## ALLIED PAPERS OFFERED FOR OTHER DEPARTMENT STUDENTS

| Course Code | Allied-IA | T/P | C | H/W |
|---|---|---|---|---|
| 23BMBA1 | **FUNDAMENTALS OF MARINE BIOLOGY** | **T** | **3** | **3** |
| Objectives | ➢ To study the physical and chemical properties of seawater.<br>➢ To understand the community ecology of marine environment. | | | |
| **Unit - I** | Introduction to marine biology - definition, recent developments in marine sciences – Ocean expeditions- sea bottom topography and zonation. | | | |
| **Unit – II** | Physical properties of water and seawater – temperature, density, viscosity, surface tension, hydrostatic pressure. Waves: types of waves and its dynamics. Tides: types and tide generating force. Winds. Currents and its types. | | | |
| **Unit – III** | Chemical properties of seawater: Basics of chlorinity and salinity, Dissolved gases and their types. Elements-major and minor elements in seawater. Dissolved and Particulate organic matter-Biogeochemical cycles and their significance. | | | |
| **Unit – IV** | Biological properties of seawater: Primary and Secondary Productivity in coastal and marine environment. Phytoplankton and Zooplankton and their significance. | | | |
| **Unit – V** | Community ecology – sea surface and bottom-coral reef- seagrass, mangrove and inter tidal regions. | | | |

**References and Textbooks**


Naskar, K., & Mandal, R. (1999). *Ecology and Biodiversity of Indian Mangroves* (Vols. 1-2). Daya Publishing House.

Nybakken, J. W., & Mark, D. Bertness. (2004). *Marine Biology an Ecological Approach* (6th ed.). Benjamin-Cummings Pub Co.

Peter McRoy, C., & Helterich, G. (1977). *Seagrass Ecosystem: A Scientific Perspective*. New York: Marcel Dekker Inc.

Peter, C., & Michel, E. H. (2013). *Marine Biology* (9th ed.). McGraw-Hill Education.

Spoel. S. Vander, & Heyman, R. P. (1983). *Comparative atlas of Zooplankton biological patterns in the oceans*. Springer-Verlag Berlin.

Sumich, J. L. (1999*). Introduction to the biology of Marine Life* (7th ed.). The Mc Graw Hill Companies Inc.

Sverdrup, H. U., Honson, M. W., & Fleming, R. H. (1959). *The oceans their physics, chemistry and general biology*. New Jersey: Prentice-Hall Inc.


**Outcomes**

- The students gain knowledge in history of Marine biology and Oceanography features.
- The students able to know about the productivity of oceans with community ecology.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code** | **Allied Practical-IA** | **T/P** | **C** | **H/W** |
| 23BMBAP1 | **PRACTICAL** | **P** | **2** | **2** |
| **FUNDAMENTALS OF MARINE BIOLOGY** | | | | |

1. Estimation of salinity, dissolved oxygen and pH.
2. Identification of Phytoplankton and zooplankton.
3. Identification of seaweeds and seagrasses
4. Identification of fishes, molluscs and crustaceans.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code** | **Allied-IB** | **T/P** | **C** | **H/W** |
| **23BMBA2** | **MARINE RESOURCES** | **T** | **3** | **3** |

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|---|---|
| Objectives | ➢ To understand the marine non-living resources including minerals.<br>➢ To learn about marine fishery resources, drug sources.. |
| **Unit - I** | Marine Non-living resources: Distribution of different kinds of resources in Indian ocean. Preservation and conservation-Renewable and non - renewable resources and their origin. |
| **Unit – II** | Minerals in sea-types-Polymetallic nodules-exploration of seafloor minerals deposits. |
| **Unit – III** | Fisheries resources - deep-sea fisheries. Resource potential and depletion-Fish resources of Indian EEZ- fishing vessel management. Capture fisheries in India. Shell fish fishery and algal resources. |
| **Unit – IV** | Marine drugs: Definition-classification-bioactive compounds from seaweeds, actinomycetes, sponges, tunicates, molluscs and fishes. |
| **Unit – V** | Marine biotoxins and venoms: definition- classification based on their chemical structure- Source and impact. Venom-definition-source organism and their pharmacological effects. |

**References and Textbooks**


Teleki, P., Dobson, M., & Moore, R. (1987). *Marine Minerals*. Reidel Publishing Company.

Thompson, M., Sarojini, R., & Nagabushanam, R. (1991). *Bioactive Compounds from Marine Organisms*. Oxford & IBH Publishing Co. Pvt. Ltd.

Yadav, B. N. (1997). *Fish & Fisheries*. Daya Publishing House.Gautam, A. (1998). *Conservation & Management of Aquatic Resources*. Daya Publishing House.

Madhu, M., Jakhar, P., & Adhikary, P. (2013). *Natural Resource Conservation*. Satish Serial Publishing House.

Singh, R. (2013). *Fishery Resources*. Pearl Books Publishing.


**Outcomes**

- The students able to understand the marine minerals and non-living resources.
- The students acquire knowledge about marine living resources and drugs from the ocean.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code** | **Allied Practical-IB** | **T/P** | **C** | **H/W** |
| **23BMBAP2** | **PRACTICAL** | **P** | **2** | **2** |

**MARINE RESOURCES**

1. Identification of seaweeds.
2. Identification of Venomous marine molluscs, sponges and Tunicates.
3. Identification of fishing gear and crafts.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code** | **Allied-IIA** | **T/P** | **C** | **H/W** |
| **23BMBA3** | **MARINE POLLUTION** | **T** | **3** | **3** |

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| Objectives | ➢ To understand about different kinds of marine pollutants and their origin.<br>➢ To know thermal, pesticide and heavy metal pollution. |
| **Unit I** | **Marine Pollution** - Definition, pollutant and its classification. Organic wastes –. Origin and transport of organic pollutants to the oceans. Physical, chemical and biological effect of pollutants on marine organisms. |
| **Unit II** | **Sewage Pollution** - Definition, sources, nature and their treatment processes-wastes from river run off, agricultural, paper, fertilizer, pulp and soap manufacturing industries. Micro and macro plastic pollution: source and effects. |
| **Unit III** | **Thermal Pollution**- Status of thermal pollution in major oceansd and seas.<br>**Oil Pollution** – types and properties of oil and fate of spilled oil on the marine environment - consequences and treatments. |
| **Unit IV** | **Pesticide pollution** -sources, fate in the sea, factors affecting the bioaccumulation of pesticides, Impact of pesticides on the Environment- |
| **Unit V** | Heavy metal Pollution - Sources, classification and effects of marine and coastal waters . Distribution- toxicity and disease -Minamata and Itai itai. Red tide and its ecological significance. Indicator organism - Macro algae, crustaceans and molluscs- GESAMP. |

**References and Textbooks**


Aaradhana, S. (2018). *Marine, Nuclear and Thermal Pollution*. Jnanada Prakashan (P&D).

Andres, H. A., & Jorge, E. (2017). *Marine Pollution and Climate Change*. Taylor & Francis Group.

Clark, R. B. (1989). *Marine pollution*. Oxford, New York: Clarendon Press.

Coffield, R. L. (2019). *Saving Our Oceans*. Moonlight Mesa Associates.

Judith S. Weis (2015). *Marine Pollution*. Oxward University Press.

Park, P. K., Kester, D. R., Deudall, J. W. & Ketchum, B. H. (1983).*Wastes in the Ocean*. (Vols. 1-3). New York: Wiley Interscience Publishers.

Ricardo, B. (2018). *Marine Pollution: Sources, Fate and Effects of Pollutants in Coastal Ecosystem*. Elsevier.

Singh, P. (1995). *Environmental Pollution and Management*. Chugh Publications.


**Outcomes**

- Students acquire knowledge about marine pollution and their types and effects.
- The students will be able to understand about major types of pollutions such as Thermal, Pesticide and heavy metal pollution.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code 23BMBAP3** | **Allied Practical-II A** | **T/P** | **C** | **H/W** |
| | **PRACTICAL** | **P** | **2** | **2** |

**MARINE POLLUTION**

1. Estimation of BOD,
2. Enumeration of Tar balls in the coastal environment.
3. Identification of Pollution indicator organisms.
4. Estimation of macro plastic materials on the shore.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code 23BMBA4** | **Allied- IIB** | **T/P** | **C** | **H/W** |
| | **AQUARIUM FISH KEEPING** | **T** | **3** | **3** |
| Objectives | ➢ To elaborate about the importance of aquarium fishes and plants.<br>➢ To understand the aquarium design, construction and management. | | | |
| **Unit - I** | Introduction to aquarium – types of aquaria – importance of aquarium – exotic and indigenous fishes-Identification of ornamental fishes, crustaceans, molluscs and ornamental aquatic plants and their propagation methods. Status of aquarium fish culture and trade in India and world. | | | |
| **Unit – II** | Design and construction aquarium– construction of marine and fresh water aquarium-construction materials, Equipment: pumps, filters, aerator and lights. | | | |
| **Unit – III** | Care and maintenance of aquarium - criteria for selection of ornamental fishes - water quality management – Feeds and probiotics. | | | |
| **Unit – IV** | Diseases management – bacterial, fungal and viral diseases –prevention and control. | | | |
| **Unit – V** | Hatchery production – farm and hatchery design and construction - Brooder management. Breeding-Ornamental Fishes, invertebrates and plants -Genetics and Biotechnological application in aquarium fish production-packaging and transport. | | | |

**References and Textbooks**


Anderson, C. (2009).*Reef fishes of the Maldives*. Republic of Maldives: Manta Marine Pvt Ltd.

Boyd, C., & Tucker, C. (1998). *Pond Aquaculture: Water Quality Management*. Springer International Publishing.

Coche, A. G., & Muir, J. F. (1992). *Pond Construction*. Daya Publishing House.

Coleman, N. (2000). *Marine life of the Maldives* (Atoll Editions). Sea Challengers.

Dash, M. C., & Patnaik, P. N. (1994). *Brackish Water Prawn Culture*. Palani Paramount Publications.

Gupta, S., Mohapatra, B., & Routray, P. (2008). *Textbook of Breeding and Hatchery Management of Carps*. Narendra Publishing House.

Thomas, P. C., Rath, S., & Mohapatra, K. D. (2013). *Breeding and Seed Production of Finfish and Shellfish*. Daya Publishing House.


**Outcomes**

- The students gain knowledge in aquarium construction and management.
- The students will learn about breeding and hatchery production of aquarium fishers.

| SEMESTER | | | | |
|---|---|---|---|---|
| **Course Code** | **Allied Practical –II B** | **T/P** | **C** | **H/W** |
| **23BMBAP4** | **PRACTICAL** | **P** | **2** | **2** |

**AQUARIUM FISH KEEPING**

1. Identification of ornamental plants.
2. Identification of ornamental molluscs, crustaceans and fin fishes.
3. Estimation of dissolved oxygen, pH and salinity.