

Faculty of Climate Variability and Aquatic Ecosystem

Subject Code:D1912

Name of the Subject: Environmental Science

Module. 1	Basic Environmental Science Earth man Environment, The ecosystem concept, Abiotic and biotic components. Biomes and Habitats.Natural resources, Conservation and sustainable development. Autecology, synecology, tolerance range and limiting factors. Functional role and niche, key stone species, dominant species, ecotone, edge effect. Population properties and dynamics, prey predation and mutualism. Wetland systems of India, flora and fauna; marine habitats.Ecological succession, primary and secondary processes in successions, models of successions, endangered and threatened species, Biodiversity and conservation Heat budget of the earth.Energy resources and their exploitation. Conventional and non-conventional energy sources: Environmental implications of energy use, CO2 emission in atmosphere, Land use and land cover, land use change, drivers of land use change, impact of land use change on environment. Global water balance, impact of climate change on freshwater resources, Management and conservation of water resources. Important estuarine fishery resources- Important finfish and shellfish resources. Sustainability: Principles, social, economic, ecological, biological and legal issues. Bioenergy - Biofuel and biodiesel: biogas, butanol, biodiesel, ethanol,biohydrogen; bioenergy from wastes; Ecofriendly products: Biopolymers and bioplastics.
Module. 2	Environmental Geoscience Earth systems and Biosphere- Conservation of matter in various geospheres. Earth Processes-Primary differentiation and formation of core, mantle, crust, atmosphere, hydrosphere.Weathering processes and soil formation. Soil profile development, Chemical mineralogical composition of soil, Soil classification.Mineral resources and Environment. Geological hazards-Earthquakes,Volcanism, Tropical cyclones Principles of remotesensing and its applications Weather and climate - Elements of weather and climate: solar radiation, air temperature, atmospheric pressure, wind, humidity, clouds, precipitation and visibility - units of measurement of weather elements. Composition of the atmosphere - ozone in the atmosphere, aerosols, carbon compounds in the atmosphere and Green House Effect (GHE) Indian monsoon: onset, progress and withdrawal south west monsoon over India, north east monsoon - seasons of India - rainfall patterns over India - Influence of El Nino and La Nina on Indian monsoon. Climate change - preliminary concepts - global warming - anthropogenic causes. Consequences of global warming - sea level rise, changes in rainfall pattern and amount- impact on agriculture, fisheries, industries, human comfort etc. Active, Passive, Optical Remote sensing, Visible, Infrared, thermal, Platforms and sensors- orbit types– Resolution. Microwave Remote sensing sensors, Concept of Microwave Remote sensing, SLAR, SAR Scattro meter – Altimeter, Characteristics, Image interpretation characters. Land observation satellites, Maps and Spatial information – Computer Assisted Mapping and Map Analysis. Components of Geographical Information System – Introduction – GPS satellites

Module .3	Environmental Chemistry Atmospheric chemistry, reactions in the lower and upper atmosphere, radioactivity in the atmosphere and air pollution chemistry. Structure and Physico-chemical properties of water and their environmental significance, chemistry of marine and fresh water, role Titrimetry, gravimetry, colourimetry, spectrophotometry, gas chromatography, atomic absorption spectrophotometry, GLC, HPLC, electrophoresis, X-ray fluorescence, X-ray diffraction, flame-photometry.UV- Visible Absorption Spectrometry, Fluorescence spectrometry, Atomic Spectroscopic Techniques, Flame Emission Spectrometry, Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) and ICP/MS. Chromatographic Techniques in Environmental Analyses. Gas– Liquid Chromatography (GLC), Instrumentations for GLC- columns, stationery phases, detectors, applications. Gas – Solid Chromatography (GSC), Liquid chromatography (LC): High-Pressure Liquid Chromatography (HPLC), column efficiency in Liquid Chromatography (LC).
Module. 4	Environmental pollution Water pollution- Sources and consequences.Characteristics of domestic, industrial, agricultural wastes, plastics.water quality parameters; criteria and standards, sewage and industrial waste water treatment methods. Atmospheric pollution – definition, primary and secondary pollutants, sources and classification of air pollutants global implication of air pollution effect of meteorological and topographical factors, Air pollution control equipments, national air monitoring programme, effects of air pollutants on humans, animals, plants and properties Basic properties of sound waves-plane and spherical waves, sound pressure and intensity levels, decibel, effect of meteorological parameters on sound propagation, Noise pollution levels. Soil pollution-Industrial andmining wastes, and human activities, plants and animals in degraded soil; soil pollution. Noise pollution- Basic properties of sound waves, intensity levels, decibel, effect of meteorological parameters on sound propagation. Measurement and analysis of sound. Environmental problems associated with noise pollution. Radiation, Mechanism of radiation on living system-Atmospheric, Aquatic and biological pathways and transport. Carbon and Tritium dating

Module. 5	Environmental management Biodegradation of organic pollutants: aerobic, anaerobic, co-metabolic; Biofertilizers and biopesticides : types; production and role in IPM; genetically engineered organisms – Bt toxin gene. acidic, alkaline and saline soils – reclamation techniques. Biotechnology for solid waste management: sanitary landfilling; Biocomposting– aerobic, anaerobic; vermicomposting; Biomethanation. Biotechnology for wastewater treatment: Microbial processes in wastewater treatment; Biodegradation of persistent organic pollutants: microbial adaptations; enzymes catalyzing biodegradation; Biosensors, biochips, biosurfactants – microbial production and their role in bioremediation. Principles in toxicology; Animal management in toxicological evaluation; Animal toxicity tests; Bio-absorption of heavy metals. Principles and methods of occupational health. The relationship of occupation of hygiene and safety and disease. Health and safety problems in the working and living environment. Coastal Zone Management: Integrated Coastal Zone Management (ICZM): Boundaries of the coastal zone, policies and planning for coastal resource management. Basic elements and tools of statistical analysis. Measures of central tendency and graphical representation of data, contingency tables and chi-square test, difference between sample means: t-test, range tests, correlation measurements and regression analysis, Approaches to development of models
Module .6	Environmental Law Stockholm Conference, Nairobi Declaration, Rio Conference, Rio+5 and the Rio+10, etc. Global environmental issues and International laws to control Global warming, Ozone depletion Acid rains, CITES etc. National Environmental Protection Legislations: The Water (Prevention and control of Pollution) Act 1974; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; Forest Act 1927; Forest Conservation Act 1980; The Wild life Protection Act 1972(2002 Amendment); Biodiversity Act 2002; The Noise Pollution (Regulation) 2000. Kerala State Environmental Regulations and Legislations: Public Health Act, Kerala Forest (Amendment Act), 2010, The Kerala ground water (control and regulation) Act, 2002, The Kerala Forest (Vesting and Management of Ecologically Fragile Lands) Act, 2003, Kerala Municipality Building (Amendment) Rules, 2004 - Rainwater harvesting, The Kerala Land Reforms (Amendment) Act, 2005,
Module. 7	Environmental Impact Assessment EIA and project planning and implementation; EIA and building rules in India. Classification of projects for EIA. Impact Identification, Establishing the Environmental base line. Impact prediction, evaluation and mitigation. Criteria and standards for assessing significant impact. Environmental Impact statement, Environmental Management plan. Cost- Benefit Analysis and valuation of Environmental Impacts. Public Participation, presentation and review. EIA monitoring and Guidelines for environmental auditing. Mitigation measures: Restoration and rehabilitation technologies, comparison of alternatives: review and decision making: compensatory actions: green belts: review of procedures, practices and guidelines in India.