

ENVIRONMENTAL ENGINEERING

Course Code: 20CE1125

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Pre-requisites: Chemistry, Environmental Science, Fluid Mechanics, Hydraulics & Hydraulic Machinery

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Assess the quality and quantity of water requirements for a city (L3)

CO2: Design of different treatment units and distribution systems for water supply (L3)

CO3: Analyze the characteristics, collection, conveyance and disposal of wastewater (L3)

CO4: Design of sewers and various units in a wastewater treatment plant (L3)

CO5: Design of secondary and biological treatment units (L3)

UNIT-I

(10 Lectures)

WATER DEMANDS- STANDARDS -SOURCES:

Aspects of Environmental Engineering – Protected water supply – Need – Water demands – Fluctuations – Design period-Population forecast – Water quality – Drinking water standards- Testing and significance – Quality and Quantity and other considerations of surface and sub-surface sources – Yield calculations – Intake works – Storage reservoir capacity – Systems of water supply – Requirements – Detection of leakages – Selection of pump – Economical diameter of pumping main.

Learning outcomes:

At the end of the unit, the student will be able to

1. Explain the concept and importance of protected water supply (L2)
2. Estimate the Population by using different forecasting methods (L3)
3. Discuss the types of water demand and factors affecting fluctuations (L2)

UNIT-II

(10 Lectures)

TREATMENT OF WATER AND DISTRIBUTION:

Water treatment, conventional treatment flow diagram –Sedimentation types – Principles – Design factors – Coagulation –Design of Clariflocculator – Filtration – Slow, Rapid gravity filters and Pressure filters – Design Principles-Disinfection – Theory of Chlorination– Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipe method. Valves – Other appurtenances.

Learning outcomes:

At the end of the unit, the student will be able to

1. Explain the Layout and treatment units of the water treatment plant (L2)
2. Describe sedimentation, uniform settling velocity principles, surface loading rate (L2)
3. Illustrate the optimum dosage of coagulant using a jar test (L3)

UNIT-III

(10 Lectures)

WASTEWATER MANAGEMENT:

Introduction: Waste water treatment system – Definitions of terms – Collection and conveyance of sewage – Sewage flow rates – Storm water – Characteristics of sewage– Cycles of decay – BOD – COD – Ultimate disposal of sewage–self-purification of rivers– sewage farming.

Learning outcomes:

At the end of the unit, the student will be able to

1. Differentiate Conservancy and water carriage systems (L2)
2. Estimate the storm water flow, combined flow for the design of sewers (L3)
3. Explain the characteristics of sewage (L2)

UNIT-IV**(10 Lectures)****DESIGN OF SEWERS AND PRIMARY TREATMENT:**

Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewage treatment – Primary treatment: - Screens – Grit chamber – Sedimentation tanks – Design principles. Septic tanks and Imhoff tanks - rural latrines – House plumbing – Appurtenances.

Learning outcomes:

At the end of the unit, the student will be able to

1. Analyze the design of sewers, shapes and materials (L3)
2. Explain the Layout and treatment units of the wastewater treatment plant (L2)
3. Discuss the factors affecting the design of a septic tank for a community (L2)

UNIT-V**(10 Lectures)****SECONDARY BIOLOGICAL TREATMENT:**

Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Low cost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons. Sludge Digestion – Design principles – Disposal.

Learning outcomes:

At the end of the unit, the student will be able to

1. Evaluate the design of biological treatment, standard and high rate Trickling filters (L3)
2. Differentiate between Attached growth and suspended growth processes (L2)
3. Illustrate various methods of sludge disposal (L3)

Text Books:

1. S.K.Garg, “Water Supply Engineering”, Vol. 1, 20th Edition, Khanna Publications Pvt. Ltd, 2011.
2. B.C. Punmia, “Water Supply Engineering”, Vol. 1, “Waste Water Engineering Vol. II”, 2nd Edition, Ashok Jain & Arun Jain, Laxmi Publications Pvt. Ltd, New Delhi, 2008.

References:

1. Hammer and Hammer “Water and Wastewater Technology”, 4th Edition, Prentice Hall of India, 2003.
2. Fair, Geyer and Okun, “Water and WasteWater Engineering”, 3rd Edition, Wiley, 2010.
3. Metcalf and Eddy, “Waste Water Engineering”, 3rd Edition, Tata McGraw Hill, 2008.
4. G.S. Birdi, “Water Supply and Sanitary Engineering”, DhanpatRai& Sons Publishers, 8th Edition, 2010.