WASTEWATER TREATMENT AND RECYCLING

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INTENDED AUDIENCE : The course will be beneficial for B.Tech/M.Tech/B.Sc/M.Sc/Research Scholars/Faculty members from different institutions. In addition, we will strongly encourage engineers/professionals working in any area related to waste management should consider taking advantage from this unique application orientated course. Regulators (SPCB, CPCB and MOEF professionals) and policy makers will also benefit from this course.

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO : Larsen and Tourbo, Tata Group of Industries, Ramky Group of Industries, IF&LS Environment

COURSE OUTLINE :

This course has emphasises on Integrated Solid Waste Management aspects within the broad subject area of Integrated Waste Management for a Smart City. The issues of Municipal Solid Waste (MSW) management, Construction and Demolition (C&D) Waste and Electronic Waste Management will be covered in this course. The topics will include: generation rates and waste composition; Integrated waste management issues, collection, recovery, reuse, recycling, energy-from-waste, and landfilling; Biological treatment of the organic waste fraction - direct land application, composting, and anaerobic digestion. The environmental impact of waste management and its relationship on the big picture sustainable development and smart city development will be discussed. A major focus of this course will be the role of MSW management within the various initiatives of the Govt. of India including: Swachh Bharat Mission, Smart Cities as well as Make in India. The challenges of waste management for smart cities will also be discussed taking case studies from the first list of 20 smart cities identified in the first phase for this program. This will be followed by overview of the Construction and Demolition (C&D) Waste and Electronic Waste (E-Waste) management issues in India in general and for the smart cities in particular. The new rules with respect of C&D Waste and E-Waste Management will be covered. The challenges of managing these waste streams effectively will be discussed.

ABOUT INSTRUCTOR :

Prof. Manoj Kumar Tiwari [Ph.D. (IIT Kanpur)] is a Civil Engg. graduate with specialization in Environmental Engg. and holds expertise in water and wastewater treatment, water distribution systems, water pricing, and contaminant fate and transport. He is a recipient of prestigious Fulbright Fellowship. Dr. Tiwari has co- authored several papers in apex international journals, and has presented his research in various top ranked conferences across the globe. Dr. Tiwari has over 8 years of teaching experience with both UG as well as PG level courses has designed several new courses at IIT Kharagpur for Master's programme in Water Engineering and Management.

COURSE PLAN :

Week 1 : Introduction: General outline; Introduction to wastewater; Various sources and types of wastewater; Need of wastewater management; Concept of wastewater treatment and recycling

Week 2 : Wastewater Generation and Characteristics: Wastewater generation and quantity estimation; Water quality parameters and standards (COD, BOD, DO, Solids, Nutrients, metals and emerging contaminants); Sources specific wastewater physical and chemical characteristics

Week 3 : Natural Attenuation of Pollutants in Wastewater: Concept of natural attenuation; Wastewater discharge in rivers; Attenuation of pollutants on land application.

Week 4 : Treatment Philosophy: Objectives of wastewater treatment; Concept of mass balance; kinetics and equilibrium processes; Reactors tanks; Continuously mixed tank
reactors; Plug-flow reactors Introduction to primary, secondary and tertiary treatment;
Week 5 : Preliminary and Primary Treatment Processes: Screening; Grit removal; Equalization tank; Sedimentation theory; Rectangular and circular sedimentation tanks
Week 6 : Secondary Treatment Processes: Biological treatment of wastewater; Microbial ecology and growth kinetics; Types of microorganisms; Aerobic and anaerobic processes; Suspended and attached growth systems; Activated sludge process; Tricking filters and Rotating biological contactors
Week 7 : Secondary Treatment Processes - Anaerobic: Anaerobic treatment; Anaerobic decomposition of organic matter; Fluidized bed systems; Upflow anaerobic sludge blanket systems; Biogas production and collection; other reactor configurations
Week 8 : Sludge Management: The quantity and characteristics of sewage sludge; Sludge dewatering, drying, and thickening; Sludge digestion; Aerobic and anaerobic sludge stabilization; Composting
Week 9 : Tertiary (Advanced) Treatment Processes: Need and Objectives of advanced treatment; Nutrient (N and P) removal; Chemical treatment processes; Advanced oxidation processes; Adsorption and Ion-exchange; Membrane processes
Week 10 : Current Treatment Approaches: Conventional systems; Integrated treatment systems; Advanced reactor configurations; SBR, MBR and MBBR; Application and case studies
Week 11 : Wastewater Recycling: Scope and demands; Types and stages of recycling; Recycling requirements; Designated reuse criteria; centralized vs decentralized recycling systems.
Week 12 : Technology Selection and Decision Making: Research trends in wastewater treatment and recycling; Choice modelling and decision making; Risks and challenges; Socio-economic perspectives; Case studies