GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3151303
Semester – V
Subject Name: Physico-chemical Treatment Technology

Type of course: professional Core Course

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)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
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
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
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	34

	affecting, Disinfection with chlorine, chlorine dioxide, ozone, ultraviolet radiation	
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 sludge drying beds. Aerobic and anaerobic sludge digestion	**10**

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**40**	**30**	**20**		

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 Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Outline water and wastewater parameter with type of treatment required.	10
CO-2	Describe purpose of preliminary treatment of water and wastewater.	10
CO-3	Apply concepts of various physic chemical processes with its process parameters for treatment.	60

CO-4	Explain sludge treatment and disposal methods.	20

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 numerical on Screens
3. Questions and numerical on Grit chamber
4. Questions and numerical on Coagulation & flocculation/flash mixer
5. Questions and numerical on Sedimentation
6. Questions and numerical on Filtration
7. Numerical on determination of Solids
8. Questions and numerical on Disinfection.