INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

1. **Name of the Academic Unit: Civil Engineering**

2. **Subject Name: Environmental Science and Engineering; L-T-P: 3-0-0; Credits: 3**

3. **Pre-requisites: NIL**

4. **Syllabus and reference books:**

Module 1
Air pollution: Air pollution sources, classification of air pollutants, units of measurements, effects of air pollutants, acceptable air quality and emission standards; Air pollutant emission (stationery and non- stationery) sources, influence of meteorological phenomena on air quality, temperature, lapse rates and stability, plume behaviour; Major pollutants and classification thereof: Carbon Monoxide, Oxides of Nitrogen, Volatile Organic Compounds, Photochemical Smog and Ozone, Oxides of Sulphur, Lead, and Particulate Matter; Pollutant measurement units and instruments for measurement; Meteorological aspects of air pollutant dispersion: Adiabatic lapse rate, Atmospheric stability, Smokestack plumes; air pollution concentration models, the gaussian plume model, plume rise, area source box model, line source model. Air sampling, pollutant measurement methods and air pollution control methods and equipment

Module 2
Pollution of surface water bodies: Sources of pollution such as, pathogens, oxygen-demanding wastes, nutrients, salts, heat waste, heavy metals, pesticides, volatile organic chemicals, and emerging contaminants; Biochemical oxygen demand (BOD) – its determination and modelling as a first order reaction; BOD rate constant; Deoxygenation and reaeration in rivers; Oxygen sag curve and its mathematical model; Eutrophication and stratifications in lakes. Water and waste water quality and treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment. Water treatment systems: screening, sedimentation, filtration, disinfection, water softening, adsorption, ion-exchange, miscellaneous treatment.Distribution of water: Appurtenances in distribution system, types of pumpsand pumping, conveyance of water, types of pipes and problems associated,wasteage of water in a distribution system.

Module 3
Municipal Solid Waste: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste treatment and management (reuse/ recycle, energy recovery, biological treatment and disposal); Solid waste categories: municipal wastes, industrial wastes, and hazardous wastes; Impact of solid wastes on the biosphere; Leaching of contaminants; Resource recovery from solid wastes.

Module 4
Pollution of the marine environment: Sources of pollution such as, plastic, nutrients from fertilizer runoff, nonpoint sources, light, noise, and industrial chemicals; UN Sustainable Development Goals # 13, 14, and 15 and how pollution in different media may be managed in order to achieve the goals.

Reference Books:

1) G. M. Masters, and D. Jacob (1991). Introduction to environmental science and engineering. Prentice Hall.