

# **Post Graduate Diploma Course in Ocean Sciences and Underwater Technology**

- 1. Objective of the Course:** To acquaint the students with the concepts of ocean environment, man and machine underwater, seafloor issues, marine resources and technology, ocean resources, salvaging and decommissioning, underwater science and archaeology etc.
- 2. Eligibility:** Graduate in any discipline
- 3. Duration:** One Year (Part time-evening)
- 4. Fees:** Rs 15,000/- (per student)
- 5. Total Intake:** 20 students
- 6. Medium of Instruction:** English

## **Course Content:**

### **Section I: Introduction to Ocean Sciences and Technology**

- 1. Introduction to Ocean Environment** – Above surface effects; winds, tides and waves, temperature effects, cyclones formations, Sea water composition, pollutions, Temperature gradients and salinity, – Underwater effects; prevalent streams and currents, pressure effects with variation of depth, formation of Eddy Currents, renewable energy source, travel of EM and Acoustic waves in seawater, coastal and marine meteorology, climate formation effects etc.
- 2. Man Underwater** – Depth variation and effects of pressure on human body, counter-effecting the pressure effects, absorption of Nitrogen and decompression sickness

(DCS), shallow and deep water blackouts, hypoxia, oxygen and carbon monoxide toxicity, types of decompression sicknesses, Self-contained Underwater Breathing Apparatus (SCUBA), roles of SCUBA divers, types of diving and their support equipment, surface supported diver's umbilical, gas panel, low pressure breathing compressor, breathing support system associated gadgetry, communication underwater with diver, bailout gas system, use of weights for depth control, saturation diving and associated medical complications, extreme depth effects, decompression chamber, saturation diving support vessels – history developments, records, hazards and dangers, case discussions etc.

3. **Machine Underwater** – Robotic developments, use of Robot to handle hazardous works, **Remotely Operated Vehicle (ROV)** background, concept, developments, ROVs substituting divers, Basic components of ROV – operating system, LARS, Umbilical, object illuminating lights, CCTV, operating arms SCARA (manipulators) construction features, buoyancy and depth control, propulsion system. ROV usages in various fields – Military operations, Scientific ROVs, Educational ROVs. Classification of ROVs – Micro, Mini, General class, Light work class, Heavy work class, Trenching and burials etc., Tether Management System for extended deployment and operations of ROV, TMS operations and deployment. ROV crew and surface support. **Autonomous Underwater Vehicle (AUV)**, On-board sensors, Navigation – LBL, USBL, Inertial Navigational System, GPS Intelligent Buoys etc., AUV propulsion and power system, AUV applications – Commercial, Military, Research, Hobby etc., AUV design and construction, India's progress in fields of ROVs & AUVs, associated Indian organizations and their programmes under deployment.
4. **Seafloor Issues: Offshore Site Investigation and Geotechnics (OSIG)** – Background history, need of seafloor survey, site survey for offshore pipe laying, site investigation and survey methods, associated equipments and scientific techniques, subsea pipelines, associated issues, surveys, inspections and certifications, roll of divers and ROVs, use of various acoustic data collection equipment, preservation of pipelines by internal and external coating, pipeline leak detection and associated technology, Importance of understanding seabed soil properties, soil mechanics and soil behavior when subjected to various forces, theory of consolidation, seabed response to cyclic loads, cutting

process of dense sand, types of foundations on seabed, beams on elastic foundations, loading of foundation piles – lateral loading, plugging of hollow piles, piles in layered elastic material, waves in piles etc. and gravity foundations.

## **Section II Marine Resources and Technology**

1. **Oil and Gas Sector** – Importance of fossil fuels, oil and gas production technology, oil & gas exploration, offshore seismology, exploratory wells and logging, issues with offshore oil & gas as compared to onshore, oil and gas well drilling, drilling rigs, drilling muds, blowout preventer, drilling templates, drilling platforms, various drilling techniques such as straight hole, directional and horizontal drilling, air and foam drilling, well completion, well head, Christmas tree, collection and processing of well outputs, pipeline construction, sub-sea production systems, deep water fields, oil platforms, fixed platforms and various other types, manning requirements for maintenance and supply, post production treatment and storage, natural gas and its growing importance, natural gas processing, carbon capture and storage.
2. **Marine Renewable Energy** – Wind power – onshore Vs offshore, site survey, turbine foundations, cabling, developments about offshore wind farms in India, tidal power and its generating methods, dynamic tidal power, technological challenges and geographical issues, tidal power in India, Wave power technology, methods under deployment and sites, Ocean Thermal Energy Conversion working principle, types of OTEC plants and their constructions, locating of OTEC plant, developments in India, sites under deployment, advantages and difficulties with Marine Renewable Energies, Reverse Osmosis – principle and operation, desalination, developments in India.
3. **Ocean Resources (other than Oil/Gas & renewable)** – Marine aggregates. Marine minerals and seabed mining, Methane Clathrates – structure and composition, their natural deposits, formation of clathrates in natural Gas processing, commercial usage of Methane hydrates. Biotechnology and Biological Engineering, learning opportunities in India. Mariculture, Fisheries, methods and usage, fisheries management, environmental effects, genetic pollution and parasite transfer, habitat modification, activities in India. Ocean providing climate buffer, Oxygen production, marine conservation.

4. **Salvaging and Decommissioning** – General strategy for decommissioning and salvaging, environmental impacts of abandoned objects at sea, marine salvaging, classifications of salvages, salvage ships and salvage associated laws, decommissioning – surface and subsea, subsea infrastructure removal, suspended well abandonment etc.
5. **Underwater Science and Archaeology** – Marine Biology and assessment techniques, Computer modeling, sampling, physical oceanography, Temperature, Salinity, Density and circulations caused, measurements and monitoring of physical constituents of oceans and sea bodies, ways of current observations and measurements, Environmental monitoring, use of Wave Gliders for monitoring. Maritime Archaeology and techniques used, position fixing, site surveys, recording, excavation etc., Archaeological Science, Artifacts recovery and conservation, Interpretation and presentation of underwater archaeology, Marine Archaeology in India.

**Suggested Reading:**

- Handbook “Underwater Technology and Ocean Sciences” compiled by UWT Committee – MCCIA Pune.
- “Acoustical Physics” published by Royal Society, London
- “Underwater Technology” publications of Society of Underwater Technology (SUT), London.
- Website of “Woods Hole Oceanographic Institute”
- “Manmade Objects on Seafloor – 2000” published by SUT-London and GEOTEK.
- Google site “Diving, Diving Safety and Diving Equipment”
- Google site on “Seafloor and Oceanography”
- Google site on “Oil and Gas – Exploration and Exploitation”
- Google site on “bathymetry”
- Google site on “ROVs and AUVs”
- Handbook “Underwater Technology and Ocean Sciences” compiled by UWT Committee – MCCIA Pune.
- “Underwater Technology” publications of Society of Underwater Technology (SUT), London.