| | |
|---|---|
| **INSTITUTE** | **FACULTY OF TECHNOLOGY** |
| **PROGRAM** | **MASTER OF TECHNOLOGY in CHEMICAL ENGINEERING** |
| **SEMESTER** | **1** |
| **COURSE TITLE** | **INDUSTRIAL EFFLUENT TREATMENT** |
| **COURSE CODE** | **01CM1108** |
| **COURSE CREDITS** | **3** |

**Objective:**

1 The Course aims to educate the students on the working principles and design of physical, chemical and biological treatment systems for industrial effluent.

**Course Outcomes:** After completion of this course, student will be able to:

1 Know the need of industrial effluent treatment.

2 Analyze the principle and working mechanism of various effluent treatment processes.

3 Choose the appropriate treatment method for different industries

4 Propose the innovative technologies for the areas requiring further improvements.

**Pre-requisite of course:**Basics of Environmental Studies, Environmental Sciences

**Teaching and Examination Scheme**

| Theory Hours | Tutorial Hours | Practical Hours | ESE | IA | CSE | Viva | Term Work |
|---|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 50 | 30 | 20 | 0 | 0 |

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to Industrial Effluent**<br>Industrial scenario in India, Industrial activity and Environment, Uses of water by industry, Characteristics of waste water,, Sources and types of industrial wastewater, Industrial wastewater and environmental impacts,, Regulatory requirements for treatment of industrial wastewater, Industrial waste survey,, Toxicity of industrial effluents and Bioassay tests. | 8 |
| 2 | **Unit Operations & Processes**<br>Screen, Grit chamber, Equalization, Neutralization, Oil separation, Flotation, Precipitation,, Coagulation & flocculation, Sedimentation tank, Heavy metal Removal, Refractory organics separation by adsorption,, Chemical oxidation, Ozonation, Chlorination | 8 |

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**Digitally signed by (Name of Dean/ Principal)**

| Contents : Unit | Topics | Contact Hours |
|---|---|---|
| 3 | **Biological Treatment of Effluents**<br>Role of microorganism in waste water treatment, Microbial growth kinetics,, Aerobic biological oxidation, Anaerobic fermentation & Oxidation,, Activated sludge process, Aerated Lagoons,, Rotating biological contactors, Trickle bed filters | 10 |
| 4 | **Advanced Effluent Treatments**<br>Depth filtration, Surface filtration,, Membrane filtration processes, Gas stripping, Ion Exchange,, Advanced Oxidation Processes, Distillation | 10 |
| 5 | **Issues Related to Treatment-Plant Performance**<br>Odour management, Automatic process control,, Energy efficiency, Upgrading Wastewater treatment. | 6 |
| **Total Hours** | | **42** |

**Textbook :**

1 Wastewater Engineering, Treatment & Reuse, Metcalf & Eddy,, Tata McGraw –Hill 4 th edition., 2003

**References:**

1 "Industrial Water Pollution Control", "Industrial Water Pollution Control", Eckenfelder, W.W., McGraw- Hill,, 2001

2 “Waste Water Treatment”, 3rd edition., “Waste Water Treatment”, 3rd edition., Rao, M. N., Datta, A. K.,, Oxford and IBH Publishing, 2018

**Suggested Theory Distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| **Remember / Knowledge** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Higher order Thinking / Creative** |
| 10.00 | 20.00 | 25.00 | 25.00 | 10.00 | 10.00 |

**Instructional Method:**

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as collaborative learning, demonstration, role play, Quiz, brainstorming, MOOCs, Active Learning Assignments etc

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of semester for evaluationof performance of students in laboratory.

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**Instructional Method:**

4 Students will use supplementary resources such as online videos, Virtual Laboratory NPTEL videos, ecourses.

**Supplementary Resources:**

1 https://nptel.ac.in/courses/105/106/105106119/