

**The Environmental Studies minor supplements other majors to facilitate students' understanding of complex environmental issues from a problem-oriented, interdisciplinary perspective. Students:**

1. Perceive key ideas from economic, political, and social analysis as they pertain to the look and analysis of environmental policies and establishments.
2. Appreciate ideas and ways from ecological and physical sciences and their application in environmental downside resolution.
3. Appreciate the moral, society, and historical context of environmental problems and therefore the links between human and natural systems.
4. Mirror critically concerning their roles and identities their roles and identities as citizens, consumers and environmental actors in a complex,
5. Perceive the international character of environmental issues and ways in which of addressing them, together with interactions across native to world scales.
6. Apply systems ideas and methodologies to research and perceive interactions between social and environmental processes.

#### FOUNDATION COURSE

1. Computer Basics & Informatics
2. Computer Application for Biostatistics

#### CORE COURSES

1. Research Methodology & Perspectives of Science
2. Environmental Studies
3. Natural Resources and Conservation
4. Environmental Management
5. Environmental Biotechnology and Microbiology
6. Biophysics, Biostatistics and Computer Application
7. Environmental Geology and Mineralogy
8. Natural Hazards and Meteorology
9. Environmental Pollution and Control Measures I
10. Environmental Pollution and Control Measures II

#### VOCATIONAL COURSES

1. Water Resources and Fluid Mechanics
2. Water Resources Management
3. Hydrology
4. Water Quality Parameters and Assessment
5. Water Quality Management -I
6. Water Pollution
7. Water Quality Management-II

Open Course :Solid Waste Management

## Elective Course: Rain Water Harvesting

### COMPLEMENTARY COURSES

1. Theoretical Inorganic Chemistry
2. Organic and Environmental Chemistry
3. Analytical Chemistry and Biomolecules
4. Physical Chemistry

The foundation course gives an awareness about History and development of computers - basic knowledge of computer systems - softwares and hardwares - free softwares - M.S Word, Excel, Power point. Computer ethics - software piracy – internet. Piracy – privacy- computer security; computer crimes -hacking and cracking. Internet - managing bodies of the internet - Internet Society - Internet Service Provider – Internet application software. Features of the modern personal computer and peripherals - Computer network

It also helps to develop their overview of information technology, knowledge skills about Data information and knowledge - Internet as knowledge repository - Introduction to use of IT in teaching and learning. Educational softwares. INFLIBNET - academic services. Also get some ideas about social informatics including IT and society - overview of it's application in medicine, health care, environmental studies-defence crime detection, communication. Applications of IT in weather forecasting, education, film and media - virtual reality.

Various **core courses** including

1. Research Methodology & Perspectives of Science
2. Environmental Studies
3. Natural Resources and Conservation
4. Environmental Management
5. Environmental Biotechnology and Microbiology
6. Biophysics, Biostatistics and Computer Application
7. Environmental Geology and Mineralogy
8. Natural Hazards and Meteorology
9. Environmental Pollution and Control Measures I
10. Environmental Pollution and Control Measures II

gives an overall idea regarding various natural resources, their importance, exploitation and conservation different types of pollution, their causes and remedial measures, population explosion ,population growth, some aspects about biotechnology and microbiology, geology and mineralogy, natural hazards ,their reasons and precaution measures etc.

The **vocational courses** mainly deals with water and water related issues. It mainly comprises of various topic such as Water as a resource material - multiple uses of water.-consumptive uses-irrigation; Partial consumptive uses-public water supply - Fire demand - Industrial uses - thermal uses. Nuclear power generation - non consumptive uses - hydropower generation - inland navigation water resources – rivers, ponds, lakes. Introduction to fluid mechanics - properties of fluids – density – viscosity - surface tension- types of flow - laminar flow - turbulent flow.

Water resources : types – surface water, ground water, water availability and uses. Water requirement for various uses - Industrial uses – aquaculture - recreational uses; Irrigational uses - definition of irrigation – necessity – benefits; ill effects - systems. Lift irrigation – advantages – disadvantages-flow irrigation – Inundation – irrigation. Perennial system of irrigation. Direct irrigation-storage irrigation.

Hydrology (surface water); definition ; importance. Hydrologic cycle; climatic factors influencing hydrologic cycle – humidity, temperature, radiation, wind. Precipitation - condition for occurrence of precipitation. Measurement of rainfall - different types of rain gauge; rainfall measurement by radar; errors in measurement; estimation of missing rainfall data; average rainfall over an area. Mean and annual rainfall; measurement of snow fall. Characteristics of precipitations of India. Evaporators; factors affecting evaporation - Estimation of evaporation - evaporation pan method - Evaporation from soil surface. Transpiration - Factors affecting infiltration rates. Infiltration rate; infiltration capacity; Infiltration indices; runoff; estimation of runoff; hydrograph; global water balance; water losses-inter basin transfer. Hydrology - ground water hydrology; occurrence of ground water; different types; Aquitard- Aquifuge- ground water collecting systems – wells. Types of wells-collection – conveyance and distribution-general study-Ground water movement-Darcy's law (No derivation required); Ground water and well hydraulics.

Water quality parameters - USPHS Scale and WHO scale, sampling; preservation. Water as a solvent. Collection of water sample. Analysis of natural and waste water sampling procedures. Main quality characteristics of water a) Alkalinity b) Hardness c) Total solids. Physical properties of water- like BP, MP, critical temperature, viscosity, Surface tension, dielectric constant, dipole moment, Heat of vaporization; tolerance limits for trace metals in drinking water (Al, B, Cd, Co, Pb, Mn, Ni, Fe, Zn, Cr, Cu, Mo, Se, Sc). International standards for Drinking water - pH, BOD, COD, B, As, Cd, Cr,  $\text{NH}_3$ , Fe, Cl, Hg, Mg, total hardness, pesticides, *E. Coli*, TDS; International standards for drinking water prescribed by WHO.

Quality and characterization of domestic waste water - physical Chemical and Biological Properties of waste water. Determination of COD, BOD. Natural methods of sewage disposal : Dilution method, Sewage farming method, Self purification theory; Sanitary water management - sanitary waste; Definition-importance, historical background. Systems of sewage disposal. Dry conservancy system & water carriage system. Sewage sickness - primary and secondary treatment - conventional and low cost - advanced wastewater treatment including nitrogen and phosphorous removal - miscellaneous treatment of sewage Oxidation pond – cesspool - septic tank - soak pit. Waste water disposal and reuse. Characteristics and treatment of industrial waste water : breweries and wineries; distilleries; paper and pulp mill; sugar mill; oil refineries. Petrochemical industries; tanneries; pharmaceutical plants; fertiliser plant; electroplating industries; textile mills. Treatment and disposal of sludge : thickening and digestion; conditioning and dewatering-incineration -ultimate disposal.

**The complimentary courses** deals with atomic structure ,radio activity and nuclear chemistry, chemical bonding ,metallurgy, coordination chemistry, reaction mechanisms, stereochemistry, analytical chemistry, chromatography, polymer chemistry etc.,

The **elective course** deals with Rain water harvesting- Rainwater collection for drinking purpose; domestic rain water collection community,rain water collection.Artificial recharge; methods of artificial recharge; roof water harvesting-surface water harvesting; dug cum borewells.Mini artificial aquifersystems; borewell and hand pumps; artificial recharge in roads and colonies.Recycling and treating- methodology land use planning in watershed. Rain water harvesting for sustainable development - water related sustainability issues in cities-Depletion of ground water table- concept of zero run off. Urban RWH practices. The importance of watershed management in Kerala - Rain water harvesting in Institutional buildings.Legal provisions in rain water harvesting in India and Kerala.

**Opencourse** gives an insight in to Solid Waste management ,Solid wastes and its characteristics; classification of solid waste – source; factors affecting quality &quantity. Physical and chemical characteristics - collection & transportation. Solid wastes from households, institutions, commercial establishment, public amenities; demolition sites;construction sites; mining & quarrying; sewage treatment plants. Types of solid wastes – municipal; agriculture;biomedical; hazardous; radioactive wastes. Waste Management - global perspective - source reduction - Reuse and recycling. Disposal techniques - composting; principles of composting; factors affecting composting. Types of composting - Windrow layout and management. Methane recovery; sanitary landfill - advantages and disadvantages of sanitary landfill. Methods of landfill. Incineration - types of incinerators - reactions involved - advantages and disadvantages of incineration