Third Semester

Skills, employability and entrepreneurship: This semester is quite unique opportunity for students not only to know about the oceans as they cover 71% of the earth surface, but explore further living and non-living mineral resources, in the scenario of depletion of continental resources. Students have chance to go on ocean expedition and exit with course have skills to work in organizations related to ocean and well as Navy. They will be exposed to start their own entrepreneurship. Students are encouraged to undergo internships after the regular offline classes and attend the webinars related to the oceans.

MGH 501: Oceanography – I

Skills, employability and entrepreneurship: These are similar to the above mentioned ones with an emphasis on the physics and chemistry of the oceans. Students have chance to go on ocean expedition and exit with course have skills to work in organizations related to ocean and well as Navy including the R & D Labs. and educational institutions.

Physical Oceanography

Unit 1	Wind generated waves in the oceans; their characteristics; shallow and deep water waves. Propagation, refraction, reflection and diffraction of waves. Wave spectrum, principles of wave forecasting. Mixing processes in the oceans; characteristics of important water masses. Tide-producing forces and their magnitudes; prediction of tides by the harmonic method; tides and tidal currents in shallow seas and estuaries.	6 hrs
Unit 2	Factors influencing coastal processes; transformation of waves in shallow water; effects of stratification; effect of bottom friction, littoral currents; wave action on sediment movement; rip currents; beach stability, ocean beach nourishment; harbour resonance; seiches; tsunami; interaction of waves with structures.	6 hrs
Unit 3	The global wind system; action of wind on ocean surface; Ekman's theory; Sverdrup, Stommel and Munk's theories; upwelling and sinking with special reference to the Indian ocean. Inertial currents; divergences and convergences; geostrophic motion; barotropic and baroclinic conditions; oceanic eddies, relationship between density, pressure and dynamic topography; relative and slope currents.	6 hrs
Unit 4	Wind driven coastal currents; typical scales of motion in the ocean. Characteristics of the global conveyor belt circulation and its causes. Formation of subtropical gyres; western boundary currents; equatorial current systems; El Nino and La Nina; monsoonal winds and currents over the North Indian Ocean; Somali current; Upwelling process in the Arabian Sea. Estuaries: classification and nomenclature; estuarine circulation and mixing; depth-averaged and breadth-averaged models; sedimentation in estuaries; salinity intrusion in estuaries; effect of stratification; coastal pollution; mixing and dispersal of pollutants in estuaries and near-shore areas. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises related coastal and beach protection, to the curriculum.	8 hrs

Chemical Oceanography

Unit 5	Introduction to Chemical Oceanography: Principles and processes regulating the composition of seawater – primary and secondary inputs. Rivers, atmosphere, hydrothermal and diagenesis.	6 hrs
Unit 6	Constancy of ionic composition of seawater. Composition of seawater – Classification of elements based on their distribution; major and minor constituents; behavior of elements; chemical exchanges across river-sea, particulate-dissolved and sediment-water interfaces.	6 hrs
Unit 7	Distribution of radionuclides and gases in the oceans for understanding water column and sedimentary particles scavenging in the oceans. Residence times of elements in seawater and processes regulating it.	6 hrs
Unit 8	Chemical and biological interactions – Ionic interactions; cycling and air-sea exchange of important biogenic dissolved gases; carbon dioxide-carbonate system; alkalinity and control of pH; abiotic and biotic controls of trace elements in the ocean; biological pump and controls on atmospheric composition. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs

List of References:

1. Principles of Oceanography - M. Grant Gross.
2. Oceanography – J.J. Bhat.
3. The Open University Set Book (Second Edition) 314p.
4. Pinet P. R. (1992) Oceanography: An introduction to the Planet Oceanus, West Publ., Co. 571p.
5. Emerson, E and Hedges, J. (2008) Chemical Oceanography and the Marine Carbon Cycle. Cambridge University Press.
6. Riley, J. P. and Chester, R. 1971. Introduction to Marine Chemistry, Academic Press,
7. Chemical Oceanography, Vol. 1- 10 (2nd Ed.) - J. P. Riley and G. Skirrow, eds, Academic Press (1975–1989).
8. Fasham, Michael J.R. (2003) Ocean Biogeochemistry. The Role of the Ocean Carbon. Cycle in Global Change Series.
9. Komar, P. D., (1976) Beach Processes and Sedimentation, Prentice-Hall. 429p.
10. Reddy M.P.M. (2001) Descriptive Physical Oceanography, A ABalkema, Press, 440p.
11. Shepard, F.P. (1963), Submarine Geology. 2nd. Ed. New York: Harper Row.557p.
12. Shepard, F.P. (1937), Retreived classification of marine shoreline. J. Geology 45: 602-24.
13. Schulz, H.D. and Zabel, M. (2006) Marine Geochemistry. Springer. 221p.
14. Coastal Engineering Processes: Dominic Reeve, Andrew Chadwick and Chris Fleming -Allied Publishers