

**P.G. Department of Marine Sciences
Berhampur University**



Courses of Studies for M.Phil. Examination – 2017

M.Phil. Oceanography

M.Phil. Marine Biology

Course of Study for M.Phil. Oceanography Examination 2016-17

Semester I (16 credits)

CC- 1	: Research methodology	(04 credits)
CC- 2	: Advanced level course on the subject concerned	(04 credits)
CC- 3	: Seminar presentation (Presentation with a review report based on review of 05 important published research articles of reputed journals)	(04 credits)
CE- 1	: Elective course related to research	(04 credits)
CE- II	: Elective course related to research	(04 credits)

(Out of the two Core elective courses a student shall choose either CE-I or CE-II depending on his/her specialization at M.Sc Level)

Semester II (16 credits)

CC- 4	: Review of research progress (through PowerPoint presentation)	(04 credits)
Dissertation	:	(12 credits)

*(*CC- Core course; CE- Core elective)*

M.Phil.: Oceanography

Semester 1 (16 Credits)

Core Course I: Research Methodology

(There are five units in Research Methodology. Unit-I,II and V are compulsory for all the students while a student shall choose either Unit-III or IV depending on her/his specialization at M.Sc. level.)

Unit-I

(Statistical analysis and Computer applications)

Use of MS Office Word, MS Office Excel, Power Point Presentation, simple correlation and regression analysis, factor analysis, Cluster analysis and Principal components analysis (PCA), analysis of time series data, interpolation and extrapolation.

Unit-II

(Communication Skill and their preparation)

Project design, Literature survey, Problem Identification and Project preparation, data analysis and interpretation, thesis planning and writing.

Unit-III

(Research Methodology in Chemical and Geological Oceanography)

Methods of water sample collection and preservation, methodology for estimation of salinity, dissolved oxygen, nutrients, particulate matter, and major elements such as fluoride, Boron, Magnesium, Calcium, principle of Atomic Absorption Spectrometry for identification of trace elements in sea water. Sampling methods for collection of surface and core sediments, Methods of grain size analysis of sediments and their statistical interpretation, Method for separation of heavy minerals, Geochemical analysis: organic carbon, CaCO_3

Unit-IV

(Research methodology in Physical Oceanography and Meteorology)

Observations on tides, currents and waves, Types of tide gauge and its working principle. Types of current meter and its working principle. Wave rider bouy and its working principle. Conductivity, temperature and depth (CTD) meter and its working principle. Littoral Environmental Observation (LEO), Shoreline mapping through different methods/ Instruments. Beach profile measurements: methods and instruments.

Methods for measurement of surface weather parameters and the required instruments and their working principles. Methods of upper air measurements using different instruments and their working principles, Synoptic Chart for interpretation of weather conditions.

Unit-V

(Research methodology in Remote Sensing)

Field Survey: The need for field survey, Planning field surveys, The need for accuracy assessment: Classification Accuracy and Kappa statistics; Satellite data acquisition, In situ data collection using GPS/DGPS, Hyperspectral Underwater Radiometer, AOT measurement using Microtops Sun Photometer, Laboratory Determination of Chlorophyll, Total Suspended Matter (TSM), Coloured Dissolved Organic Matter (CDOM) and study of their absorption spectra, Geometric and Radiometric correction of satellite data, validation of satellite data with in situ data

Semester I (16 Credit)

Core Course- 2

Advanced level courses in the subject concern

(Remote Sensing Applications in Oceanography)

Multispectral and Hyperspectral remote sensing principles, Spectral signatures of minerals, rocks, soils, vegetation and water. Remote Sensing Application to Coastal Zone management; Passive Remote Sensing of ocean colour and development of Bio-optical algorithms; Understanding of high resolution satellite data, analysis and interpretation, Image classification methods and classification accuracy.

Semester I (16 Credit)

Core Course 3

Literature Review and Seminar Presentation

Review of Literature : Meaning, Significance and techniques of Reviewing the literature for the specific topic/research paper

Development guidelines for review of literatures

Selecting five Research Papers of any topic of Marine Sciences and reviewing all

Preparation of a Scientific Report based on review of papers and to make presentation in PPT

Semester I (16 credits)

Core Elective

Elective course related to research

(Out of the two core elective courses a student shall chose either Core Elective-I or Core Elective-II depending on her/his specialization at M.Sc. level.)

Core Elective-I

Advances in Chemical and Geological Oceanography

Unit I

Dissolved gases in sea water: Dissolved Oxygen, Dissolved Carbon Dioxide; Nutrients, Organic Carbon and the Carbon Cycle in sea water: Nutrients and primary production in sea water, distribution of nutrients in the oceans, primary production (plankton and limitations); Organic matter in the sea: source, distribution and composition of POM and DOM; Toxins and bioactive compounds in the marine environment: Origin and Sources of Biodynamic Compounds, Diversity and Distribution of Biodynamic Compounds, Detection and Identification of Biodynamic Compounds

Unit II

Coastal processes and Geomorphology: Humans and the Coastal Zone, Factors influencing Coastal Morphology and Processes, Coastal erosion and protection measures, Coastal geomorphic analysis using satellite imageries with special reference to Indian Coast, Coastal lagoon: Identification of lagoon ecosystem, Biogeochemical cycles, effects of changing environmental conditions on lagoon ecology, Estuaries: source and distribution of sediments, sediment transport processes in estuaries, nutrient loading and eutrophication, carbon dioxide and methane emissions in estuaries, Sea Level Change: Recent change in sea level, Glacial Isostatic Adjustment and Relative Sea-Level Change, Quaternary Sea-Level Change

Semester I (16 credits)

Core Elective

Elective course related to research

(Out of the two core elective courses a student shall chose either Core Elective-I or Core Elective-II depending on her/his specialization at M.Sc. level.)

Core Elective-II

Advances in Physical Oceanography and Meteorology

Unit -III

Coastal currents and circulation in and around Indian seas. East India currents (EIC), Upwelling and sinking in the Arabian Sea and Bay of Bengal. Indian Ocean Dipole (IOD), El-Nino and Southern Oscillation. Salt balance in estuaries and Estuarine Circulation. Coastal erosion and protection measures.

Unit IV

Forces in the atmosphere. Momentum equation in different co- ordinate system and their scale analysis. General circulation of the atmosphere and circulation models. Indian monsoon and its variability-seasonal and intraseasonal. Climate change and its impact on extreme weather events including Tropical cyclones. Future climate projections by IPCC and possible effects at regional, national and global scales.

Semester II (16 credits)

Core Course- IV

Review of research progress

Unit I

Presentation of research proposal (overall)

Unit II

Presentation of review of literature on the dissertation topic

Unit III

Presentation on methodology and plan of research

Unit IV

Presentation of final dissertation or pre-submission of dissertation

Course of Study for M.Phil. Marine Biology Examination 2016-17

Semester I (16 credits)

- CC- 1 : Research methodology (04 credits)
- CC- 2 : Advanced level course on the subject concerned (04 credits)
- CC- 3 : Seminar presentation (Presentation with a review report based on review of 05 important published research articles of reputed journals) (04 credits)
- CE- 1 : Elective course related to research (04 credits)

Semester II (16 credits)

- CC- 4 : Review of research progress (through PowerPoint presentation) (04 credits)
- Dissertation : (12 credits)

(*CC- Core course; CE- Core elective)

Semester I (16 credits)

Core Course- 1

Research methodology

Unit I

(Statistical analysis and computer application)

Use of MS office word, MS Office excel, PowerPoint presentation,

Standard deviation, mean, median, mode, simple correlation and regress analysis, analysis of variance, one way and two way ANOVA

Unit II

(Research methodology in plankton studies)

Collection and preservation of phytoplankton, Quantitative and qualitative analysis of phytoplankton, Standing stock measurement and estimation of biomass of phytoplankton, Collection and preservation of zooplankton, Methods of qualitative and quantitative analysis of zooplankton, Standing stock measurement/biomass estimation of zooplankton

Unit III

(Research methodology in study of benthos and ecological sensitive areas)

Methods of collection of benthos from rocky, sandy and mussy shore using quadrat sampling, core sampling and net sampling, Preservation of benthos, Standing stock assessment of macro and meiofauna, Qualitative and quantitative analysis of macrofauna and meiofauna, Survey methodology for seagrass, mangrove and coral reef ecosystems

Unit IV

(Research methodology in fishery)

Methods of population size estimation of pelagic and demersal fishes, Collection, transportation and preservation of fish sample for biochemical and karyological studies, Methods of fish seed collection from natural environment, Methods of transportation of seed materials, Site selection for shrimp hatchery and hatchery management

Semester I (16 credits)

Core Course- 2

Advanced level courses in subject concern

Unit I

(Plankton and productivity)

Distribution of plankton on spatio-temporal scale, Vertical migration of zooplankton, Factors affecting distribution of plankton, Concept of primary and secondary production, Methods of estimation of primary productivity, Productivity of Arabian sea and Bay of Bengal with reference to EEZ

Unit II

(Benthic ecology)

Distribution of benthos in EEZ of Indian seas, Factors affecting the distribution of benthos in the intertidal region and deep sea, Adaptation of deep sea benthos

Unit III

(Fisheries and fishery technology)

Major fisheries of the world, Riverine, estuarine, lacustrine and marine fishery resources of India, Status of capture fisheries from Indian seas, Marine and estuarine fishery potential of Odisha coast, Impact of climate change on marine fisheries, Types of craft and gears used in India, Fish handling, fish processing and value added products, Fish marketing and role of cooperatives in fish marketing

Unit IV

(Advances in aquaculture)

Scope of aquaculture, Status of fresh water, brackish water and mariculture in India, Criteria for selection of culture species, Farm management, Status of shrimp, crab, oyster and ornamental fish culture in India, Aquaculture and pollution, Role of induced breeding in aquaculture, Hatchery development and management with special reference to *Penaeus vannamei* and Scampi (Giant fresh water prawn)

Semester I (16 credits)

Core Course- 3

Literature review and seminar presentation

Review of literature: meaning, significance and techniques of reviewing the literature for the specific topic/research paper.

Developing guidelines for review of literatures.

Selecting five research papers on any topic of marine sciences/marine biology and reviewing all.

Preparing a report on the review papers based on at least 05 research papers and presentation through PPT

Semester I (16 credits)

Core Elective- 1

Elective course related to research

Unit I

(Advances in marine ecology and pollution)

Definition, principles and scope of ecology, Structure and function of ecosystems, Abiotic and biotic components, energy flow, food chain, food web, ecological pyramids

Unit II

(Biodiversity and conservation)

Definition, Hotspots of biodiversity, strategies for biodiversity conservation, Factors responsible for depletion of marine natural resources

Unit III

(Marine pollution)

Water pollution, Sewage and waste water treatment and recycling, Water quality standards, Sources of marine pollution and its control, Criteria employed for disposal of pollutants into marine ecosystems: Domestic sewage, industrial wastes, thermal wastes, agriculture wastes, oil pollution, radioactive wastes, heavy metal pollution, Pollution and its effects on marine organisms

Unit IV

(Waste management)

Sources and generation of solid waste, their characterization, chemical composition and classification, Different methods of disposal and management of solid wastes- recycling of waste materials, Waste minimization technologies, Eutrophication and restoration of lakes

Semester II (16 credits)

Core Course- IV

Review of research progress

Unit I

Presentation of research proposal (overall)

Unit II

Presentation of review of literature on the dissertation topic

Unit III

Presentation on methodology and plan of research

Unit IV

Presentation of final dissertation or pre-submission of dissertation

Dissertation

Suggested References

Sl. No.	Name of Book	Author (S)
1.	Numerical Prediction and Dynamical Meteorology	G. J. Haltiner and R. T. Williams
2.	An Introduction to Dynamic Meteorology	J. R. Holton
3.	Introduction to Theoretical Meteorology	S.L. Hess
4.	Weather analysis and Forecasting	S. Peterson
5.	Monsoons	J. S. Fein & P. L. Stephens (Eds)
6.	Regional Oceanography: An introduction	M. Tomczak & J.S. Godfrey
7.	Data analysis methods in Physical Oceanography	William J. Emery and Richard E. Thomson
8.	Predictability of Monsoons: Monsoon Dynamics	Charmey, J. G and J. Shukla
9.	Global Climate	X. Rodo and F. A. Comin
10.	Remote Sensing and image interpretation	T. M. Lillesand and R. W. Keifer
11.	Satellite Oceanography an introduction for Oceanographers and remote sensing scientist	I.S. Robinson
12.	Methods of Satellite Oceanography	R. H. Stewart
13.	Regional Oceanography	Mathias Tomczak
14.	Physical Oceanography of coastal waters	K. F. Bowden
15.	Advanced series on ocean Engineering Vol-1: The applied dynamics of ocean surface waves by	R. G. Deam & R. A. Dalrymple

	change Vol-2 : Water wave mechanics for engineers and scientist	
16.	Estuary and Coasts	M. C. Graw Hall
17.	Beach Process & Sedimentation	P. Komar
18.	Hand book of Coastal and Ocean Engineering	Y. C. Kim
19.	Coastal Process	T Shibayama
20.	Surface Meteorological instruments and measurements practices	G. P. Srivastav
21.	Marine chemistry and geochemistry	Kark K. Turekain
22.	Principals of geographical information systems	Peter A. Burrough and Rachael A. Mc Donnell
23.	Climate and Development	H.J. Karpe, D. Otten, S.C. Trinidade (Eds)
24.	The Indian Ocean Tsunami	Tad S. Murty, U. Aswathanarayana, N. Nirupama
25.	Earth System Analysis	H. J. Achellnhuber and V. Wenzel (Eds)
26.	Foundations of geographic Information Science	Duckham Matt et al.
27.	Indian Ocean tropical Cyclones and Climate Change	Charabi Yassine
28.	Marine Chemistry and geochemistry: A Descriptive of the Encyclopedia of ocean Sciences	Steele John H. et al.
29.	New direction of Oceanographic research and development	Nasu and Honjons
30.	Ocean circulation and climate: Observing and Modelling the global Ocean	Sieldler John H. et al.
31.	Wind Generated Ocean Waves: Vol-2	Young I. R.
32.	Numerical Methods for Engineers and scientist	R. W Hamenting
33.	Numerical Methods for Engineers and scientist	J. R. Rice
34.	User Manual GPS, DGPS and RTK-GPS	
35.	User Manual tide gauge (Directional and Non-Directional)	
36.	User Manual Wave Rider Buoy	
37.	User Manual for Current Meter	
38.	The Sea, Vol-3	R. N. Hill
39.	M. S. Office	B. P. B. Publications
40.	Fundamentals of computers	S. Jaggi and S. Jain