SEMESTER-I

Course Code	Course Title	Course Type	Credits	Contact Hours		
				L	P	T
CE-501	Biological Process of Wastewater Treatment	DC	4	3	0	1

Unit 1

Principles of Biological Treatment, Treatment Kinetics, Substrate Removal Efficiency, Kinetics of Organics Removal, Substrate Utilization and Biomass Growth, Monod's Kinetics, Estimation of Kinetic Parameters, Cell Yield, Sludge Settling, Nutrient Requirements.

Unit 2

Activated Sludge Process Description and its Modifications, Process Design, Process Performance Evaluation and Troubleshooting, Extended Aeration, Design of Aeration Systems, Design of Secondary Settlers, Sludge Bulking and Foaming.

Unit 3

Biofilm Processes, Trickling Filter, Biotowers, Substrate Removal Attached Growth System, Rotating Biological Contactors, Oxidation Ditches, Stabilisation Ponds and Aerated Lagoons-Types and their Description, Design, Operation and Maintenance, Aerobic Digestion, Sequencing batch reactor and Process Design, Wetland Treatment Systems, Membrane Bioreactor, Moving Bed Biofilm Reactor.

Unit 4

Biological Nutrient Removal, Nitrification and Denitrification- Process Kinetics, Treatment Plants for Nitrification and Denitrification, Anaerobic Ammonium Oxidation, Biological, Biological Phosphorus Removal, Theory and design of sludge treatment; Wastewater disposal systems.

Unit 5

Anaerobic Treatment Fundamentals, Kinetics of Anaerobic Treatment, Application of Anaerobic Digestion to Waste Treatment, Anaerobic Treatment Processes, Suspended Growth and Fixed Film Processes, Fixed Film Anaerobic Reactor Design, UASB Process Design for various types of Wastewaters, Anaerobic Lagoons, Anaerobic Sludge Digestion, Post Treatment of Effluents from Anaerobic Reactors, Refractory Organics, Biogas Utilization, Selected case studies.

Text Books and Reference Materials

1. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, McGraw Hill, FourthEdition,2002.

Course Code	Course Title	Course Type	Credits	Contact Hours		
				L	P	T
CE-502	Chemistry for Water and Wastewater Treatment	DC	4	3	0	1

UNIT 1

Basic Principles, Chemical Kinetics, Reaction Rates, Oxidation-Reduction reactions, Redox Stoichiometry, Applications of redox Chemistry.

UNIT 2

Chemical Equilibria, Basic concepts from Equilibrium Chemistry, Solubility Product, Common Ion Effect, Solubility Equilibria, Precipitation-Dissolution, Acid-Base Equilibria, Strong and Weak Acids, Carbonate System, pH, Buffers and Buffer Intensity.

UNIT 3

Complex Formation, Log Concentration Diagrams, Metal Hydroxide Precipitation, Metal Speciation, Water stabilization, Langlier Saturation Index, Cadwell-Lawrence Diagram **.**

UNIT4

Organic Chemistry, Aquatic chemistry, Atmospheric chemistry, Toxic Compounds, Organic Solvents, Pesticides, Dioxins, PCBs and PAHs, Surfactants, Laboratory practice for determination of ions and solids.

Text Books and Reference Materials

1. C. N. Sawyer and P. L. McCarty, Chemistry for Environmental Engineers, McGrawHill.
2. Benefield, L.D. Judkins J.F. and Weand B.L. (1982). Process Chemistry for Water and Wastewater Treatment, End ed., Prentice-Hall, Inc, New Jersey,USA

Course Code	Course Title	Course Type	Credits	Contact Hours		
				L	P	T
CE-503	Principles of Water Quality and Legislation	DC	4	3	0	1

UNIT 1

Water quality requirement, Water borne diseases, distribution of water in the hydrosphere, availability of potable water at national and global level, water cycle, Water quality indices**.** Legislations for water quality: Wastewater Effluent Discharge Standards, Indian Drinking Water Standards (IS10500), Drinking water standards prescribed by World Health Organization.

UNIT 2

Quality of water in different surface and subsurface water sources, quality of ground water sources including wells tubes wells and springs, quality of lake, river, pond and impounding reservoir water, water quality issue-case studies.

UNIT 3

Physical water quality parameters: colour, odours, taste, temperature, turbidity and suspended solids, their impact on the quality of water.

UNIT 4

Chemical quality of water: pH, Total Dissolved Solids, Alkalinity, Acidity, Hardness, Fluoride, Chloride, Nitrate, Sulphate, Iron, Heavy metals, Lithium, Calcium, Magnesium, Electrical Conductivity, Dissolved Oxygen and Organic matter(in terms of Biochemical Oxygen Demand,

Chemical Oxygen Demand, Theoretical Oxygen Demand and Total Organic Carbon) and their impact on the quality of water.

UNIT 5

Microbial quality of water: Types of microorganisms present in the water, type of diseases cussed by them, pathogens, pathogen indictors, Indicator microorganisms, Total Coliform Group, Fecal Coliform Group, Membrane Filter Technique and Multiple Tube Fermentation technique or MPN technique to determine the presence of coliform groups in water.

Text Books and Reference Materials

1. *Environmental Engineering* By Howard S. *Peavy*, Donald R. *Rowe*, George Tchobanoglous published by Tata McGraw-Hill Education.
2. W.J.Weber Physiochemical process for water quality control, John Wiley &Sons.
3. CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication.

Course Code	Course Title	Course Type	Credits	Contact Hours		
				L	P	T
CE-503P	Water Quality Lab	DC	1	0	2	0

List of Experiments:

1. Determination of the pH of given water sample
2. Determination of the alkalinity of a given water sample
3. Determination of the acidity of a water sample
4. Determination of the Electrical Conductivity of a water sample
5. Determination of the Turbidity of a given water sample
6. Determination of Chloride, Fluoride and Nitrate content in a water sample
7. Determination of Dissolved Oxygen level of a given water/wastewater sample
8. Determination of the Turbidity of a given water sample
9. Determination of Biochemical Oxygen Demand of a given water/wastewater sample
10. Determination of Chemical Oxygen Demand of a given water/wastewater sample
11. Determination of the concentration of Calcium, Lithium and Magnesium ions in a given water sample
12. To determine the concentration of TDS, TSS, TS, TVS, TVSS and TVDS in wastewater/water sample
13. Determination of the concentration of the Arsenic, Copper, Mercury and Lead in a given water/wastewater sample
14. Determination of the concentration of iron present in a given water sample
15. Determination of the Hardness of a given water sample
16. To determine the presence of coliform organisms in a water/wastewater sample using MPN technique