

M.Sc., Marine Biology (Syllabus - April 2008 Onwards)
(Semester Pattern)

Course Code	Theory / Practical	Assessment		Credit	Total Marks
		Internal	External		
I SEMESTER					
MABO 410	Physical Oceanography	40	60	4	100
MABO 411	Chemical Oceanography	40	60	4	100
MABO 412	Biological Oceanography	40	60	4	100
MABO 413	Invertebrates	40	60	4	100
MABO 451	Practical - I covering courses 410, 411, 412, 413	40	60	4	100
II SEMESTER					
MABO 415	Vertebrates	40	60	4	100
MABO 416	Marine Microbiology	40	60	4	100
MABO 417	Cell Biology	40	60	4	100
MABO 418	Biochemistry	40	60	4	100
MABO 452	Practical –II covering courses 415, 416, 417, 418	40	60	4	100
III SEMESTER					
MABO 510	Molecular Genetics	40	60	4	100
MABO 511	Marine Ecology	40	60	4	100
MABO 512	Ocean Management	40	60	4	100
MABO 513	Fishery Science	40	60	4	100
MABO 551	Practical –III covering courses 510, 511,512, 513	40	60	4	100
IV SEMESTER					
MABO 515	Pollution & Toxicology	40	60	4	100
MABO 516	Coastal Aquaculture	40	60	4	100
MABO 517	Marine Biotechnology	40	60	4	100
MABO 530	Project	Int-Viva –25 External - 75		4	100
		Total		76	1900

SEMESTER -I

MABO-410 PHYSICAL OCEANOGRAPHY

UNIT-I

16 HOURS

Introduction to Oceanography - history of oceanography- expeditions, marine biological Institutions, origin of oceans- bottom topography, abyssal hills-plains: submarine canyons- ocean trenches.

UNIT –II

5 HOURS

Physical Properties of Seawater- density, viscosity, surface tension, conductivity and their relationship, temperature distribution in the sea-heat budget, UV radiation, acoustics.

UNIT –III

12 HOURS

Dynamics of the ocean-general surface circulation - wind and thermohaline circulation. forces causing currents, boundary currents, Langmuir circulation, Geotropic currents, turbidity currents, monsoon and trade winds, Upwelling.

UNIT- IV

15 HOURS

Waves, Currents and Tides – theories of waves-tidal waves- formation of swells – internal and standing waves- storm surges – tsunami - tide generating forces- tidal currents- tidal effects in coastal areas – tide and wave energy.

UNIT-V

12 HOURS

Estuaries -origin and classification – estuarine circulations- estuarine zonation- lagoons. Sedimentation- origin and physical properties of sediments (lithogenous, biogenous and cosmogenous), distribution and transport of sediments, determination of age of sediments.

Text Books

1. Grant Gross, M., 1993 Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
2. Thurman, Harold., 2001 Introduction to Oceanography, Prentice Hall Inc. New Jersey.
3. Steve Neshya, 1987. Oceanography perspective on a fluid earth. John Wiley & Sons, New Jersey.
4. Qasim, S.Z. 1999. The Indian Ocean, Images and realities. Oxford and IBH.

Reference Books

5. Sverdrup, H.U., M.W. Johnson and R.H. Fleming, 1958. The Oceans- their Physics, Chemistry and General Biology, Prentice- Hall Inc. New Jersey.
6. Pickard, G.L. and W.J. Emery 1995. Descriptive Physical Oceanography. Pergamon Press, London.
7. David A. Ross, 1977. Introduction of Oceanography. Prentice Hall Inc. New Jersey.

MABO-411 CHEMICAL OCEANOGRAPHY

UNIT-I

10 HOURS

Introduction to marine chemistry- ocean as a chemical system - origin of sea salts- properties of water molecules differences between fresh and seawater.

UNIT –II

13 HOURS

Chemical composition of seawater- ionic, major and minor constituents, constancy- ionic compositions and factors affecting constancy- major and minor elements, trace elements- their importance, distribution. Chemistry of seawater constituents- concept of chlorinity and salinity - methods of measurements.

UNIT –III

13 HOURS

Radio nuclides in the sea- origin, distribution and use as tracers of water masses. Dissolved Gases- carbon dioxide- origin, importance and distribution. Oxygen origin and factors governing the distribution- BOD and COD. Other Gases – nitrogen, hydrogen sulphide, methane.

UNIT-IV

14 HOURS

Nutrients- Inorganic, origin, distribution and important role in the fertility of the sea. Nitrogen, Phosphorous and Silicon in the sea- distribution, cycling, regeneration concept- “new and regenerated” production, N: P ratio. Mineral wealth of the sea- salts, glauconite, petroleum, phospharite, manganese nodules- potential, economy of extraction. Desalination - recovery of chemicals.

UNIT- V

10 HOURS

Organic matter- dissolved, particulate and colloidal species, sources, classification, composition, distribution, seasonal variation- ecological significance- growth promoting and growth inhibiting effects – biogeochemical cycle.

Text Books

1. Pilson, M.E.Q., 1998. An Introduction to the Chemistry of the Sea Prentice Hall New Jersey.
2. Millero F. J 2002. Chemical Oceanography CRC press.
3. Grasshoff, Klaus 1999. Methods of Sea water Analysis. Wiley VCH New York

Reference Books

1. Riley, J.P. and Skirrow, 1975-1984. Chemical Oceanography Vols. 1 to 8. Academic Press, London.
2. Hill, M.N. 1963. The Sea Vols. 1 to3. Inter science Publishers, New York.
3. Strickland J.D.H and T.R Parson 1972. A Practical handbooks of seawater analysis. Fisheries Research Board of Canada, Ottawa, Bulletin 167.

MABO-412 BIOLOGICAL OCEANOGRAPHY

UNIT-I

15 HOURS

Sea as a biological environment- Plankton- classification based on size, mode of life and habitat. Phytoplankton and Zooplankton - methods of collection, estimation of standing crop-wet and dry weight estimation-plankton volume settling and displacement methods. Oxidation as carbon (as organic matter).

UNIT-II

13 HOURS

Adaptation of plankton- structural (weight, increase of surface area, flotation) physiological (specific gravity, water content, fat content, mono and divalent ions, gas, defensive vacuoles) mechanisms. Phytoplankton and Zooplankton interrelationship-microbial loop- red tide phenomenon- causes and effects.

UNIT-III

11 HOURS

Organic production- Primary and secondary productions – methods of estimation of primary production. Factors affecting primary production- regional differences in (primary and secondary) production.

UNIT-IV

11 HOURS

Seaweeds- Occurrence and distribution in India - economic importance. Life cycles of *Ulva*, *Sargassum* and *Gracilaria*. Seagrasses - morphological and anatomical adaptations – ecological role. Mangroves - distribution, adaptation, conservation and ecological role.

UNIT-V

10 HOURS

Salt marsh and sand dune vegetation -morphological, anatomical and physiological features, ecological role, uses and conservation. Biological resource assessment and management using remote sensing techniques and Geographical Information System (GIS).

Text Books

1. Sumich, J. L., 1999. Introduction to the biology of Marine Life 7th Edition. The Mc Graw Hill Companies Inc.
2. Nybakken, J. W 2001. Marine Biology – an Ecological Approach 4th edition. Addison Wesley Edu. Pub. Inc
3. Peter McRoy, C. and G. Helfferich, 1977, Seagrass Ecosystems. A scientific Perspective. Marcel Dekker Inc., New York.

Reference Books

1. Tomas, Carmelo, R. 1997. Identifying Marine Phytoplankton. Academic Press
2. Chapman, V.J. 1978. Coastal vegetation. Pergamon Press, Oxford.
3. Parsons, T.R., M. Takahashi and B. Hargrave (II Ed.), 1977. Biological Oceanography Processes. Pergamon Press Oxford.
4. Naskar, K and R. Mandal, 1999 Ecology and Biodiversity of Indian Mangroves Vol. I & II Daya Publishing House.

MABO-413 INVERTEBRATES

UNIT-I

13 HOURS

Classification - life history and phylogenetic relationship of Protozoa and Sponges.
Coelenterate - polymorphism, life history- theories of Coral reefs, distribution.
Polychaete – classification, morphology, reproduction and adaptive radiation.

UNIT –II

10 HOURS

Functional morphology, development and evolution Nemertinea, Entoprocta, Ectoprocta, Phoronida, Pogonophora.
Chaetognatha- Classification, distribution, morphology and anatomy, embryology and evolution. Brachiopoda - classification, morphology, paleontology and evolution.

UNIT –III

13 HOURS

Crustacea – classification, comparative morphology, crustacean appendages, larval forms, evolution and paleontology.

UNIT- IV

13 HOURS

Mollusca –classification, general characters with reference to bivalves, gastropods and cephalopods.

UNIT-V

11 HOURS

Echinodermata- water vascular system, - larvae, their comparative morphology and evolution. Prochordata - classification and comparative morphology, reproduction and early development, larval metamorphosis.

Text Books:

1. Meglitsch, Paul, 1991. Invertebrate Zoology. Oxford press New York.
2. Pechenick, Jan A, 2000. Biology of Invertebrates. Tata McGraw Hill.
3. Ruppert, E.E and R.D Barnes. 1994. Invertebrates Zoology. 6th Edition. Saunders College Publishers, Philadelphia.

Reference Books:

1. Kaestner, A., 1967. Invertebrate Zoology vols. I to III. Willey Interscience Publishers. New York
2. Barnes, R.D 1980 Invertebrate Zoology. 4th edition Saunders College Publishers, Philadelphia. Hyman L., 1967. The Invertebrate Zoology Vols. I to IV. McGraw Hill Books Co., New York

Deleted: .

MABO-451 PRACTICAL -I

1. Measuring Devices 1- Secchi Disc, Lux meter, Turbidity meter, Under water photometer.
2. Measuring Devices- II Current meter, Echo Sounder, Hygrometer.
3. Water and Sediment sampling devices: Nansen, Mayers, Van Dorn, Niskin and Bacteriological water samplers, Van -Veen grab - Petersen grab, Vertical gravity corer.
4. Estimation of Salinity.
5. Estimation of Dissolved Oxygen.
6. Determination of Nitrite, Nitrate and Ammonia.
7. Determination of Reactive Phosphate and Total phosphorous.
8. Determination of Silicate.
9. Identification of Phytoplankton- Diatoms, Dinoflagellates, Blue green algae and Coccolithophores.
10. Identification of Zooplankton- Copepods, Hydromedusae, Pteropods, Chaetognatha, Thaliaceae and planktonic Larvae.
11. Identification of locally available Seaweeds, Seagrasses and Mangrove plants.
12. Extraction and Estimation of Chlorophyll 'a', Primary productivity.
13. Identification of coastal invertebrate fauna.
14. Mounting of gastropod radulae.
15. Anatomy of hermit crabs, prawn, gastropod and bivalve.
16. Identification of minor phyla.

SEMESTER - II

MABO - 415 VERTEBRATES

UNIT-I

12 HOURS

Origin of chordates; geological time scale- progression of vertebrates through time, chordate features and theories on the origin of chordates.

UNIT –II

13 HOURS

Evolution of bony fishes and amphibian: characteristic features of ancestral vertebrates- classification and evolution of jawless and primitive jawed vertebrates. Evolution and adaptive radiation of elasmobranches and bony fishes.

Origin and distribution of amphibia - anatomical peculiarities and affinities of urodele and apoda.

UNIT –III

13 HOURS

Reptiles and Marine birds- origin of reptiles- adaptive radiation of contemporary reptiles, turtles, amphibian and reptilian features of *Seymouria*, - mammal like reptiles, rise and fall of dinosaurs, including Mesozoic marine reptiles- importance of coastal and marine birds.

UNIT- IV

11 HOURS

Evolution of mammals- general characters of mammals-, classification and evolution of monotremes, marsupials and placentals - aquatic mammals- classification, adaptation and evolution of cetaceans and sirenians.

Aquatic adaptation of respiratory and circulatory mechanisms- comparative anatomy of skin derivatives.

UNIT-V

11 HOURS

Developmental biology- gametogenesis, fertilization, cleavage, development upto gastrulation with special reference to *Amphioxus*. Embryology (with special reference to marine vertebrates fish, bird and mammal).

Nuclear transplantation- embryo transplantation, artificial insemination

Text Books

1. Colbert, et al., 1991. Evolution of the Vertebrates. John Willey & sons Inc., New York.
2. Minkoff, E.C., 1983 Evolutionary Biology, Addison Wesley Publishing Company, Massachusetts.
3. Schreiber, E.A Burger 2001. Biology of the Marine Birds CRC press.

Reference Books

1. Romer, A.S., 1945. Vertebrate Paleontology. University of Chicago,
2. Farland, W.N., Pouch, F.H., Cod, T. J and Heisser, J.B., 1979. Vertebrate life-- Collier McMillan International Edition. McMillan Publishing Inc. New York.
3. Howard Elliott Winn Behavior of Marine Animals: Vertebrates Publisher: Plenum Pub Cor.

MABO-416 MARINE MICROBIOLOGY

UNIT-I

13 HOURS

Ecology of coastal, shallow and deep sea microorganism - importance and their significance. Diversity of microorganism - Archaea, bacteria, cyanobacteria, algae, fungi, viruses and actinomycetes in the mangroves and coral environs.

UNIT-II

Importance of taxonomy – conventional and modern methods. General microbial techniques. Unculturable forms. 16S rRNA genomic similarity - content of guanine (G) + cytosine (C) (%GC)., DNA-DNA homology, Fatty acid analysis and genomic sequencing using Microbial identification system (GCFAME), DNA hybridization, polyphasic taxonomy.

UNIT-III

13 HOURS

Nutrient cycles- Role of microorganisms in carbon, nitrogen, phosphorous and sulphur cycles in the sea under different environments including mangroves.

UNIT-IV

12 HOURS

Food Microbiology- pathogenic microorganisms, distribution, indicator organisms prevention and control of water pollution, quality standards, International and National standards. Microbiology of processed finfish and shellfish products. Microbial diseases – diagnosis and control.

UNIT-V

11 HOURS

Microbial biodegradation - natural and synthetic material in the marine environment- pesticide, cellulose degradation, hydrocarbon production. Bioremediation of xenobiotics – oil, heavy metals, pesticides, plastics, etc. Mining and metal biotechnology.

Text books

1. Austin, B, and D.A Austin 1999. Bacterial Fish pathogens- Diseases of Farmed and Wild Fish. Springer Publisher.
2. John Paul 1999. Marine Microbiology, Elsevier.
3. Munn and Munn 1996. Marine Microbiology: Ecology and Applications. BIOS Scientific publisher.
4. Atlas, R.M 1988. Microbiology, Fundamentals and applications Maxwell McMillan International Editions

Reference Books

1. Rheinheimer, G., 1980 Aquatic Microbiology-an Ecological Approach. Blackwell Scientific Publications
2. Kirchman, L Microbial Ecology of the Oceans 2000 John Wiley and Sons. Hans G. Truper et. al 1991.
3. The Prokaryotes: 1992 A Handbook on the biology of Bacteria. Vol. 1-4 Springer & Verlag New York

MABO-417 CELL BIOLOGY

UNIT-I

12 HOURS

Introduction to Cell, Prokaryotic & Eukaryotic, their characteristics cell wall, composition, function. Plasma membrane, structure, function, fluid mosaic, model, membranes, lipids and protein transport across the membranes- passive, active; phagocytosis, endocytosis, role of clatherin coated vesicles.

UNIT –II

12 HOURS

Endoplasmic Reticulum, golgi complex – exocytosis Lysosomes: phagocytosis, endocytosis; Plant cell vacuoles. Structure of mitochondria and organization of respiratory chain; structure of chloroplast and photophosphorylation; structure of nucleus- nucleolus, nuclear membrane, transport across nuclear membrane.

UNIT –III

12 HOURS

Molecular aspects of cell division and cell cycle, regulation of cell cycle events, apoptosis, necrosis. Water, inorganic, organic constituents of cell minerals, polysaccharides, proteins lipids, nucleic acids, vitamins, enzymes and their functions

UNIT- IV

11 HOURS

Extracellular Matrix, collagen, proteoglycans, fibronectin, laminins, integrins, selectin, cadherins, role of tight junctions and gap junctions, role of G- proteins coupled receptors, cAMP, tyrosine kinase in cell signal transductions.

UNIT-V

13 HOURS

Study of Cells using microscopes (light, phase dark field, fluorescence, polarization and electron microscope). Modern trends in cell biology- cellular inclusions at ultra structural level, cell divisions, cell and tissue culture.

Text Books

1. B. Alberts, D. Bray, J. Lewis, K. Roberts and J.D. Watson, 1996. Molecular Biology of the cell. Garland Publishing Inc., New York,
2. Sheller, D.E. Bianchi, 2002. Cell and Molecular biology

Reference Books

1. De Robertis E.D.P. and E.M.F. De Robertis, 1996 Cell and Molecular Biology, B.I Waverly Pvt. Ltd New Delhi.
2. Thorpe N.O. 1984. Cell biology, John Wiley & Sons, New York.

MABO-418 BIOCHEMISTRY

UNIT-I

10 HOURS

Biochemical basis of life. Significance of macromolecules and micromolecules – carbohydrates, proteins, lipids and nucleic acids.

UNIT-II

12 HOURS

Chemistry of carbohydrates and their metabolism- structure and functions of monosaccharides, oligosaccharides and polysaccharides- glycolysis, citric acid cycle, HMP pathway, gluconeogenesis, glycogen synthesis and glycogenolysis.

UNIT- III

12 HOURS

Classification and chemistry of lipids: structure and functions of triglycerides, phospholipids, glycolipids, significance of PUFA. Metabolism of fatty acids.

UNIT-IV

16 HOURS

Classification of Proteins and their functions- structure of proteins, essential and nonessential amino acids - chemistry, catabolism, urea cycle, biosynthesis of essential amino acids. Biocatalysts- enzymes- nomenclature, classifications, kinetics and mechanism of action allosteric enzymes, isoenzymes, lysozymes, co-enzymes, cofactors catalytic RNA.

UNIT-V

10 HOURS

Biochemical methods – filtration, centrifugation, sedimentation, solvent extraction, aqueous two phase system, sorption, precipitation, chromatography (ion exchange, size exclusion, affinity, adsorption, hydrophobic interaction, TLC, GLC, HPLC) – Spectrophotometric technique – UV, VISIBLE, IR, NMR, MASS.

Text Books

1. Lehninger, et al 2001. Principles of Biochemistry. Macmillan New Delhi.
2. Robert et al 2000. Harper's Review of Biochemistry. McGraw Hill
3. Plummer David 2003. Introduction to Practical Biochemistry

Reference Books

1. Geoffery Zubey-1983. Biochemistry -Addison Wesley,
2. Berg ,J. M, J.L Tymoczko & Styrrer, 2002. Biochemistry. W.H .Freeman & Co.
3. Voet and Voet, 1995. Biochemistry. John Wiley and Sons.

MABO-452 PRACTICAL-II

1. Functional morphology of respiratory organs of aquatic animals- gills of shark, mullet and mudskipper.
2. Functional morphology of integument and its derivative in different groups (skin, scale, etc).
3. Preparation of bacterial media- culture- nutrient broth, agar medium, agar slants.
4. Methods of sample collection from marine environments; estimation of bacterial, fungal and actinomycte population.
5. Isolation of pathogenic organisms from seafood water and sediment..
6. Identification of unknown bacteria- separation of mixed cultures.
7. Isolation, maintenance and preservation of pure cultures
8. Characterization- biochemical tests-. staining of bacteria, cell morphology.
9. Qualitative analysis of carbohydrates- reduction of monosaccharide, reducing and non reducing sugars, pentose, aldoses and ketoses.
10. Estimation of carbohydrates.
11. Estimation of proteins.
12. Estimation of lipids.
13. Estimation of Amino Acids.
14. Isolation of DNA from Fishes.
15. Preparation of mitochondria.
16. Preparation of chloroplasts and nuclei from any tissue and assay for their activity.

SEMESTER - III

MABO 510- MOLECULAR GENETICS

UNIT-I

10 HOURS

Evidence of DNA as genetic material- gene as a unit of mutation and recombination. Molecular nature of the gene, organization of prokaryotic and eukaryotic genomes- replication of DNA- role of different enzymes and accessory proteins in prokaryotic and eukaryotic DNA replication.

UNIT –II

11 HOURS

DNA Replication: conservative, semi conservative, rolling circle, Cairn's model of replication. mechanism of replications: okazaki fragments, role of different enzymes and accessory proteins. Specific examples of replication – single stranded phage, double stranded, SV40, ϕ 174.

UNIT –III

11 HOURS

Mutation and Mutagenesis- mechanism of mutation – spontaneous mutations, Induced mutations, reverse mutations, suppressor mutations, chemical mutagenesis by nitrous acid, hydroxylamine, alkylating agents, intercalaters- physical mutation by UV. Mechanism of DNA repairs process- Photo reactivation, excision repair, recombination repair, sos pair mechanism and their regulation- heat shock response.

UNIT- IV

14 HOURS

Genetics of Bacteria and Viruses- Transformation, Conjugation- F + Hfr, transduction- generalized and specialized. Gene expression- DNA transcription in prokaryotic and eukaryotic system and its regulation- Types of RNA and their functions- translation- relation between genes and proteins- co linearity of the gene and polypeptide, elucidation of genetic code, wobble base pairing, suppression of nonsense, missense and frameshift mutations, overlapping genes.

UNIT-V

14 HOURS

Regulation of Gene Expression- prokaryotes- operon concept- positive, negative and as attenuation control- control sequences- promotor, operator, terminator and attenuator, lac and trp operons and translational regulation model. Eukaryotes – regulation at the level of transcription- role of transcriptional factors, regulation of allosteric enzymes. Cloning gene mapping sequencing chromosomal mapping

Text Books

1. David Friefeilder et .al 1999. Basic Genetics. Narosa Publishing company.
2. David Friefeilder et al 1998. Molecular Biology. Narosa Publishing Company
3. Freiefelder's , Essentials of Molecular Biology 2000. Narosa Publishing House.

Reference Books

1. Watson et. al 1999 Molecular Biology of the Gene Volume I & II. Benjamin Cummings Publishing Company.
2. Old, R.W and S.B. Primrose 1988. Principles of gene Manipulation- an Introduction to genetic engineering Blackwell science.

MABO-511 MARINE ECOLOGY

UNIT-I

14 HOURS

Marine environment – ecological factors – light, temperature, salinity, pressure. Classification of marine environment – pelagic environment, planktonic and nektonic adaptations, benthic environment – intertidal, interstitial and deepsea adaptation. Other coastal environments – coral reefs, estuaries, mangroves, seagrass beds, kelp forests, polar seas and hydrothermal vents.

UNIT –II

12 HOURS

Animal association in marine environment- endoecism, inquilinism- phoresis-epizoism - mutualism- communalism- symbiosis- parasitism. Marine zoogeography with reference to Indian Arctic and Antarctic Oceans.

UNIT- III

12 HOURS

Population Ecology- group attributes, population growth, density variations, concept of carrying capacity. Dispersal, prey-predator relationship- density dependant- density independent factors.

UNIT –IV

12 HOURS

Structure and composition, diversity and stability, concept of niche, succession, community wise adaptation, e.g. fouling and boring community.

UNIT-V

10 HOURS

Marine Ecosystems – concepts- principal components- marine food chains-trophic structure – food web- ecological pyramids- energy flow- evolution and management- system ecology and modeling.

Text Books

1. Barnes R. S. K , 1999, Introduction to Marine Ecology, Blackwell Science.
2. Jeffery S. Levinton 2000 Marine Ecology, Biodiversity and Function. Oxford University Press.
3. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology Sinauer Associates.

Reference Books

1. Gage. J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press, Cambridge.
2. Balakrishna Nair, N. and D.M. Thampy, 1980 A text Book of Marine Ecology, The Macmillan Co. of India Ltd., New Delhi.
3. Crowder, 1991 William Seashore Life Between the Tides, Dover Publication

MABO-512 OCEAN MANAGEMENT

UNIT-I

05 HOURS

Scientific Expeditions for ascertaining the wealth of the sea. The three-major Oceans- their relative importance. Historical evolution of ideas on Ocean as a common heritage of mankind.

UNIT –II

17 HOURS

Evolving the Law of the Sea. - Geneva Conventions- UNCLOS series- The Exclusive Economic Zone- its significance- comparative survey of specific issues- North Sea Oil, Gas and Fishery- George Bank- Bombay High- Importance of strategic straits.

UNIT –III

13 HOURS

The Regional Seas Programme of UN- their global significance- Antarctic treaty and its importance- Endangered marine animals- CITES Convention- marine biosphere reserves- marine Parks.

UNIT- IV

10 HOURS

Beach Sand Mineral deposits with special reference to India- marine metalliferous mud and placer deposits. Scientific economic and geo- political aspects of seabed exploration and mining- Seabed treaty. Coastal Zone – importance- changes due to development- Coastal management issues- Comparison between temperate and tropical countries- Coastal Zone management –integrated management, policies and programmes.

UNIT-V

15 HOURS

Role of National and international agencies and organizations in ocean management- FAO, UNEP, DOD, WOCE, WHOI, IOI –Malta, IMO – INMARSAT- IUCN, SCAR, SCOR, Marpol, Traffic. Ocean policy (India) - research and management.

Text Books

1. Stanislav Patin 1996 Environmental Impact of the Offshore Oil and Gas Industry. Ecomonitor Pub.
2. Roonwal, G.D. (Ed.) 1986. The Indian Ocean exploited mineral and petroleum resources, Springer Verlag, Berlin.

Reference Books

1. Borgeses, E.M and N. Ginsburg, (Eds.) 1978. Ocean Year Books- 1 & 2. The University of Chicago Press, Chicago
2. Juda, L.1998. International Law and Ocean Use Management: The Evolution of Ocean Governance. Routledge.

MABO-513 FISHERY SCIENCE

UNIT-I

05 HOURS

General Morphology and outline classification of fishes - major groups of fishes of the world and their characteristics – Identification of fishes of Andaman & Nicobar Islands.

UNIT –II

12 HOURS

Basic Anatomy of fish- digestive, circulatory, respiratory, nervous and reproductive systems. Maturation and spawning marine fishes- process of maturation- methods of assessment of spawning- biotic and abiotic factors affecting spawning in fishes.

UNIT- III

13 HOURS

Population Dynamics- theory of fishing- unit stock- recruitment- mortality. Migration- fish tagging and marking. Marine fisheries of India- methods of fishery resources survey- acoustic method, survey of fish eggs and larvae, analyzing population features

UNIT-VI

10 HOURS

Principle methods of exploitation of marine fishes- indigenous and modern crafts and gears. Principle methods of fish preservation and processing in India- freezing, canning, pickling, smoking - types of fish spoilage- causative factors.

UNIT –V

20 HOURS

Collection and analysis of biological data – mean, median, mode, standard deviation, standard error, coefficient of variation, student ‘t’ test, skewness, kurtosis, chi – square, correlation regression and analysis of variance.

Text Books

1. Peter B. Moyle, Joseph J. Cech 1990 Fishes: An Introduction to Ichthyology, Prentice Hall.
2. Carl E. Bond 1979 Biology of Fishes. W.B. Saunders Company, Philadelphia. York.
3. Bensam, P., 1999 Development of Marine Fisheries Science in India. Daya Publishing House.

Reference Books

1. Simpson G.G.A. Roe & R.C. Lewontin 1966 Quantitative Zoology. Harcourt Brace and Company, New
2. Bal. D.V and K.V Rao 1990. Marine Fisheries of India Tata Mcgraw Hill Pub Co.
3. Biswas K.P 1996. A textbook of Fish, Fisheries and Technology 2nd Edition Narendra Publishing House New Delhi.

MABO-551 PRACTICAL - III

1. Isolation and purification of DNA/RNA.
2. Isolation of mutant using chemical and UV radiation.
3. Interstitial fauna and meiofauna -Methods of collection and sorting.
4. Rocky shore fauna- Methods of collection and sorting.
5. Sandy shore fauna- Methods of collection and sorting.
6. Population analysis of *Cerithidea cingulata* and *Uca sp.*
7. Pelagic and Benthic fauna identifications.
8. Field trip to study animal communities in different biotopes- mudflat, sandy and rocky shore, mangrove, oyster bed, fouling organisms, symbionts, parasites, commensals, phytal fauna.
9. Identification of common fin and shell fishes of Andaman waters
10. Study on the external morphology of fishes.
11. Collection of biological data and analysis using computers.
12. Collection of data on fishery resources.

SEMESTER - IV

MABO-515 POLLUTION & TOXICOLOGY

UNIT-I

10 HOURS

Marine Pollution-definition- role of GESAMP- major pollutant- sources, transport path, dynamics. Toxicology- lethal and sub lethal effects of pollutants to marine organisms- bioconcentration, bioaccumulation and biomagnifications- methods of toxicity testing- factors influencing toxicity- synergistic and antagonistic effects- role of microcosms and mesocosms.

UNIT –II

12 HOURS

Sewage pollution – industrial, agricultural and domestic – impact on marine environment, treatment methods. Detergents- composition- eutrophication and ecological significance- Plastics and Litter source and impact in the marine environment.

UNIT –III

14 HOURS

Heavy Metal pollution- sources, distribution, fate- analytical approaches; Pesticide pollution – classification, sources, distribution, fate and ecological impacts with special reference to marine fishes, birds and mammals.

UNIT- IV

12 HOURS

Oil Pollution- composition, sources, biological impacts on fishes, birds, mammals, . treatment techniques. Thermal pollution- sources - uses of waste heat – role of biocides, chlorine – ecological impacts. Radioactive pollution- sources (natural and artificial) – biological effects of radiation.

UNIT-V

12 HOURS

Environmental monitoring methods for critical pollutants-objectives status limitations- biological indicators - natural bioaccumulations (mussel watch – water quality assessment. Use of analytical instruments AAS, ICP, GLC, Spectrofluorometer for analyzing Petroleum hydrocarbon, Pesticides, Heavy metals etc.

Text Books

1. Clark R.B 1992. Marine pollution 3rd edition Clarendon, Press Oxford.
2. Williams 1996. Introduction to Marine Pollution Control. John Wiley.
3. Michael J. Kennish 1994. Practical Handbook on Estuarine and Marine Pollution.

Reference Books

1. Johnston, R. (ed), 1976. Marine Pollution, Academic Press, London.
2. Goldberg, E. D. 1974. The Health of the oceans, UNESCO Press. Paris.
3. Park, P .K, Kester D.R., J.W. Deudall and B.H Ketchum, 1983. Wastes in the Ocean. Vols. 1 to 3. Wiley Interscience Publishers, New York.

MBAO- 516 COASTAL AQUACULTURE

UNIT-I

11 HOURS

Overview – importance of aquaculture, global scenario, present status in India - prospects and scope.

UNIT –II

11 HOURS

Aqua-farming systems traditional, extensive, semi-intensive and intensive; selection of site: topography, water availability and supply, soil conditions, design and layout, structure and construction.

UNIT –III

13 HOURS

Cultivable Species- Seaweeds- (*Gracilaria*, *Gelidiella*, *Kappaphycus*) Finfishes – (Asian sea bass, groupers, pearl spot, mullets, milkfish and ornamental fishes). Shellfishes – (shrimps, crabs, lobsters, mussels, edible oysters, pearl oysters, clams).

UNIT- IV

13 HOURS

Culture techniques - monoculture, polyculture - pond, raceway, cages, pens, raft and rope culture. Hatchery seed production techniques- breeding, hatchery and nursery phases.

UNIT-V

12 HOURS

Management Practices - farm conditioning- feed and feeding methods- culture of live feed organisms diatoms- brine shrimp, rotifers, - bioenvironmental monitoring- harvesting- control of predators, parasites and diseases - Best management practices in shrimp farming.

Text Books

1. Pillay, T.V.R .1990. Aquaculture Principles & Practices. Fishing News (Books) Limited, London.
2. Santhanam R. N. Ramanathan and G. Jegatheesan 1990. Coastal Aquaculture in India, CBS publishers and Distributors.
3. Joachim W., Hertrampf and F.P Pascal, 2000 Handbook on Ingredients for Aquaculture feeds. Kluwer Academic Publishers, London

Reference Books

1. Bardach, John.E. 1997 Sustainable Aquaculture. John Wiley and Sons.
2. Chapman, V.J., 1980. Seaweeds and their uses Chapman and Hall London.
3. Wheaton, F.W. 1977. Aquaculture Engineering. John Wiley and Sons, New York.
4. Stickney, 1995. Principles of Aquaculture, John Wiley & Sons.

MBAO- 517 MARINE BIOTECHNOLOGY

UNIT-I

12 HOURS

Biotechnology in marine science- history of marine biotechnology – application in aquaculture, pharmaceutical, environment remediation, biofouling and biocorrosion.

UNIT –II

14 HOURS

Developmental biotechnology – induced breeding – in-vitro fertilization – cryo preservation – biotechnological tools - ELISA, FISH, PCR Gene probes, dot immuno binding activity, monoclonal antibodies – biosafety ethics.

UNIT-III

12 HOURS

Bioactive marine natural products – membrane receptors, anti tumor compounds, anti inflammatory / analgesic compounds, anti viral agents, isolation and identification of marine bioactive compounds such as labile proteins, toxins, carotenoids – bioterminator – Commercial development of marine natural products- chitosan, chitin.

UNIT-IV

11 HOURS

Algal biotechnology – single cell protein, hydrocolloids, agarose, carrageen alginates and other by products. Marine Enzymes – sources and their applications – Marine Lipids sources and their applications.

UNIT-V

11 HOURS

Bioinformatics –introduction to computers, Internet and bioinformatics, Bioinformatics servers- (European Bioinformatics Institute, National Centre for Biotechnological Information, DNA Data Bank of Japan), DNA sequence & structural analyses, Basic Logical Alignment Tool, DNA sequence alignment and phylogeny, protein structural analysis, 3D Molecular Visualiser, drug designing.

Text Books

1. Italy, E (Eds). 1998, New Developments in Marine Biotechnology, Plenum Pub. Corp.
2. Milton Fingerman and Rachakonda Nagabhushanam, 1996, Molecular Genetics of Marine Organisms, Science Pub Inc.
3. Y. Le Gal and H.O.Halvorson 1998, New Developments in Marine Biotechnology. Springer.

Reference Books

1. David H. Attaway, 2001. Marine Biotechnology, Volume 1, Pharmaceutical and Bioactive Natural Products.
2. Rita R. Colwell 1984. Biotechnology in the Marine Sciences (Advances in Marine Science & Biotechnology) Wiley Interscience.
3. Scheupr, P.J. (Ed.), 1984. Chemistry of Marine Natural Products, Chemical and Biological Perspectives. Vol. I – III, Academic Press, New York.

MBAO- 530 PROJECT

Each student will be under a Faculty member and the students will put in 80 hours of field oriented research work which mainly consists of visiting to the field for sample collection and analyzing in the laboratory. Data collected is compiled and submitted as a dissertation to the Department. During Viva Voce the student has to present his work to the panel of examiners. The dissertation is sent to experts for evaluation.

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