GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Environmental Engineering
Level: Post Graduate
Branch: Environmental Management
Course/Subject Code: ME02018021
Course / Subject Name: **ANAEROBIC TREATMENT TECHNOLOGIES**

w.e.f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Knowledge of Biological treatment process and anaerobic treatment basics
Rationale:	To learn the basic principles and to develop better understanding about various aspects of anaerobic treatment technologies

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Understand the various Fundamental concepts and Applications of anaerobic treatment along with its microbiology and biochemistry
02	Describe the different Anaerobic Reactor Configurations
03	Discuss the process operation parameters of anaerobic reactors
04	Apply concepts of design of anaerobic reactors
05	Discuss treatability protocol for anaerobic Treatment technologies

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	ESE (E)	PA/ CA (M)	PA/CA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

CourseContent:

Unit No.	Content	No. of Hours	% of Weightage
1	**Anaerobic Treatment:** Fundamental concept, Application ● Applications, Advantages & disadvantages of Anaerobic Treatment. ● Principles of Anaerobic Treatment, Methanogenic series Metabolism, CO Dequivalence of Methane. ● Factors affecting Anaerobic Treatment ● Evaluating the applicability of Anaerobic Treatment	**9**	**20**
2	**Microbiology and Biochemistry of Anaerobic Treatment processes** ● Sources of Methane in Anaerobic Treatment ● Role of Acid fermentation and Methane fermentation Characteristics	**5**	**10**
3	**Anaerobic Reactor Configuration** ● Anaerobic Suspended growth processes ● Anaerobic Attached growth processes ● Anaerobic Sludge Blanket processes Treatment of raw sewage under Tropical condition	**9**	**20**
4	**Process operation parameter** ● Mixing and facilities ● Heating facilities	**4**	**10**
5	**Design of Anaerobic reactors :** Detailed design of any four reactors from following:- (1) Conventional treatment units including stabilization pond, Oxidation pond,anaerobic lagoons standard rate and high rate sludge digesters. **(2)** High rate: Upflow Anaerobic Sludge Blanket, Upflow Anaerobic Filters, Expanded Granule Sludge Blanket, Internal Circulation, migrating blanket,biphasic anaerobic reactors	**11**	**30**
6	**Treatability Protocol** Assay techniques, Biochemical Methane Potential (BMP), Anaerobic toxicity assay,Treatability Parameters, plot plant Studies	**4**	**10**
	Total	**42**	**100**

Suggested SpecificationTable with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	30	20	30	10	10

Where R:Remember; U:Understanding; A:Application, N:Analyze and E:Evaluate C:Create(as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

(1) Anaerobic Biotechnology for Industrial Wastewater by Dr. R.E. SpeeceARCHAE PRESS
(2) Wastewater Engineering Treatment and Reuse by Metcalf & Eddy
(3) Design of Anaerobic Process for the Treatment of Industrial and Municipal Wastes byJ. F. Malina
(4) Biological Process Design for Wastewater Treatment by Larry D Benefield, CliffordW Randall
(5) Wastewater Treatment for Pollution Control and Reuse by Soli Arceivala & Shyam R. Asolekar

(b) Open sources of software and website: US EPA, MOEF&CC, NPTEL

Suggested Course Practical List:

- Numericals related to anerobic reactors
- Measurement of various anerobic reactor operational parameters.
- Design of UASB.
- Design of AMBR.
- Design of Stabilization Pond.

List of Laboratory/Learning Resources Required:

1. COD digestion unit
2. Hot Air Oven
3. pH meter
4. BOD Incubator

Suggested Activities for Students:

- Visit to Sewage Treatment plant which has anaerobic treatment facility

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