functions – Permutation andcombinations – Arithmetic and geometric progression – Differentiation, application of differentiation – Velocity, acceleration, related rates – Introduction to simple differential equations and integration to determine growth and decay – Matrices: addition, substraction, multiplication, inverse by adjoint method.

Descriptive Statistics – Sample, population – Measures of central tendency, dispersion: skewness, kurtosis – Correlation: simple correlation, Karl Pearson's coefficient off correlation, concurrent deviation method, method of least squares (regression) – Regression equations – Binomial and normal distribution – Inferential statistics – Hypothesis testing, significance level – Student ***t*** test x^2 test, **F** test, standard error – Test of significance for attributes, large samples and small samples – Analysis of variance

Introduction to computers – FORTRAN programming: operators, relational operators, type declaration, READ, WRITE, FORMAT, DIMENSION, CONTINUE, GO TO STOP, END statements, intrinsic functions, arithmetic assign statement, Doloop, nested DO LOOP, arithmetic and logical IF statements, IF-ENDIF block statements, IF-ELSEIF-ENDIF block statements, computed GO TO statements – Introduction to C and VisualBasic

Reference books

A biologist's basic mathematics, 1983 - Causton, D.R., Edward Arnold, London

Introduction to mathematics for life scientists, 1971-Batchelet, E

Mathematics for biological sciences, 1980-Newby, J.C., Oxford Univ. Press, U.K.

College algebra, 1966-Bardell, R.H. and Spitzbart, A, Addison-Wesley, Massachusetts, U.S.A.

Introduction to algebra, 1966-Perlis, S, Blaisdell Publ. Co., London

Differential equations, 1985 - Wylie, C.R., McGraw-Hill Publ., Singapore

Statistics: Theory, methods and applications, 1998 - Samchetr, D.C. and Kapoor, V.K. Sultan-Chand & Sons, New Delhi

Biometry, 1981 - Sokal, R.R. and Rohlf, F.J., Freeman & Co., San Fransisco

Statistical methods, 1967-Snedecore, G.W. and Cochran, W.G., Allied Pacific Pvt. Ltd., Mumbai

Multivariate statistical methods, 1990- Morrison,D.F., McGraw-Hill Publ., Singapore

Fundamental computer concepts, 1986 - Davis, W.S. McGraw-Hill Publ., Singapore

Theory and problems of data processing, 1982-Lipschutz, M.M. and Lipschutz, S, McGraw-Hill Book Co., Singapore

Fortran 77 and numerical method 1994-Xavier, C., Wiley-Eastern Ltd., New Age International Ltd., New Delhi.

ES 578 : ESTUARINE AND COASTAL OCEANOGRAPHY

General characteristics of estuaries – Classification – Estuarine circulation and mixing – Factors influencing coastal processes – Tides – Waves – Phenomena of wave reflection, refraction and diffraction – Breakers and surf – Littoral currents – Rip currents.

Estuarine chemistry – Salinity intrusion in estuaries, flushing time, mixing and diffusion dispersal of pollutants in estuaries and nearshore areas – Conservative and non-conservative properties of dissolved constituents during estuarine mixing – Simple flux calculations – Behaviour of dissolved oxygen, pH and major elements in estuarine water – Biogeochemistry of P, N and Si in estuaries – Minor and trace metals – Sources, sinks and general biogeochemistry in estuaries.

Coastal ecosystems and their characteristic fauna and flora: sandy shores, rocky shores, estuaries, coral reefs – Adaptations of coastal and estuarine organisms – Effects of pollution on coastal fauna – Coastal living resources: algae, dominant crustaceans (major penaeid and non-penaeid prawns, crabs, horseshoe crabs, lobsters), dominant molluscs, holothurians and major teleost fishes.

Estuaries: Geological classification and evolution – Sediment source, transportation and deposition – Bed and suspended sampling and analysis – Coasts: classification, types of coast with reference to Indian coastline – Evolution of the Indian coast – Mineralogy and geochemistry of estuarine sediments – Global sea level changes: eustatic, tectonic and isostatic.

Reference books

Estuarine chemistry, 1976 - Burton, J.D. and Liss, P.S.

Practical estuarine chemistry, 1985 - Head, P.C.

Chemistry and biogeochemistry of estuaries, 1980 - Olausson, E. and Cato, I.

Chemical oceanography (Vol. 7), 1978 - Riley, J.P. and Chester, R.

Waves, tides and shallow-water processes, 1991 - The Open University

Coastal and estuarine sediment dynamics, 1986 - Dyer, K.R., John Wiley & Sons

Estuarine hydrography and sedimentation, 1986 - Dyer, K.R. John Wiley & Sons

Beach processes and sedimentation, 1976 - Komar, P.D., Prentice Hall

Sea-level rise and coastal subsidence: causes, consequences and strategies, 1996 - Milliman, J.D. and Haq, B.U., Kluwer Academic

Introduction to geochemistry, 1967 - Krauskopf, K.B., McGraw-Hill

Flements of ecology (3rd End.), 1982 - Tait, R.V.

An introduction to marine sciences, 1988 - Meadows, P.S. and Campbell, J.J.

Textbook of marine ecology, 1989 - Nair, N.B. and Thampy, D.M.

ES 579 : DYNAMIC OCEANOGRAPHY

Basic physical laws used in oceanography – Classification of forces and motion – Equation of continuity – Static stability of motion – double diffusion – Equation for the mean or average motion – Non-linear terms in the equation of motion – Eddy viscosity – Currents without friction – Geostrophic flow – Hydrostatic equilibrium – Geopotential – Geopotential surfaces and isobaric surfaces – Geostrophic methods for calculating relative velocity – Thermal wind equation – Relation between isobaric and isopyonal surfaces – Currents with friction wind driven circulation – The equation of motion with friction: Transport and upwelling – Bottom friction and shallow water effects – Ekman's solution to the equation of motion with friction – Limitation to Ekman's theory – Sverdrup's solution for the wind driven circulation – Stommel's contribution – The planetary wind field, upwelling and sinking with special reference to the Indian ocean – Velocity: relative velocity, planetary vorticity, absolute vorticity, potential vorticity – Westward intensification – equatorial current system – Boundary layer approach to obtain a solution to Munk's equation – The mixed layer of the ocean – Co-ordinate system – Governing equations – Boundary conditions layer averaged equations – Staggered grid – Finite difference method – Stability criteria.

Reference books

Introductory dynamical oceanography, 1983 - Pond, S and Pickard, G.H., Pergamon Press, U.K.

Principles of physical oceanography, 1966 - Newman, G. and Pierson, W.J., Prentice Hall, Inc., New Jersey, U.S.A.

Physical oceanography (Vol. 1), 1961 - Defant, A., Oxford Pergamon Press, U.K.

The dynamics of the upper ocean (2nd Edn.), 1977 - Phillips, O.M., Cambridge Univ. Press, U.K.
Modeling and prediction of the upper layers of the ocean, 1977 - Krous, E.B. (Ed.)
Modeling of marine systems, 1986 - Nihoul, J.C.J., Elsevier Scientific Publ. Co., Oxford, U.K.

ES 580 : PHYSICAL AND INORGANIC CHEMISTRY OF SEAWATER

The structure of liquid water - Theories of water structure, Colligative properties of seawater with the thermodynamic derivations of expressions for boiling point elevation and freezing point depression, electrostriction – The Thermodynamics of Seawater – Ideal and real solutions, equation of state for pure water and seawater, thermodynamics of PVT changes in seawater; activities, activity coefficients; Debye-Huckel limiting law; heat of solution, dilution and mixing – Transport processes in Solution – Dielectric relaxation, diffusion, viscosity and electrical conductivity.

Acids and bases – basic concepts, proton condition and the electroneutrality of solutions; pH as a master variable – log C – pH diagram for monoprotic and diprotic acid – base shystem; buffer pH, buffer intensity and acid – base neutralizing capacity – Oxidation and Reduction Reactions – Redox equilibria, electron activity and pE – Peters-Nernst equation; pE-pH diagram for the aqueous chlorine system, pE – pe diagram for Fe (II) Fe (III) system, Kinetics fo redox processes (Oxidation of Fe (II) and Mn (II) only).

Metal Ions in Aqueous Solutions – hydrolysis of metal ions, the stability of hydrolysis species, complex formation and the solubility of solids: chelates – inorganic and organic complexes in natural waters – Precipitation and dissolution – Heterogeneous equilibria, solubility product and saturatin; the solubility of oxides and hydroxides; carbonate system closed to atmosphere and in equilibrium with $CO_2(g)$; the stability of hydroxides and carbonates; crystal formation – The initiation and production of the solid phase – Solubility equilibria for silicates, alumino silicates and iron (oxy) hydroxides.

Reference books

Marine chemistry, 1969 - Horne, R.A.A, Wiley-Interscience, London
Aquatic chemistry, 1981, 1996 - Stumm, W. and Morgan, J.J., Wiley-Interscience, New York
Water chemistry, 1980 - Snocink, V.L. and Jenkins, D., John Wiley & Sons, New York
Principles of aquatic chemistry, 1983 - Morel, E.M.M.
Chemical kinetics and process dynamics in aquatic systems, 1994 - Brezonik, P.L., Lewis Publ., London
Aquatic chemistry, 1995 - Huang, C.P., O'melia, C.R. and Morgan, J.J., American Chemical Society, Washington D.C.
Aquatic surface chemistry, 1987 - Stumm, W., Wiley-Interscience, New York
Chemical oceanography (Vol. 1), 1975 - Riley, J.P. and Chester, G.
Physical chemistry, 1980 - Glasstone, S.
The geochemistry of natural waters, 1982 - Drever, J.L.
Introduction to geochemistry, 1995 - Krauskopf, K.B. and Bird, McGraw-Hill

ES 581 : MARINE BIODIVERSITY AND CONSERVATION

Concept of biodiversity – Biodiversity conservation priorities: values and approaches – Biodiversity of Indian flora and fauna – Economic importance and exploitation of marine organisms along the Indian coast: algae, major penacid and non penacid prawns, crabs, lobsters, horseshoe crabs, dominant mllusces (mussels, oysters, clams, gastropods, squids, cuttlefishes and octopuses), holothurians,dominant fish species (mackerels, sardines, pomfrets, bombay duck, seer fishes, tunas, scianids, carangids, sole fishes, silver bellies, ribbon fishes, major sharks, skates and rays) – Protected marine organisms of the Indian Seas: corals, turtles and dugongs.

Principles of Integrated coastal management – Problems associated with conversion of mangrove areas for shrimp aquaculture development – Problems of exploitation of reef related fisheries – Banned fishing practices – Effects of coastal tourism – Conservation and management of marine resources – An overview of laws relevant to biodiversity and environmental protection of coastal ecosystems – Marine parks, sanctuaries and reserves of India: Bhitarkanika Wildlife Sanctuary, Gulf of Kachchh Marine National Park and Sanctuary, Gulf of Mannare Biosphere Reserve, Wandoor Marine National Park.

Reference books

Prawn and prawn fisheries of India, 1976 - Kurian, C.V. and Sebastian, V.O.
Marine fisheries, 1984 - Bal, D.V. and Rao, K.V.
Text book of marine ecology, 1989 - Nair, N.B. and Thampy, D.M.
Coral reef management handbook, 1984 - Kenchinton, R.A. and Hudson, B.E.T. (Eds.)
Biodiversity in the balance: Approaches to setting geographic conservation priorities, 1995 - Johnson, N.C., Biodiversity Support Program, WWF, Washington
Ministry of Environment & Forests, New Delhi notifications on environmental protection

ES 582 : MARINE GEOPHYSICS

Fundamentals of Geophysical prospecting, sound transmission in water and sediments. Acoustic properties of water and sediments – Marine instrumentation – Techniques of echosounding, sound ranging side scan sonar, sparker and pneumatic pulsar profiling – Marine geophysical instrumentation and various methods employed in oceans – Single channel and multi-channel seismic reflection source – Airguns, sleeve guns, water guns – Array configuration and advantages. Seismic reflection receivers – Geophones – hydrophones: steamers, Wide angle reflection – Seismic refraction – sonobuoys, ocean bottom seismometers OBH – Data acquisition and quality control – Seismic data processing, signal processing – Spectral analysis in geophysics – Analysis of geophysical signals – frequency and spectral analysis, Spectra vs. time domain analysis – Fourier series and Fourier transforms – Theoretical development of Fourier series and applications – Identification of reflectors, their correlation and interpretation – Gravity and magnetic surveys over the ocean – Reduction of observations, identification of anomalies and interpretation of the data set – Integrated interpretation of geophysical data – Continental margin studies of India – Application of geophysical methods in offshore exploration for oil and natural gas and other minerals.

Reference books

Principles of geophysical prospecting, 1976 - Dobrin, M.B., McGraw-Hill
Geophysical prospecting for oil, 1976 - Nettleton, L.L., McGraw-Hill
Exploration seismology (Vol. 1 and 2) 1982, 1983 - Sheriff, R.E. and Geldant, L.P., Cambridge Univ. Press.
Developments in solid earth geophysics (Vol. 5) Spectral analysis in geophysics, 1974 - Bath Markens
Seismic prospecting instruments (Vol. 1) 1972 - Evenden, B.S., Stone, D.R. and Ansley, N.A.

7. PROGRAMME EVALUATION

Programme evaluation will be as stipulated in the PGIS Hand Book 2002.

8. TEACHING PANEL

Dr. Champa Amarasiri, NARA, Crow Island, Mattakuliya, Colombo 15
M.Sc. (Wales), Ph.D. (James Cook)
Mr. K Arulananthan, NARA, Crow Island, Mattakuliya, Colombo 15
M.Sc. (Mangalore), M.Sc. (Gothenburg)
Prof. K Dahanayake, Department of Geology, University of Peradeniya
B.Sc. (Cey.), Ph.D. (Nancy)
Prof. C B Dissanayake, Department of Geology, University of Peradeniya
B.Sc. (Cey.), Ph.D. (Oxen), D.Sc. (Oxford)
Dr. P R T Cumaranathunga, Department of Fisheries Biology, University of Ruhuna
B.Sc. (Kelaniya), Ph.D. (Aston)
Prof. A. Gunatilleke, Formerly Professor of Geology, University of Kuwait & University of Oman

B.Sc. (Wellington); Ph.D (Reading)

Dr. D S Jayakody, NARA, Crow Island, Mattakuliya, Colombo 15
M.Phil. (Kelaniya), Postgraduate Diploma (Bergan), Ph.D. (Sterling)

Dr. J M P K Jayasinghe, NARA, Crow Island, Mattakuliya, Colombo 15
M.Phil. (Col.), Ph.D. (Sterling)

Mr. H B Jayasiri, NARA, Crow Island, Mattakuliya, Colombo 15
M.Sc. (Gothenburg)

Prof. S. A. Kulasooriya, Department of Botany, University of Peradeniya
B.Sc. (Cey.), Ph.D (London)

Dr. K P P Pathirana, Faculty of Engineering, University of Peradeniya
Ph.D. (Belgium)

Dr. A Pitawala, Department of Geology, University of Peradeniya
B.Sc., M.Phil. (S.Lan.), Ph.D. (Mainz)

Mr. J K Rajapaksha, NARA, Crow Island, Mattakuliya, Colombo 15
M.Sc. (Gothenburg)

Prof. Lars Rydberg, Professor of Oceanography, Gothenburg University, SE- 405 30 Sweden
Ph.D. (Sweden)

Dr. S Samita, Department of Crop Science, Faculty of Agriculture, University of Peradeniya
B.Sc. Agric. (Perad.), M.Phil. (Perad.) Ph.D. (Edin.)

Dr. J S Sarupriya, Data and Information Division, National Institute of Oceanography (NIO), Dona Paula, Goa – 403 004, India

Dr. A Senaratne, Department of Geology, University of Peradeniya
B.Sc. (S.Lan.), M.Sc. (London), Ph.D. (Germany)

Dr. R Shankar, Department of Marine Geology, Mangalore University, Mangalagangotri (D.K.), Karnataka 574 199, India, *B.Sc., M.Sc., Ph.D. (India)*

Dr. P B G S N Siriwardene, NARA, Crow Island, Mattakuliya, Colombo 15
M.Sc., Ph.D. (Sterling)

Dr. T K D Tennekoon, Oceanography Division, NARA, Crow Island, Mattakuliya, Colombo 15
M.Sc., Ph.D.

Dr. T B Wanninayake, NARA, Crow Island, Mattakuliya, Colombo 15
M.Phil. (Kelaniya), Ph.D. (Liverpool)

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