GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3163510
Semester – VI
Subject Name: Wastewater Treatment - III

Type of course: Professional Core Course

Prerequisite: Fundamental of wastewater treatment.

Rationale: The main objective of this subject is to make students aware about the importance of biological treatment and to make them learn design of biological treatment units.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1.	CPCB norms for wastewater discharge, Wastewater Segregation, Concept of biological treatment, Removal Mechanism, Objectives of biological treatment, Classification of treatment process, Role of microorganism in wastewater treatment, Bioaggumentation, Culture media and its type for bacterial growth.	12
2.	Microbial growth kinetics: Bio kinetic coefficients, Significant Bio kinetic coefficients, Specific growth rate, Yield coefficient, Maximum substrate utilization rate constant, Half velocity constant, Endogenous decay coefficient, Basic kinetic constants equations, Rate of oxygen uptake, effects of temperature, volatile suspended solids & active biomass, Determination of bio kinetic coefficients, MCRT, F/M ratio, Design Examples. Importance of MLSS, difference between MLSS & MLVSS.	10
3.	Aerobic suspended growth biological treatment systems: Aerobic Biological oxidation, Process description, environmental factors, Modification in ASP: Complete Mix activated sludge, Extended Aeration system, Oxidation Ditch systems, Intermittently aerated and decanted systems, Oxygen activated sludge, Oxidation ponds, stabilization ponds, Secondary settling tank, Design examples for activated sludge process, oxidation ditch, secondary settling tank. Aerobic attached Growth Biological Treatment systems: Introduction to attached growth systems, Trickling Filter, Oxygen transfer and utilization, Applications rotating biological contactors, Bio-Towers, Design Examples for rotating biological contactor, trickling filter. Operational excellence of activated sludge process.	12

4.	Anaerobic biological wastewater treatment: Introduction, Removal Concept, Design Considerations, Anaerobic reactors, Packed bed reactor, Fluidized bed reactor, Up flow Anaerobic sludge blanket reactor, high rate and multi stage anaerobic digesters. Operational excellence of UASB.	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
22	**23**	**08**	**07**	**5**	**5**

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:

- Wastewater Engineering: Treatment and Reuse, Metcalf & eddy; McGraw Hill Book Company, 4th Ed, 2002.
- Environmental Pollution and Control engineering, Rao C. S. - Wiley Eastern Limited, India, 1993
- Water Treatment Plants: Planning, Design & Control, S R Qasim, Technomic Pub. Co., 1999.
- Industrial Water Pollution Control, Eckenfelder W.W.; McGraw Hill Book Company, 3rd Ed, 2000.
- Environmental Engineering, Kiely G.; McGraw Hill Book Company, 1998.
- Pollution control in process industries, S.P. Mahajan TMH., 1985.
- Waste water treatment, M.Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.
- Industrial Pollution Control and Engineering, Swamy AVN, Galgotia publications, 2005.
- Environmental Engineering (Vol. II) - Sewage disposal and Air pollution, S.K Garg & Rajeshwari Garg, Khanna Publishers, 27th Edition, 2013.
- Environmental Engineering and Sanitation: Joseph A. Salvato, John Wiley & Sons,4th Ed. 2003
- Water Supply and Sanitary Engineering, Birdie and Birdie, Dhanpatrai and Sons, 1996.
- Environmental engineering (Vol. I) - Water Supply Engineering S.K Garg & Rajeshwari Garg, Khanna Publishers, 23rd Edition, 2013.
- Wastewater treatment concepts and design approach: GL Karia & R.A Christian.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3163510

Course Outcomes: After learning this course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	List out all the existing norms related to wastewater discharge	20
CO-2	Explain the microbial growth kinetics for treatment of wastewater	15
CO-3	Calculate the quantify the total Suspended and volatile suspended solids	15
CO-4	Differentiate between aerobic and aerobic treatment process	15
CO-5	Summarize all the methods used for treatment of wastewater	20
CO-6	Assess the treatment efficiency of anaerobic treatment process	15

List of Practicals:

- To determine Mixed Liquor Volatile suspended solids of a wastewater sample.
- To determine Mixed Liquor Suspended Solids of a wastewater sample.
- To determine Sludge Volume Index of a wastewater sample.
- To determine Coagulant dose by using jar test apparatus
- To determine residual chlorine of a wastewater sample.
- To determine Most Probable Number (MPN) in wastewater sample