GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL ENGINEERING (13)
DESIGN OF WATER TREATMENT UNITS
SUBJECT CODE: 2161306
B.E. 6th SEMESTER

Type of course: Applied Science

Prerequisite: Knowledge of subject Physico chemical Treatment Technologies

Rationale: To learn the procedure and calculations for design of water treatment plant

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	2	0	6	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Sources of water and water treatment schemes: (i) Regulatory water quality standards (ii) Selection criteria (iii) Surface water treatment. (iv) Ground water treatment	5	10
2	Flow measuring devices for water treatment	4	5
3	Screens for water treatment	4	5
4	Rapid mixers & flocculators (i) Chemical dosing calculations (ii) Chemical mixing devices (iii) Types and design of rapid mixers (iv) Types and design of flocculators	5	10
5	Clarifiers , Clariflocculators & tube settlers for water treatment (i) Types of sedimentation tanks (ii) Inlet and out let arrangements. (iii) Design of plain sedimentation tanks: Rectangular and circular. (iv) Design of clariflocculator (v) Design of tube settlers	5	10
6	Filtration systems for water treatment. (i) Design of Rapid sand filter. (ii) Design of under drainage system and wash water trough. (iii) Design of multi media filter	5	10
7	Disinfection (i) Chlorine dose calculations (ii) Gas chlorination facilities and auxiliaries	5	10

8	Special water treatment (i) Process selection (ii) Water softening calculations ; Design of softeners ; DM plants (iii) RO plants (iv) Iron and manganese removal (v) Deflouridation systems	10	20
9	Layout and hydraulic profile of water treatment plant	4	5
10	Water treatment plant residuals	5	10
11	Point of use treatment /Domestic level treatment systems (i) Water softeners (ii) Activated Carbon filters (iii) RO systems	4	5

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**15**	**15**	**10**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Design of Water Treatment Plants by Dr A G Bhole Published by Indian Water Works Association
2. Water Works Engineering Planning ,Design & operation by Syed R Qasim,Edward M Motley & Guang Zhu Published by Prentice Hall of India.
3. Environmental Engineering – A design approach by Arcadio P. Sincero & Grecjoria A. Sincero (Prentice Hall of India).
4. Water Quality and treatment Published by American Water Works Association

Course Outcome:

After learning the course the students should be able to:

1. Identify the source of water and select the treatment scheme based on the source selected.
2. Choose the flow measuring device.
3. Identify the different types of aeration systems, rapid mixers, flocculators and choose the relevant type for water treatment plant.
4. Design sedimentation tanks, clariflocculator, filtration system and disinfection units for conventional water treatment plants.
5. Design treatment units for special water treatment .
6. Decide the layout and hydraulic profile of water treatment plant.
7. Prepare a detailed working drawing of the designed units.

List of Tutorials:

1. Sketches and description of treatment schemes for surface and ground water sources.
2. Sketches and description of flow measuring devices for water treatment.
3. Numericals on Chemical dosing and design of rapid mixers.

4. Sketches and description of Rapid mixers and flocculators.
5. Sketches and description of types of sedimentation tanks.
6. Numericals on design of clariflocculators and tube settlers for water treatment..
7. Numericals on design of rapid sand filter.
8. Numericals on water softening calculations and design of softeners and DM plants.
9. Assignment on Iron and manganese removal.
10. Design of defluoridation systems.
11. Assignment on domestic level treatment systems.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.