GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL SCIENCE AND TECHNOLOGY (35)
LIQUID EFFLUENT TREATMENT – II
SUBJECT CODE: 2163509
B.E. 6th SEMESTER

Type of course: Environmental Science & Technology

Prerequisite: Fundamental knowledge of water and wastewater treatment process along with basic design and modeling aspects for waste water treatment process

Rationale: This subject is intended to make students aware about various types of treatment methods with their basic design aspects and safe disposal & management of solid and bio solid generated after treatments of liquid waste.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	3	7	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	Wastewater Engineering: Terminology, Impact of regulation on wastewater engineering, Current status of wastewater treatment, New direction & concern, Future trends in wastewater treatment, Reclamation & reuse, Biosolid & residuals managements. Wastewater constituents: Metallic, Individual organic compound, Biological characteristic & toxicity test.	5	10
2	Wastewater sampling and analytical procedure, Units of measurement of physical & chemical parameters. Strategies for reducing interior water use and waste water flow rates, Statistical & graphical analysis of flow rates, constituent concentration and mass loading. Selection of design flow rates and mass loading. Constituent transformation and removal process, Modeling treatment process kinetics, treatment process involving mass transfer. Important factors in process selection process selection	15	30
3	Typical design information: Screens, Grit chamber, Flow equalization, mixing & Flocculation, sedimentation. Corse solid reduction: Comminutor, Macerators, Grinders. Particle settling theory: Discrete & Flocculent particles. Flotation theory: Types & design consideration. Oxygen transfer in water and waste water & effect of physical parameter. Aeration system: Types & application, removal of VOCs by aeration	15	30
4	Chemical unit process: Removal of phosphorus, heavy metals, dissolve inorganics matter and ammonia. Chemical neutralization scale control &	15	30

	stabilization. Chemical storage, feeding, piping & control system Biological process: Substrate removal in attached growth, Aerobic biological oxidation, biological nitrification & denitrification, Biological phosphorus removal, toxic & recalcitrant organic compound removal. Disposal of solid & Bio solids: Alkaline stabilization, Aerobic & anaerobic digestion		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
17	**33**	**20**	**16**	**14**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

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

Course Outcome:

After learning this course the students would have:

1) Proper understanding about designing aspects of unit & process
2) Students will able to design treatment plant
3) Basis knowledge about treatment through chemical & biological process
4) Hands on experience on sampling and measurements of wastewater parameters

List of Experiments:

1. Intoduction to liquid effluent treatment lab.
2. To determine the MLSS (Mixed liquor suspended solids) of given wastewater sample.

3. To determine the MLVSS (Mixed liquor volatile suspended solids) of given wastewater sample.
4. To determine Total Kjeldahl Nitrogen (TKN) in wastewater sample
5. Determination of Dissolve Oxygen of wastewater sample
6. Determination of the BOD in given wastewater sample
7. Determination of COD of given wastewater sample.
8. Determination of Turbidity in a given sample..
9. Determination of Optimum dose of coagulant.
10. Determination of volatile organic compound in a given sample .

Design based Problems (DP)/Open Ended Problem:

1. Surveying the characteristics of the river water body
2. Find out the treatment efficiency of the ETPs
3. Find out the treatment efficiency of the CETP
4. Find out the treatability study for a wastewater.
5. Waste and wastewater analysis
6. Case study: water & wastewater

Major Equipment:

Glass wares, Weighing balance, Jar test apparatus, Muffle furnace, Hot Air Oven, BOD incubator, COD digester, vacuum pump etc

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.