References/ Readings	1. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific, *1988b* - Carpenter K.E. & Niem V.H. *Volume 2.Cephalopods, crustaceans, holothurians and sharks*. (Food and Agricultural Organization, Rome), pp. 687-1396. 2. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. *1999a* - Carpenter K.E. & Niem V.H., *Volume 3. Batoid fishes, Chimaeras and bony Fishes Part 1 (Elopidae to Linophrynidae)*. (Food and Agricultural Organization, Rome), pp. 1397-2068. 3. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific., *1999b* - Carpenter K.E. & Niem V. H., *Volume 4. Bony Fishes Part 2 (Mugilidae to Carangidae)*. (Food and Agricultural Organization, Rome), pp. 2069-2790. 4. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific., *2001a* - Carpenter K.E. & Niem V.H. *Volume 5. Bony Fishes Part 3 (Menidae to Pomacentridae)*. (Food and Agricultural Organization, Rome), pp. 2791-3380. 5. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific., *2001b* - Carpenter K.E. & Niem V.H., *Volume 6.Bony Fishes Part 4 (Labridae to Latimeriidae), estuarine crocodiles, sea turtles, sea snakes and marine mammals*. (Food and Agricultural Organization, Rome), pp. 3381-4218.	
Learning Outcomes	Provides basic information towards the identification of few marine groups.	

Programme: M.Sc. (Marine Sciences)
Course Code:MSO 276 **Title of the Course: Environmental Impact Assessment**
Number of Credits: 01
Effective from AY: June2018-19

Prerequisites for the course	Students who have undergone courses of semester I of Marine Sciences.	
Objective	This course introduces concept of environmental impact assessment.	
Content	Environmental impact assessment (EIA) - Nexus between development and environment – Socio–economic impacts - purposes of EIA - aid to decision-making - formulation of development actions - sustainable development - EIA in project planning and implementation - EIA process - evaluation of proposed actions - scoping EIA methodologies - impact prediction- mitigation measures - monitoring - Environment Management Plan - planning - selection of appropriate procedures.	12 hours
Pedagogy	Lectures / Seminars involving presentation of environmental impact assessment studies carried out at national and international levels.	
References / Readings	1. Introduction to environmental impact assessment 2005, Glasson J., Therivel R., Chadwick A, Routledge, Taylor & Francis Group, London and New York. 2. Methods of Environmental Impact Assessment 2009, Morris P., Therivel R., 3rd edition, Routledge, Taylor & Francis Group, London and New York. 3. Methods of Environmental Impact Assessment 2001, Morris P., Therivel R., 2nd edition, Spon Press, Taylor & Francis Group, London and New York. 4. Environmental Impact Assessment 2011, Eccleston C. H., CRC Press, Taylor & Francis Group.	
Learning Outcomes	1. Ability to carry out environmental impact assessment study. 2. A potential candidate for recruitment in the EIA consultancy firms.	

Programme: M.Sc. (Marine Sciences)
Course Code:MSO 277 **Title of the Course: Environmental Impact Assessment Practical**
Number of Credits: 01
Effective from AY: June2018-19

Prerequisites for the course	Students who have undergone courses of semester I of Marine Sciences.
Objective	This course introduces field survey, sampling and experiments to assess impact on the environment.

Content	1. Introduction to national and international standard values for ambient air, noise, water, sediments and industrial effluents (4 hrs; Ref 1,2) 2. On board trawler field trip to an estuary to get familiar with field study methods for collection of water, sediment and biological samples (10 hrs; Ref 3) 3. Determination of total dissolved solids in water (5 hrs; Ref 4, 5) 4. Determination of total suspended matter in water (4 hrs; Ref 6) 5. Determination of biogenic silica from sediments (6 hrs; Ref 7, 8) 6. Comparison of determined data with the national standard value (4 hrs; Ref 1, 2) 7. Analysis of environmental impact assessment reports available (4 hrs; Ref 1, 2)	24 hours
Pedagogy	Field survey and sampling / Laboratory experiments / Interpretations	
References / Readings	1. Environmental standards for ambient air, automobiles, fuels, industries and noise. Central pollution control board, Ministry of environment and forests, India, July 2000. 2. Standards and Thresholds for impact assessment, volume 3, Environmental protection in the European Union, 2008, Schmidt M., Glasson J., Emmelin L., Helbron H., Springer-Verlag Berlin Heidelberg. 3. Methods of seawater analysis, 1983 - Grasshoff K., M. Ehrdardt and K. Krembling (eds.), Verlag Chemie, Weinneim, 419. 4. Sokoloff V.P. (1933) Water of crystallization in total solids of water analysis. Industrial and Engineering Chemistry, 5:336. 5. Howard C.S. (1933) Determination of total dissolved solids in water analysis. Industrial and Engineering Chemistry, 5:4. 6. Liu D., Fu D., Xu B., Shen C. (2012) Estimation of total suspended matter in the Zhujiang (Pearl) River estuary from Hyperion imagery. Chinese Journal of Oceanology and Limnology 30:16-21. 7. Mortlock R.A., Froelich P.N. (1989) A simple method for the rapid determination of biogenic opal in pelagic marine sediments. Deep-Sea Research, Part A, 36:1415-1426. 8. DeMaster D.J. (1979) The marine budgets of silica and ^{32}Si. Ph.D. Dissertation, Yale University, 308pp.	
Learning Outcomes	1. Ability to conduct field survey and sampling for environmental impact assessment study. 2. Conducting laboratory experiments and interpretation of data.	

Programme: M. Sc. (Marine Sciences)
Course Code: MSO 278 **Title of the Course: GIS Applications in Marine Science Practical - I**
Number of Credits: 01
Effective from AY: June, 2018-19

Prerequisites for the course:	Students who have undergone semester I of Marine Sciences.	
Objective:	To use GIS techniques in the field of oceanography / meteorology	
Content:	1. GIS, GIS software familiarization and image properties (8 hrs; Ref 1&2) 2. Data acquisition and integration in GIS software (6 hrs; Ref 1&3) 3. Image edge detection, Transects, spectra and time series images (6 hrs; Ref 3) 4. Contrast stretching, Colour palettes, smoothing satellite images(4 hrs; Ref 3 & 4) 5. Digitizing Vector maps (6 hrs; Ref 6)	24 hours
Pedagogy:	Tutorials/ assignments/practicals/field study	
References/ Readings	1. Practical Handbook of Digital Mapping: Terms and Concepts Arlinghaus, 1994 Sandra L., - CRC Press.0-8493-0131-9 2. Coastal and marine geospatial technologies. 2010. Ed. David R Green, Springer, ISBN 978-1-4020-9719-5 3. *Remote Sensing Handbook for Tropical Coastal Management*. Coastal Management Source books 3.2004.Edmund P. Green, Peter J. Mumby, Alasdair J. Edwards and Christopher D. Clark, UNESCO, Paris. 4. Principals of Geographic information systems- An introductory text book, 2009 - Eds :ottoHuisman and Roff A. de By (ed.) International Institute for Geo-Information and Earth Observation, Netherlands. 5. Essentials of Geographic Information Systems, 2011 - Jonathan Campbell, Michael Shin	