SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Masters of Technology
Environmental Engineering

M.Tech. I Semester I

Subject Name: Physico-Chemical Processes **Subject Code:** MTEN13101

Type of course: Core- I
Prerequisite: Basic knowledge of water and wastewater characteristics

Rationale: To study the principles, applications and design for treatment of water and wastewater by physical and chemical processes

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Core- I

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Sr. No.	Content	Total Hrs	Module Weightage
1	**Environmental Chemistry:** Types of chemical reactions, stoichiometric calculations, solutions, chemical equilibrium, Acid base equilibria, alkalinity, acidity, buffers and buffer index, Chemical thermodynamics, Oxidation, Reduction, Mass transfer and transport of impurities in water and air ,diffusion, dispersion , Physical and chemical interactions due to various forces, suspensions and dispersions.	7	15%
2	**Water Quality and Quantity:** Drinking water quality parameters; water quality criteria/standards, Estimate water for domestic and industrial requirement, statistical analysis, constituent characteristics and mass loadings, types of treatment, conventional water and wastewater treatment, Analysis of wastewater flow rates: components of wastewater flows	8	15%
3	**Sedimentation, Coagulation and filtration:** Purposes, Sedimentation types, Sedimentation Zones, Types of sedimentation tanks, Analysis of discrete settling, flocculant settling, zone settling and compression settling, design parameters, tube settlers. Mechanism of coagulation, Colloid chemistry, Modeling coagulation process, Effect of turbidity and alkalinity,Chemistry of coagulants, Design of coagulation process. Mechanisms of filtration, hydraulics of filtration, different types of filters, Slow and rapid sand filters. Dual media filters, filter clogging, filter washing.	12	30%
4	**Disinfection:** Processes, Chemical and non-chemical methods, Chlorination, Methods, Uses, Limitations.	5	10%
5	**Design Aspects**: Design problems on Unit operations and process in water and wastewater treatment	13	30%

Suggested Specification table with Marks (Theory):

% Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level

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15	**15**	**20**	**20**	**15**	**15**

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:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Chemistry for Environmental Engineering	Clair Sawyer, Perry McCarty and Gene Parklin	McGraw Hill Education	1 July 2017	Fifth
2	Physicochemical processes for water quality control	John Wiley and sons	New York, Wiley-Interscience	Newyork, 1983	--
3	Environmental Engineering	Peavy, H.S., Rowe, D.R. and Tchobanoglous, G.	McGraw Hills	2017	First
4	Wastewater Engineering, Treatment and Reuse	Metcalf and Eddy	Tata McGraw-Hill Publication	New Delhi, 2003	Fourth
6	Water Treatment Unit Processes – Physical and Chemical	Hendricks, D	CRC Press,	New York 2006	First

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7	Wastewater Treatment: Concepts and Design Approach	G.L. Karia, R. A. Christian	Prentice Hall India Learning Private Limited	1 January 2013	Second
8	Water and Wastewater Engineering: Design Principles and Practice	Mackenzie Leo Davis	McGraw-Hill	2010	First

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Study pertinent forcing criteria into physical and chemical treatment systems and standards. (R,U cognitive level)	10%
CO-2	Study the basics principle of various physical, chemical processes. (U,A,R cognitive level)	30%
CO-3	Evaluate the removal efficiencies of physico-chemical treatment units. (E,N cognitive level)	20%
CO-4	Developed conceptual schematics required for the treatment of water and wastewater. (C,N,N cognitive level)	10%
CO-5	Design various treatment processes for treatment of water and wastewater. (N, E, U cognitive level)	30%

List of Open learning website: https://nptel.ac.in/courses/105/107/105107207/

https://nptel.ac.in/courses/105/106/105106119/

FOR LAB SESSIONS:

List of Experiments:

- Introduction to Standards, collection and preservation of samples, sampling techniques and laboratory equipment

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- Physical Parameters of water & wastewater quality like turbidity, conductivity, colour and odour etc.
- Major Chemical Characteristics of water & wastewater like Solids, DO, Chlorides, Hardness, Acidity, Alkalinity, heavy metals etc. using most modern instruments
- Jar Test for determining optimum dosage of coagulant
- Experimentation based on Optimum doses required for different field condition turbidity
- Model of water & wastewater treatments

Major Equipment Needed:

- Jar Test Apparatus
- Titration Apparatus
- pH meter
- Conductivity Meter
- Hot Air Oven
- BOD Incubator
- Dissolved Oxygen Meter
- Turbidity meter
- Microscope
- Spectrophotometer

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