GUJARAT TECHNOLOGICAL UNIVERSITY , AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: BIOLOGICAL TREATMENT OF WASTE WATER
(COURSE CODE: 3361301)

Diploma Programme in which this course is offered	Semester in which offered
Environment Engineering	Sixth

1. RATIONALE

This course will provide a detailed knowledge of the current practices in biological wastewater treatment in general with specific reference to industrial wastewater treatment and technologies. Students are expected to learn the principles, objectives and basic criteria for the selection of appropriate process for biological wastewater treatment. During the course they will visit industrial wastewater treatment plants that employ different types of wastewater process units to achieve the discharge limits and minimize the pollution parameters. The field trips and site visits will give student an opportunity to discuss operational problems with the process engineers and plant operators and to become familiar with plant layouts.

2. COMPETENCY

The course content should be taught with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Maintain the operation of the wastewater treatment plant effectively and efficiently**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

i. Identify various parameters of biological methods of analysis of waste water
ii. Select appropriate biological wastewater treatment processes and discuss pros and cons of each process
iii. Troubleshoot the various problems encountered in aerobic treatment of waste water
iv. Troubleshoot the various problems encountered in anaerobic treatment of waste water
v. Identify specific biological wastewater treatment to remove pollutants in general and nitrogen and phosphorus in particular and recognize emerging technologies for biological wastewater treatment.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+P+T)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	100
3	0	0	3	70	30	-	-	

Legends : L-Lecture ; **T**-Tutorial /Teacher Guided Student Activity ; **P**-Practical ; **C**-Credit ; **ESE**-End Semester Examination ; **PA** –Progressive Assessment

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
Unit-I Biological Methods of Analysis of Wastewater	1a. Describe the methods of determination of BOD, COD, TOC and their inter-relationships 1b. Explain the factors affecting parameters of pollution with examples	1.1 Methods of determination of BOD, COD, TOC and their Inter relationships 1.2 Factors affecting parameters of pollution
Unit-II Biological Treatment Methods	2a. Explain the different methods of biological treatment used at site 2b. Describe chemistry of aerobic and anaerobic treatment methods with advantages and disadvantages.	2.1 Methods of biological treatment on site 2.2 Chemistry of aerobic and anaerobic treatment methods
Unit-III Aerobic Treatment of Wastewater	3a. Describe the working principle, construction, benefits, limitations and applications of the Aerobic treatment units of the following: i. Suspended growth processes ii. Activated sludge process (ASP) and its modifications iii. Aerated lagoons iv. Waste stabilization ponds. v. Trickling filters (TF) vi. Rotating biological contractors (RBC)	3b. Working principle, construction, benefits, limitations and applications of the Aerobic treatment units of the following: i. Suspended growth processes ii. Activated sludge process (ASP) and its modifications iii. Aerated lagoons iv. Waste stabilization ponds. v. Trickling filters (TF) vi. Rotating biological contractors (RBC)
Unit- IV Anaerobic Treatment of Wastewater	4a. Working principle, construction and benefits, limitations and applications of the of following Anaerobic treatment units i. Sludge digesters. ii. Suspended growth Processes iii. Attached growth Processes iv. Up-flow Anaerobic sludge blanket reactor (UASB)	4b. Working principle, construction and benefits, limitations and applications of the of following Anaerobic treatment units i. Sludge digesters. ii. Suspended growth Processes iii. Attached growth Processes iv. Up-flow Anaerobic sludge blanket reactor (UASB)
Unit-V Removal of Refractory Organics	5a. Explain the biological treatment for nutrient removal 5b. Describe the specific features of emerging technologies and methods for biological wastewater treatment with real cases of field.	5.1. Nitrogen removal process. 5.2. Phosphorus removal process. 5.3. Emerging technologies for biological wastewater treatment

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Biological Methods of Analysis of Wastewater.	06	4	3	3	10
II	Biological Treatment Methods	06	3	3	4	10
III	Aerobic Treatment of Wastewater.	11	3	7	8	18
IV	Anaerobic Treatment of Wastewater.	11	3	7	8	18
V	Removal of Refractory Organics.	08	6	6	2	14
Total		**42**	**19**	**34**	**18**	**70**

Legends: R = Remember**, U** = Understand**, A=** Apply and above Level (Bloom's revised 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.

7. SUGGESTED EXERCISES/PRACTICALS

N.A.

8. SUGGESTED STUDENT ACTIVITIES

i. Prepare report on operational problems in Biological Treatment units and their solution after industrial visit
ii. Prepare sketches for : Different types of Biological Waste water Treatment Units
iii. Prepare case study using internet for emerging technologies for advanced wastewater treatment.
iv. Visit industrial wastewater treatment site and discuss specific features of emerging technologies and methods for biological wastewater treatment used there.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

i. Ask students to study different biological waste water treatment plants in nearby locations and present a report on them.
ii. Arrange Expert lectures of environmental engineers having experience of maintaining biological waste water treatment plants.
iii. Show video clips of good designs of biological waste water treatment plans and discuss their designs.

10. SUGGESTED LEARNING RESOURCES

(A) Books

S. No.	Title of Books	Author	Publication
1	Wastewater engineering its reuse and disposal	Metcalf and Eddy (4th Edition)	Tata McGraw-Hill, new delhi,2003
2	Waste Water Engineering	Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain,	Laxmi Publications, new delhi,1998
3	Introduction to environmental Engineering	Mackenzie L Davis and David A Cornwell	WCB McGraw-Hill, 1998, the University of Michigan
4	Environmental Engineering	Howard S. Peavy, Donald R. Rowe, George Tchobanoglous	McGraw-Hill, 1985

(B) Software/Learning Websites

i. www.gpcb.gov.in
ii. www.cpcb.nic.in

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof Jini Sunil**, Lecturer in Environmental Engineering, Shri K. J. Polytechnic, Bharuch
- **Prof M.C. Sanandiya**, Lecturer in Environmental Engineering, Shri K. J. Polytechnic, Bharuch

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof . M.C. Paliwal** , Associated Professor, Department of Civil and Environment Engineering
- **Dr V.H.Radhakrishnan**, Professor, Department of Civil and Environment Engineering,