WATER ANALYSIS AND TREATMENT

Semester	Subject Code	Category	Lecture Hours		Theory Hours		Practical Hours		Credits
			Per week	Per sem.	Per week	Per sem.	Per week	Per sem.	
IV	21SCH4A	Skill based-II	2	30	2	30	-	-	2

COURSE OBJECTIVES:

The students will be able to

- Gain introductory idea about various methods of purification, removal of hardness and analysis of water.

COURSE OUTCOMES:

On the successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Learn the various water sources, characteristics and physical methods of purification of water.	K4
CO2	Know different softening techniques of water and to determine hardness of water.	K4
CO3	Understand the softening of water by boiler methods, desalination of brackish water and effluent treatment of water from various industries.	K3
CO4	Understand the analyses of chemical substances of water collected from various industries and properties of water samples.	K3
CO5	Learn about analyses of chemical substances affecting health and bacterial examination of water. Learn to protect our health and well-being.	K2

*CO –Course Outcomes

Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze.

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	S
CO2	S	S	S	M	S	S
CO3	S	S	S	S	S	M
CO4	M	S	S	S	S	S
CO5	S	S	S	S	M	S

(S – Strong; M – Medium; L – Low)

UNIT-I: Characteristics and Purification of Water **6 Hours**

1.1 Introduction – Sources and characteristics of water – Alkalinity, Hardness, Total Dissolved Solids, Oxidation, Transparency and Silica content.

1.2 Purification of water for drinking purpose – Potability of water – Clarification – Coagulation – Contact and electrochemical coagulation – Sterilisation and disinfection of water – Precipitation – Aeration – Ozonisation– Chlorination– Break point Chlorination.

UNIT-II: Water Softening Methods and Determination of Hardness of Water **6 Hours**

2.1 Difference between Hard water and Soft water – Water softening methods – Clark's process – Lime soda process – Permutit or Zeolite process – Ion exchange (demineralization) process.

2.2 Determination of Hardness of water – Titration method – Complexometric method using EDTA.

UNIT-III: Water Treatment Methods **6 Hours**

3.1 Hard water and industries – Industrial water treatment – Boiler feed water method of softening – Prevention of plumbo solvency – Scales and sludge formation in boilers, consequences – Internal conditioning methods – Priming and foaming.

3.2 Desalination of brackish water – Electrodialysis – Reverse osmosis – Effluent treatment of water from paper industry, petrochemical and fertilizer industries – IS 15453 (2004) packaged drinking water.

UNIT-IV: Sampling Techniques and Analysis **6 Hours**

4.1 Water analysis – Sampling of water for analysis – Chemical substances affecting potability – Colour, turbidity, odour, taste, temperature, pH and electrical conductivity.

4.2 Analysis of solids present in water – Analysis of suspended solids, dissolved solids, total acidity, alkalinity, free chlorine, free CO_2, calcium, magnesium, iron, manganese, zinc and silver.

UNIT-V: Bacteriological Examination of Water **6 Hours**

5.1 Analysis of chemical substances affecting health – NH_3, sulphate, chloride and fluoride – measurement of toxic chemical substances – Dissolved oxygen (DO) – Biochemical oxygen demand (BOD) – Chemical oxygen demand (COD).

5.2 Bacteriological examination of water – Total count test – *E. coli* index – Most probable number (MPN) method – WHO drinking water standards.

Demonstration experiments:

- Estimation of temporary and permanent hardness.
- Estimation of calcium and magnesium hardness.
- Estimation of chloride.
- Determination of conductance of wastewater
- Estimation of sulphate.

TEXT BOOKS:

S. No.	Authors	Title	Publishers	Year of publication
1.	S. P. Mahajan	Pollution Control in Process industries	Tata McGraw-Hill Publishing Company Ltd., New Delhi	1991
2.	P. E. John De Zuane	Handbook of Drinking Water Quality	John Wiley and Sons, Inc.	1996

REFERENCE BOOKS:

S. No.	Authors	Title	Publishers	Year of publication
1.	C. K. Varashney	Water Pollution and Management	Wiley Eastern Ltd., Chennai	1991
2.	B. K. Sharma	Industrial Chemistry [including Chemical Engineering]	Goel Publishing House, Meerut	1987
3.	P. N. Sudha	Water Analysis and Treatment	Supra Associates	2007

TEACHING METHODOLOGY:

- Chalk and board teaching
- Power point presentation
- Group discussion
- Seminars
- Assignments

SYLLABUS DESIGNER:

- Dr. N. Dhanam, Assistant Professor of Chemistry