GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL ENGINEERING (13)
PHYSICO - CHEMICAL TREATMENT TECHNOLOGIES
SUBJECT CODE: 2151303
B.E. 5th SEMESTER

Type of course: Applied Science

Prerequisite: Knowledge of subjects Environmental Sciences I and II

Rationale: To learn the principles and theories behind the treatment of water and wastewater by physical and chemical processes

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Characteristics of water and wastewater, types of treatment, conventional water and wastewater treatment, Analysis of wastewater flow rates: components of wastewater flows, statistical analysis, constituent characteristics and mass loadings.	06	11
2	Preliminary treatment of water and wastewaters: : Screens, purposes, types of screens and Headloss in screens; Grit chambers: purposes and types of grit chambers.	06	11
3	Primary Treatment of water and wastewater : Coagulation and Flocculation: Colloid characteristics, chemistry of metallic coagulants, polyelectrolytes as coagulant, mixing of coagulants, power requirement; Flocculation: Types of flocculation, types of flocculators, Design considerations, power requirement II. Sedimentation: Purposes, Sedimentation types, Sedimentation Zones, Types of sedimentation tanks, Analysis of discrete settling, flocculant settling, zone settling and compression settling, design parameters, tube settlers III Filtration: Mechanisms of filtration, hydraulics of filtration, different types of filters, filter clogging, filter washing IV Disinfection: Purposes, Characteristics of ideal disinfection, Disinfection methods and mechanisms, Factors affecting, Disinfection with chlorine, chlorine dioxide, ozone, ultraviolet radiation	34	60
4	Sludge dewatering , treatment and disposal: Sources of sludge; estimation of bulk density of sludge, principles of dewatering; methods of dewatering and the suitability, dewatering machines ; chemical conditioning; elutriation; vacuum and pressure filtration, thickening of waste sludges , sludge drying beds, design of	10	18

	sludge drying beds. Aerobic and anaerobic sludge digestion.		

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**	-

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. Water Supply & Sewage Systems by McGhee (5th Edition-McGraw-Hill Kogakusha Ltd.)
2. Waste water Engineering Treatment & Reuse by Metcalf and Eddy (4th Edition – Tata McGraw-Hill Publishing Company Ltd.)
3. Environmental Engineering by Peavy and Rowe
4. Environmental Engineering by Mckenzie Davis and Cornwell (3rd Edition-published by WCB McGraw-Hill)
5. Wastewater Treatment for Pollution Control by Soli J Arceivala (2nd Edition- Tata McGraw-Hill Publishing Company Ltd.)

Course Outcome:

After learning the course the students should be able to do:

1. Identify the physical and chemical treatment units.
2. Relate the parameters with types of treatment required and identify the types of treatment required.
3. Evaluate the removal efficiencies of physico-chemical treatment units.
4. Select optimized dose of chemical coagulation as well as disinfecting agents.
5. Justify the types of disinfection process for treatment of water.

List of Experiments:

1. Determination of optimum coagulant dose using multiple Jar Test Apparatus.
2. Determination of effect of coagulant dose on pH and alkalinity of water.
3. To measure Ammonical Nitrogen from waste water.
4. Determination of Residual Chlorine in drinking water.
5. Determination of removal efficiency in Type I settling using Settling Column

Design based Problems (DP)/Open Ended Problem:

1. Sketches & description of water treatment processes
2. Questions and numericals on Screens
3. Questions and numericals on Grit chamber
4. Questions and numericals on Coagulation & flocculation/flash mixer
5. Questions and numericals on Sedimentation
6. Questions and numericals on Filtration
7. Numericals on determination of Solids

8. Questions and numericals on Disinfection.

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.