



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Environmental Management

Subject Code: ME02018051

Subject Name: Wastewater Treatment Technologies

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

|                      |   |
|----------------------|---|
| <b>Prerequisite:</b> | Knowledge of Subject of Environmental Chemistry and Microbiology                                |
| <b>Rationale:</b>    | To learn the principles and theories behind the treatment of wastewater by biological processes |

## Course Outcome:

After Completion of the Course, Student will able to:

| No. | Course Outcomes   |
|-----|---|
| 01  | Compare the Domestic, Municipal and Industrial Wastewater.  |
| 02  | Apply concepts of various physico-chemical treatment processes for wastewater.  |
| 03  | Apply fundamental concepts of microbiology in biological treatment processes of wastewater by developing the reaction rate kinetics |
| 04  | Estimate the sludge generation in wastewater treatment and suggest the sludge handling units.                                       |
| 05  | Apply the concept of advance treatment processes for wastewater.  |

## Teaching and Examination Scheme:

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

## Course Content:



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| Unit No. | Content   | No. of Hours | % of Weightage |
|----------|---|--------------|----------------|
| 1        | <b>Types of wastewater:</b><br>Domestic, Municipal and Industrial Wastewater and its characteristics, treatment flow schemes, Site selection criteria for wastewater treatment plants, Basic design considerations for domestic and industrial wastewater | 03           | 6              |
| 2        | <b>Primary Treatment for wastewater:</b><br>Screening, Grit Removal, Equalization, Oil and Grease removal, Neutralization, Chemical Precipitation for removal of heavy metals, sedimentation  | 08           | 20             |
| 3        | <b>Fundamentals of Secondary Treatment:</b><br>Measurement of Organic Pollutants, Objectives of the treatment, types of biological processes for wastewater treatment, Microbial Growth Kinetics for Aerobic Treatment                                    | 05           | 12             |
| 4        | <b>Aerobic Biological Treatment:</b><br>Activated Sludge Process and its Modifications, Rotating biological contactors, Bio-Towers, Sequential Batch Reactors   | 08           | 18             |
| 5        | <b>Anaerobic Biological Treatment:</b><br>Mechanism of anaerobic fermentation, Microbiology and biochemistry of anaerobic processes, Factors affecting anaerobic treatment, Conventional and High rate anaerobic reactors                                 | 08           | 20             |



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|              |   |           |            |
|--------------|---|-----------|------------|
| 6            | <b>Sludge Treatment:</b><br>Sources & characteristics of various sludge, solids calculation, sludge thickening methods, sludge conditioning, sludge dewatering methods, sludge stabilization methods.   | 07        | 14         |
| 7            | <b>Advanced Treatment for Wastewater:</b><br>Need of Advanced Treatment, Nitrogen and Phosphorus removal, Working Principle and applications of Membrane Technologies, Adsorption, Ion Exchange, Advanced oxidation Processes, Electro-chemical Treatment Processes | 06        | 10         |
| <b>Total</b> |   | <b>45</b> | <b>100</b> |

## Suggested Specification Table with Marks (Theory):

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

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:

- Waste water Engineering Treatment & Reuse by Metcalf and Eddy (4th Edition – Tata McGraw-Hill Publishing Company Ltd.)
- Environmental Engineering by Peavy and Rowe
- Environmental Engineering by McKenzie Davis and Cornwell (3rd Edition-published by WCB McGrawHill)
- Wastewater Treatment for Pollution Control by Soli J Arceivala (2nd Edition- Tata McGraw-Hill Publishing Company Ltd.)

### (b) Open sources of software and website:

- <https://nptel.ac.in/>

## Suggested Course Practical List:



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- Determination of COD of given wastewater
- Determination of BOD of given wastewater
- Determination of TSS and TDS of given wastewater
- Determination of Chloride of given wastewater
- Determination of Acidity of given wastewater

### List of Laboratory/Learning Resources Required:

Hot air oven, Jar test apparatus, pH meter, TDS meter, Conductivity meter, glasswares etc.

### Suggested Activities for Students:

- Visit to Sewage treatment plant
- Visit to Industrial wastewater Treatment Plant

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