

ENVIRONMENTAL ENGINEERING – II

Course Code: CIV 603

Credit Units: 03

Total Hours: 30

Course Objective:

The objective of the course is to make students gain insight into how the water and wastewater gets transported through conduits and open channels, and use the same for the design, operation and maintenance of these systems, to provide an in depth understanding of physical and physico-chemical processes used for water and wastewater treatment systems and to provide capability to design such systems.

Course Contents:

Module I: Water Quality Engineering. Fundamental theory underlying the unit processes utilized in the treatment of water for domestic and industrial usage, and in the treatment of domestic and industrial wastewaters: **(5 Hours)**

Module II: Transport of wastewater: Sanitary Sewerage Systems: Flow estimation, sewer materials, hydraulics of flow in sewers, sewer lay out, sewer transitions, materials for sewers, appurtenances, manholes, sewer design, conventional and model based design, sewage pumps and pumping stations, corrosion prevention, operation and maintenance, safety. Storm water Drainage Systems: Drainage layouts, storm runoff estimation, hydraulics of flow in storm water drains, materials, cross sections, design of storm water drainage systems, inlets, storm water pumping, operation and maintenance: **(10 Hours)**

Module III: Physico-Chemical Processes for wastewater treatment.

Water purification in natural systems, physical processes, chemical processes and biological processes. Primary, secondary and tertiary treatment. Unit operations, unit processes. Aeration and gas transfer. Sedimentation, different types of settling, sedimentation tank design. Coagulation and flocculation, coagulation processes, stability of colloids, destabilization of colloids, destabilization in water and wastewater treatment, transport of colloidal particles, design aspects: **(5 Hours)**

Module IV: Biological processes for contaminant removal

Characterization of waste. Aerobic, anaerobic and anoxic systems. Suspended and attached growth biological systems. Activated Sludge process and process modifications, Process design considerations, Treatment Ponds and aerated Lagoons, aerobic pond, facultative pond, anaerobic ponds, polishing ponds, constructed wet lands etc. Attached Growth Biological Treatment Systems, Trickling Filters, Rotating Biological Contactors, Activated Biofilters, Moving bed biological reactor (MBBR), Sequential Batch reactors (SBR), Membrane Biological Reactors (MBR) etc. Anaerobic processes, Process fundamentals, Standard, high rate and hybrid reactors, Anaerobic filters, Expanded /fluidized bed reactors, Upflow anaerobic sludge blanket reactors, Performance and design aspects, Expanded granular bed reactors, Two stage/phase anaerobic reactors. Sludge Digestion, anaerobic digestion, aerobic digestion: **(10 Hours)**

Course Outcomes:

After successfully studying this course, students will:

- Able to make students gain insight into how the water and wastewater gets transported through conduits and open channels, and use the same for the design, operation and maintenance of these systems, able to provide an in depth understanding of physical and physico-chemical processes used for water and wastewater treatment systems and to provide capability to design such systems.
- Develop understanding of basics of microbiology, metabolism and energetic, bio kinetic parameter, reactors and reactor analyses.

Examination Scheme:

Components	HA	V/S/Q	CT	AT	ESE
Weightage (%)	7	8	10	5	70

Text & References:

- Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
- Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
- Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw - Hill International Editions, New York 1985.
- MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.
- Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
- Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
- Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
- Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

