FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF

CIVIL ENGINEERING

Marwadi University
Marwadi Chandarana Group

Water and Wastewater Engineering

01CI0622

Objective of the Course:

- To design the water supply schemes, distribution systems, and treatment units.
- Understand the technologies of processes/systems.
- Design of wastewater treatment processes/systems.
- To determine the treatment efficiency of treatment units.

Credit Earned: 04

Pre-requisite of course: Basic knowledge of Environmental Engineering.

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to:

1. Discover general design considerations of water and wastewater treatment systems.
2. Analyze the water distribution systems in terms of their applicability.
3. Design the primary treatment units of water and wastewater handling systems.
4. Design biological treatment units of wastewater handling infrastructures.
5. Evaluate existing practices of sludge management, and general design considerations.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	01	00	04	50	30	20	25	25	150

Detailed Syllabus

Sr. No.	Title of the unit	Number of Hours
1	**Water treatment plant**	**8**
	1.1 Overview of collection and conveyance of raw water from source: Intakes, types of intakes, conveyance of water.	2
	1.2 Design of pumps and gravity and rising mains Layout plan and section of water treatment plant.	2
	1.3 Estimation of raw water discharge for treatment plant, Design period, and factors considered for selection of design period.	2

	1.4 Treatment plant site selection, factors considered, future stages of expansion, selection of treatment train.	2
2	**Water treatment processes and treatment units**	**10**
	2.1 Plain sedimentation, aeration, sedimentation tank & its design, sedimentation with coagulation, optimum dose of coagulants, mixing devices, design of flocculation unit.	3
	2.2 Theory of filtration, types of filters and their comparison, design of rapid sand filter, washing of filter.	2
	2.3 Methods of disinfection, methods of removing hardness Computation of dose of chemicals for removal of hardness.	2
	2.4 Distribution system: Layouts of distribution networks, Components of distribution system, Newton's and Hardy cross methods for network analysis.	2
	2.5 Storage capacity of ESR and underground reservoir, determination of location and height of ESR.	1
3	**Collection of sewage & estimation of its discharge**	**6**
	3.1 Different types of sewers, sewerage systems, variation in sewage flow, sewer appurtenance, estimation of wastewater discharge in a sewer in sewerage system.	3
	3.2 Estimation of storm water discharge in urban area, separate and combined sewerage systems, laying and testing of sewers.	3
4	**Unit operations/ processes for wastewater treatment:**	**8**
	4.1 Layout plan and section of municipal wastewater treatment plant, Physical unit operation screening.	2
	4.2 Flow equalization, mixing, flocculation, sedimentation, chemical unit processes-chemical precipitation.	2
	4.3 Biological unit processes: Aerobic attached growth and aerobic suspended growth treatment processes, anaerobic suspended growth treatment processes, an aerobic suspended growth treatment process.	3
	4.4 Wastewater reuse and recycling.	1
5	**Design of wastewater treatment units**	**10**
	5.1 Design of racks, screens, grit chamber, aeration units, primary & secondary clarifiers.	4
	5.2 Activated sludge plant and trickling filter units, rotating biological contactors.	3
	5.3 Sludge management: sludge dewatering units, sludge digesters and drying beds.	3
	Total	**42**

List of Tutorials

1. Treatment schemes and general design consideration of water treatment systems.
2. Treatment schemes and general design consideration of wastewater treatment systems.
3. Design problems on Screen.
4. Design problems on Grit chamber.

5. Design problems on Oil removal units, and equalization chamber.
6. Numerical on settling tank.
7. Numerical on Clariflocculator design.
8. Design problems on completely mixed activated sludge process.
9. Design problems on RBC and bio tower units.
10. Design of sludge handling/management units.
11. Case study on an actual water treatment plant design.
12. Case study on an actual wastewater treatment plant design.

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
10%	20%	25%	25%	20%	0%

Instructional Method and Pedagogy:

1. The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching method by white board, may also use any of tools such as collaborative learning, demonstration, role play, Quiz, brainstorming, MOOCs, Active Learning Assignments etc.
2. The internal evaluation will be done based on continuous evaluation of students in the classroom and tutorial sessions.
3. Students will use supplementary resources such as online videos, Swayam, NPTEL videos, e-courses.

Recommended Study Material

Reference Books:

1. Environmental engineering volume 1 and 2 by S.K. Garg, Khanna publisher.
2. Environmental engineering volume 1 and 2 by B.C. Punamia, Laxmi publication.
3. Water supply and sanitary engineering by G.S. Birdie and J.S. Birdie.
4. Environmental pollution engineering by C.S. Rao Wiley eastern.

5. Metcalf and eddy, (revised by G. Tchobanoglous) Wastewater Engineering: Treatment, disposal reuse, Tata-Mc Graw Hill, New Delhi
6. Wastewater treatment plants, Planning Design and Operation, Syed Qasim, CRC Press.
7. Water Works Engineering: Planning, Design and Operation, Syed R. Qasim, Edward M. Motley, Guang Zhu, CRC Press

Web Link:

1. Water and wastewater treatment
   https://onlinecourses.nptel.ac.in/noc21_ce25/preview
2. Urban Utilities Planning: Water Supply, Sanitation and Drainage
   https://onlinecourses.nptel.ac.in/noc21_ar13/preview
3. Wastewater Treatment and Recycling
   https://onlinecourses.nptel.ac.in/noc21_ce49/preview