

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ENVIRONMENTAL ENGINEERING (17) ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY SUBJECT CODE: 2711702 SEMESTER: I

**Type of course:** Engineering and Technology

**Prerequisite:** Student shall have studied basics of chemistry and microbiology

**Rationale:** To educate the students about the chemistry of water, air and soil and to give an exposure in the laboratory for determination of environmental pollutants.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
		ESE			OEP	PA	RP			
3	2#	2	5	70	30	20	10	10	10	150

### Content:

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Significance of Environmental Chemistry in Environmental Engineering</b> Units of Measurement, Stoichiometry. Basic Concepts from General Chemistry, Physical Chemistry, Organic Chemistry, Equilibrium Chemistry, Colloidal Chemistry and nuclear Chemistry as applied to the Measurement of Pollution Parameters.	8	19
2	<b>Methods of Chemical Analysis</b> Analysis applicable to water, waste water and Air quality principles of analysis of gravimetric, Volumetric, Colorimetric, photoelectric, Polarographic and Gas Chromatographic methods: Applications of above analysis methods for testing of Turbidity, colour , pH, acidity , alkalinity, Hardness, Dissolved Oxygen, Biochemical Oxygen Demand , Nitrogenous compounds, Sulphurous compounds, etc..	7	17
3	Principles of Optical Methods such as Absorption, Spectrophotometry, Flame photometry, Fluorometry etc	6	14
4	Scope and Areas of Environmental Microbiology, Cell and its Structure, Introduction to Enzyme and Metabolic Reactions, Aerobic and anaerobic respiration, Classification.	8	19
5	Microscopy and Micrometry, Observations, Measurements and Isolation of Microorganism, Different Cultures, Media and Techniques of Staining and Enumeration of microorganism.	6	14
6	Applied Microbiology of Soil, Air, Water and Biological Processes of Wastewater Treatments, Industrial Microbiology.	7	17

### Reference Books:

1. Chemistry for Environmental Engineering and Science, C.N Sawyer, P.L McCarty and G.F Parkin, 5th ed., Tata McGraw-Hill, 2003
2. Standard Methods of Testing of Water and Wastewater Use by APHA, AWWA, AND WPCF (USA) – Latest Edition
3. Physico Chemical Examination of Water Sewage and Industrial Effluents, Pragati Prakashan, Meerut, India
4. Environmental Chemistry by Manahan, S.E., Eighth Edition, CRC press,2005
5. Elements of Environmental Chemistry by Ronbald A. Hites, Wiley, 2007
6. Fundamental of environmental Chemistry by Stanley E. Mahajan – Lewis Publishers
7. Microbiology by Plezar, Chan, Krieg - McGraw Hill
8. Environmental Microbiology by E. Gaudy and Gaudy – McGraw Hill
9. Environmental Microbiology by Maier, R.M., I.L. Pepper and C.P. Gerba, Academic Press, New York, 1999

**Course Outcome:** After successful completion of the course the students shall be able to understand

- Basics of environmental chemistry and microbiology and its applications in environmental engineering field
- Type of microorganisms in the environment and the role of microorganisms in the cycling of nutrients in an ecosystem.
- Role microbial metabolism in a wastewater treatment plant.
- Role of microorganisms in contaminated water and the diseases caused.

### List of Experiments:

1. Water and Waste Water Sampling, Preservation and storage. Exposure Integrated, Composite and grab sampling techniques and instrumentation
2. Gravimetric Analysis : (a) Total solids (b) Sulphate determination
3. Volumetric Analysis of water and Waste water : Acidity, Alkalinity, Hardness: total & Calcium hardness Chloride and the like
4. Colourimetric Analysis: (a) pH (b) Fluoride, (c) Chlorine (d) Turbidity etc.
5. Determination of parameters of major chemical parameters like Nitrogen compounds, Phosphorous compounds
6. Practical demonstration of Microscope and Microbes
7. Preparation of culture media including isolation
8. Identification of Micro organisms and staining of bacteria
9. Experiment on Testing of culture media and microbial growth
10. Experiment on MPN test
11. Experiment on Confirmation test of Coliform organisms

**Design based Problems (DP)/Open Ended Problem: --**

### Major Equipments:

- Titration Apparatus

- pH meter
- Hot Air Oven
- Turbidity meter
- Spectrophotometer
- Microscope
- Autoclave

**List of Open Source Software/learning website:**

- <http://nptel.ac.in/>
- <http://elearning.vtu.ac.in/>