Faculty of Ocean Science and Technology

Subject Code: B1805

Physical Oceanography

Module. 1	**Physical Properties of Sea Water**- Pressure-Temperature-Salinity and Conductivity-Density of sea water-Effects of temperature and salinity on density-Potential density- Specific volume and specific volume anomaly - Sound in the sea-Light in the sea- Color of sea water. T-S diagram-Water type and water mass – Formation and classification of water masses- Major water masses- Bottom-Deep-Intermediate and surface watermasses in the world oceans- Indian Ocean watermasses.
Module. 2	**Ocean Circulation**- Thermohaline and Wind-driven Circulation- General Circulation of World Oceans- Equatorial Currents, Undercurrents. Indian Ocean circulation- geographical features-wind pattern- Surface and sub-surface currents of the Indian Ocean- Monsoon circulation. Upwelling and Sinking -Major upwelling regions of world oceans and Indian Ocean- Meso-scale Eddies and oceanic fronts. Southern Ocean Fronts and zones-Sea Ice. Large scale Oceanic variability-El Nino/La Nina-Southern Oscillation –Indian Ocean Dipole.
Module .3	**Ocean Dynamics**- Total derivative- Equation of continuity- equation of motion - Navier Stokes equation- Reynolds number- Reynolds stresses and eddy viscosity-Rossby number- Ekman number- Stability and double diffusion-Richardson Number-Buoyancy frequency. Inertial motion – Geostrophy- Ekman Current – Westward intensification - Sverdrup – Stommel – Munk solutions.Vorticity- Conservation of potential vorticity - Ekman pumping- Rossby radius of deformation-Barotrpic and baroclinic instability. Conservation of mass and salt-conservation equations.
Module. 4	**Eustrine and Coastal processes** - Classification of Estuaries- Circulation, mixing and stratification- Tidal asymmetry and flushing- Estuarine sedimentation. Ocean wave classification - Wave generation- wave dispersion - Wave transformations-shoaling, refraction, diffraction, reflection, wave run up, long-shore currents and rip currents.Wave breaking –Wave statistics and wave spectra. Internal waves- Planetary Waves - Rossby, Kelvin, Poincare and Yanai waves- Tsunamis- Seiches. Tides- Tide producing forces - Tide generation theories - Tidal currents- Internal tides -Tidal Bores- Amphidromic points- Co-tidal lines.
Module. 5	**Infrared Remote Sensing** thermal emission – atmospheric absorption – IR sensors – SST retrieval – atmospheric correction – effect of clouds. Microwave Remote Sensing: theory of microwave radiometry – microwave emission of sea surface – atmospheric effects – retrieval of salinity and wind vector – passive and active microwave radiometers – Altimetry – Scatterometry.Different types of satellite data products.
Module .6	**Air-Sea Interaction:** fluxes of mass, momentum and heat - Estimation and measurement of fluxes - eddy correlation method - bulk aerodynamic method- scales of air-sea interaction - Reynolds's Number - turbulence- characteristics of turbulent flow - Kolmogorov length scale - Atmospheric boundary layer - wind stress - wind profile in the atmospheric boundary layer. Heat budget of the ocean.
Module. 7	**Ocean Modeling**- Mechanistic and Simulation models- Global Ocean Modelling-Hydrostatic Primitive Equations- Boussinesq approximation- Initial and Kinematic Boundary conditions. Numerical Schemes- Finite Differences- Forward, Backward and Central differences- Explicit and Implicit schemes. Horizontal and vertical grid types-finite difference and finite element-lateral boundary conditions-bathymetry-Model forcing - Model Initialization. Convergence- Consistency - Stability- Different types of Errors.