**Name of the Programme:** M.Sc. Part-II (Inorganic Chemistry)

**Course Code:** CHI-623 **Title of the course:** Environmental Chemistry

**Number of Credits:** 4

**Effective from AY:** 2023-24

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| **Prerequisites for the course:** | Students should have studied chemistry/ biochemistry courses at M.Sc.Part-I. | |
| **Course Objective:** | 1. To introduce to fundamentals of environmental chemistry.<br>2. To provide important knowledge of environmental chemistry in day-to-day life.<br>3. To give the basic knowledge of environmental pollution.<br>4. To make aware of the harmful effects of environmental pollutants and control measures. | |
| **Content** | **1. Structure and properties of atmosphere:**<br>Introduction, Temperature profile of the atmosphere, Lapse rate, Temperature inversion. | No of hours<br>4 |
| | **2. Biogeochemical cycles**<br>Introduction, Biogeochemical cycles of Oxygen, Carbon, Sulphur, Nitrogen, Phosphorus, and Hydrogen. | 8 |
| | **3. Soil Pollution**<br>Introduction, Air and water in the soil, Inorganic and Organic components in the soil, Reactions in the soil, Waste pollutants in the soil and soil contamination, Excess usage of agrochemicals, Adsorption and decomposition of organic matter in the soil. | 6 |
| | **4. Air pollution**<br>Types of emissions, Air pollution dispersion models, Types of emission sources, Estimation of Dispersion parameters, Types of Plumes, global warming<br>Particulate matter: Introduction, Particle size range, Health Hazards, Analysis of particulate matter, Control devices, Inorganic Particulates, Radioactive particulates, Organic particulates and other contaminants. | 12 |
| | **5. Water pollution and Conditioning**<br>a. Introduction.<br>b. Hard water and water softening by chemical methods.<br>c. Carbonate hardness removal by lime, Magnesium hardness removal by lime, and non-carbonated hardness removal by soda ash.<br>d. Calcium carbonate solubility.<br>e. Re-carbonation and acid process.<br>f. Barium-lime cold process.<br>g. Ion exchange process. | 8 |
| | **6. Plastic pollution**<br>a. Microplastics<br>b. Global occurrence, distribution, and the fate of plastic in the | 10 |

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| | environment.<br>c. Weathering and degradation of plastics.<br>d. Microplastics, types of microplastics, nanoplastics.<br>e. Analysis and identification of microplastics.<br>f. Impact on the terrestrial and marine environment (estuarine, open ocean, coral reefs).<br>g. Inputs of microplastics into the oceans.<br>h. Transfer of microplastics into the food chain: bioaccumulation and Biomagnification.<br>i. Microplastic ingestion, toxicity, and impact on human health. | |
| | **7. Selected industrial effluent treatment.**<br>a. Industrial effluent treatment,<br>b. Effects of Industrial effluents on surface water and land,<br>c. Manufacture process and treatment of fertilizers and pesticides,<br>d. Electroplating process and treatment of the waste,<br>e. Waste from the cement industry, Waste from the sugarcane and paper industry. | 8 |
| | **8. Waste Management and Case studies**<br>a. Waste Management (sources and types of solid wastes, disposal techniques, collection methods, waste management approach).<br>b. Case study (Bhopal gas tragedy, use of DDT). | 4 |
| **Pedagogy** | Mainly lectures and tutorials. Seminars/term papers /assignments/presentations/self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning. | |
| **References / Readings** | 1. P. W. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, Shriver & Atkins Inorganic Chemistry, 5th Ed.; Oxford Publications, 2009.<br>2. J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, Inorganic Chemistry: Principles of Structure & Reactivity, 4th Ed.; Pearson, 2011.<br>3. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, 2nd Ed. (reprinted); Elsevier, 2014.<br>4. J. D. Lee, Concise Inorganic Chemistry, 5th Ed. (reprint); Blackwell Science Wiley, 2015.<br>5. F. A. Cotton, G. Wilkinson, P. L. Gauss, Basic Inorganic Chemistry, 3rd Ed.; Wiley, 2008.<br>6. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 3rd Ed.; Wiley, 1984.<br>7. G. C. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd Ed.; Pearson, 2004.<br>8. R. C. Hale, M. E. Seeley, M. J. La Guardia, L. Mai, E. Y. Zeng, A global perspective on microplastics, 2020, Journal of Geophysical Research: Oceans, Wiley, 125 (1), e2018JC014719.<br>9. S. Sharma, S. Chatterjee, Microplastic pollution, a threat to marine ecosystem and human health: a short review. 2017, Environmental Science and Pollution Research, Springer, 24, 21530–21547. | |

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| | 10. L. Andrady, Microplastics in the marine environment, 2011, Marine pollution bulletin, 62(8), 1596-1605.<br>11. R. C. Thompson, C. J. Moore, F. S. Vom Saal, S. H. Swan, Plastics, the environment and human health: current consensus and future trends. 2009, Philosophical transactions of the royal society B: biological sciences, Royal Society, 364 (1526), 2153-2166. |
| **Course Outcome:** | 1. Students will be in a position to know the basic environmental chemical processes.<br>2. Students will be able to explain the origin and harmful effects of toxic chemicals in the environment.<br>3. Students will be aware of the analysis of some pollutants.<br>4. Students will be in a position to give examples of case studies. |