Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-504

Title of the Course: Environmental control and chemical analysis

Number of Credits: 3 **Effective from AY:** 2018-19

Prerequisites for the course:	Students should have studied the Concepts in Analytical Spectroscopy), Analytical techniques at MSC Semester I and II so as to have basic knowledge of environmental chemistry and instrumental analysis.	
Course Objectives:	1. Introduction to environmental application of chemistry 2. Studying pollution from chemical perspective. 3. Creating awareness about environmental acts of India	
Course Outcomes:	1. Develop social concern for pollution based on various chemical process 2. Evaluate the use of various analytical techniques in environmental control and monitoring	
Content:	**1. Water pollution** 1.1 Constituents of aquatic life 1.2 Nature and types of water pollutants: heavy metals, inorganic pollutants, organic pollutants, pesticides, soaps and detergents, radioactive pollutants; Water standards in India [IS 10500 (2012)] 1.3 Soaps and detergents pollutants: Analysis of Soaps and detergents, general scheme of analysis, active ingredients, Test for soap (fatty acid salts), test for synthetic detergents 1.4 Municipal water treatment 1.5 Treatment of water for industrial use 1.6 Water conditioning: principle of coagulation and flocculation, softening, disinfection, demineralisation, fluoridation, chlorination, ozone treatment, electrodialysis 1.7 Wastewater treatment: pH, aerobic and anaerobic water treatment 1.8 Mercury pollution and estimation of organomercurials; 1.9 Analysis of: Dissolved oxygen (polarography and oxygen electrode), Chemical oxygen demand, Biochemical oxygen demand; 1.10 case study -DDT, Kepone, Minamata (any other) **2 Air pollution** 2.1 Introduction to atmospheric chemistry 2.2 Photochemical processes (ozone depletion) 2.3 Chain reactions in atmosphere 2.4 Oxidation process in atmosphere 2.5 Acid-base reaction in atmosphere 2.6 Sources and sinks of air pollutants 2.7 Effect of air pollutants on living and non-living things 2.8 Methods for sampling air pollutants 2.9 Air pollution problems- world and India 2.10 Sources -analysis control of: oxides of carbon, nitrogen and sulphur, H_2S 2.11 Organic compounds in atmosphere 2.12 Air act of India 1981 2.13 Greenhouse gases and global warming 2.14 Radioisotopes in air 2.15 Methods to monitor and control air pollution: scrubbers, filters, gravity and cyclone separators, absorption, adsorption, condensation,	10 hrs 10 hrs

	flare tower, gas sensing 2.16 Noise pollution 2.17 Case study-Bhopal gas tragedy, nuclear disasters-Chernobyl and Fukushima **3 Soil pollution** 3.1 Soil macrostructure and microstructure, 3.2 Micro and macronutrients of soil 3.3 Inorganic and organic matter in soil 3.4 Reactions in soil 3.5 Fertilisers in soil; Analysis of fertilizer (N, P, K) 3.6 Excessive use of agrochemicals 3.7 Waste and pollutants in soil 3.8 Type of pesticides, degradation of pesticides in soil (chemical, phochemical biochemical), Analysis of pesticides, 3.9 Soil pollution Sources, prevention and control 3.10 Biochemical effects of pesticides; analysis of pesticides 3.11 Plastic pollution 3.12 Municipal garbage treatment **4. Instrumental Techniques in environmental chemical analysis.** 4.1 Neutron activation analysis 4.2 Anodic stripping voltammetry, (Mixture: Cu, Pb, Zn, Cd) 4.3 atomic absorption spectroscopy,(Cu, Co, Cr) 4.4 Flameless atomic absorption, (Hg, Pb,) 4.5 Inductively-coupled plasma-emission spectroscopy (B,W) 4.6 X-ray fluorescence 4.7 Infrared and non-dispersive infrared spectroscopy (nitrates, carbonate, CO) 4.8 Chemiluminescence (NOx) 4.8 Gas and liquid chromatography(NOx, CO, CO_2,VOC) 4.9 Ion-selective electrodes,(F, Ag, S, Ca) 4.10 Ion chromatography-(mixture: Ni, Co and Cu; chloride, nitrate and sulphate) Above techniques shall be discussed with minimum one environmental application	8 hrs 8 hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	1. S. E. Manahan, *Environmental science and technology*, 2007, CRC Press, NW, 2nd Ed. 2. A. V. Salker, *Environmental Chemistry*, 2017, Narosa Nublishing, New Delhi, 1st Ed. 3. A. K. De, *Environmental Chemistry,* New Age International Publishers, New Delhi, 2005, 3rd Ed. 4. S. Mishra, D. Mani, *Soil Pollution*, Ashish Publishing House, New Delhi, 1991, 1st Ed. 5. B. K. Sharma, *Environmental Chemistry*, GOEL Publishing House,	