

## PHYSIO-CHEMICAL TREATMENT PROCESSES

**Paper Code: ETEN-202**

**Paper: Physico-Chemical Treatment Processes**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

### **INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

### *Objective:*

- (1) *To become familiar with conventional and advanced physical and chemical processes used to purify water, wastewater and air emissions.*
- (2) *To understand the basic principles of design and operation of a variety of treatment processes;*
- (3) *To be able to calculate basic process parameters such as needed disinfection contact times, sizing of sedimentation basins, filter flow rates, number of membrane modules needed for treatment of a given feed flow rate, etc.*

### **UNIT – I**

Unit operations and their applications in treatment of water, Sewage, Industrial effluent and emissions. Mixing and Flocculation: Gravitational, Mechanical and Pneumatic devices, Types of impellers. Sedimentation: Discrete settling, Flocculent settling, Hindered or Zone settling, Compression settling. Long tube settling tests, sedimentation equipment, Batch flow and continuous flow operations. Principles, Design concepts and suitability of gravity settlers and sludge thickeners. Flotation and aerosol separation: Methods of flotation, chemical agents promoting flotation, gas particle contact. Aerosol characteristics and their separation, Particle characteristics.

**[T1,T2][No. of Hours 12]**

### **UNIT – II**

Flow through beds of solids : Slow sand filters, Rapid sand filters, Pressure filters, Ion exchange units, Adsorption towers, Flow through expanded beds, Flow through porous plates and membranes.

Gas transfer: Mechanism of transfer, Film coefficients and equilibrium relationships, Gas dispersion. Principles, Design concepts and suitability of packed columns, Tray columns, Spray units etc.

**[T1,T2][No. of Hours 11]**

### **UNIT – III**

Principles, Design concepts and suitability of Adsorption (fixed bed and moving bed), absorption and desorption.

Membrane System: Reverse Osmosis, Electrodialysis, Ultrafiltration, Nanofiltration.

**[T1,T2][No. of Hours 11]**

### **UNIT – IV**

Principles, Design concepts and suitability of centrifugal separators, Impingement separators, Electrostatic precipitators and scrubbers, Chemical precipitation, Vacuum filtration and hydraulic press.

**[T1,T2][No. of Hours 11]**

### **Text Books:**

[T1] Davis M.L., Cornwell D.A., "Introduction to Environmental Engineering", Tata McGraw Hill Education (P) Ltd., New Delhi.

[T2] Peavy H.S., Rowe D.R., Tchobanoglous G., "Environmental Engineering", Tata McGraw Hill Education (P) Ltd., New Delhi.

### **Reference Books:**

[R1] Sincero A.P. and Sincero G.A., "Environmental Engineering- a Design Approach", PHI

[R2] Qasim S.R., "Water Works Engineering", PHI Learning (P) Ltd., New Delhi.

[R3] Droste R.L., "Theory and Practice of Water and Wastewater Treatment", Wiley India (P) Ltd.,

[R4] Hammer M.J. and Hammer M.J., Jr., "Water and Wastewater Technology",

[R5] Metcalf and Eddy, "Wastewater Engineering- Treatment and reuse," TMH

[R6] Arceivala S.J. and Asolekar S.R., "Wastewater Treatment for Pollution Control and Reuse", TMH

[R7] Weber W.J., "Environmental Systems and Processes: Principles, Modeling and Design", John Wiley and Sons.