# (CE851PE) WASTE MANAGEMENT
## (Professional Elective - V)

### I. COURSE OVERVIEW:

The aim of this course is to make the students understand the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process and waste-related laws, technologies, economic mechanisms.

### II. PREREQUISITE(S):

| Level | Credits | Periods | Prerequisite |
|---|---|---|---|
| UG | 3 | 3 | Environmental Engineering |

### III. COURSE OBJECTIVES:

**The objectives of the course are to enable the student:**

To study about waste water treatment

### IV. COURSE OUTCOMES:

**At the end of this course, a student will be able to:**

| S.No | Course Outcome | Blooms Taxonomy Level |
|---|---|---|
| 1 | Identify the physical and chemical composition of wastes | L2: Understanding |
| 2 | Analyze the functional elements for solid waste management | L4:Analyze |
| 3 | Analyze the functional elements for liquid waste management. | L4:Analyze |
| 4 | To Understand the effluent treatment Plants and its disposal | L3: Apply |

## V. HOW PROGRAM OUTCOMES ARE ASSESSED:

| Program outcomes | | Level | Proficiency assessed by |
|---|---|---|---|
| PO1 | **Engineering knowledge**: To Apply the knowledge of mathematics, science, engineeringfundamentals/principals, and civil engineering to the solution of complex engineering problems encountered in modern engineering practice. | 3 | Assignments |
| PO2 | **Problem analysis**: Ability to Identify, formulate, review research literature, and analyze complexengineering problems related to Civil Engineering andreaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | 2.5 | Exercise, Exams |
| PO3 | **Design/development of solutions**: Design solutions for complex engineering problems related to Civil Engineering anddesign system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | 3 | Exercise |
| PO4 | **Conduct investigations of complex problems**: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | 2.85 | Discussion,Seminars |
| PO5 | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. | 3 | Discussion, Seminars |
| PO6 | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Civil Engineering professional engineering practice. | 3 | Discussions |
| PO7 | **Environment and sustainability**: Understand the impact of the Civil Engineeringprofessional engineering solutionsin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | 3 | ------ |
| PO8 | **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice. | | ------ |
| PO9 | **Individual and team work**: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings. | 2.71 | ------ |

| | | | |
|---|---|---|---|
| PO10 | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | | ------ |
| PO11 | **Project management and finance**: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | 2.71 | ----- |
| PO12 | **Life-long learning**: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change. | 2.71 | Prototype,Discussions |

**VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:**

| **Program outcomes** | | **Level** | **Proficiency assessed by** |
|---|---|---|---|
| PSO 1 | **ENGINEERING KNOWLEDGE:**Graduates will be able to apply technical knowledge in drawing, analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good basics in mathematics, basic sciences and technical communication. | 3 | Lectures and Assignments |
| PSO 2 | **BROADNESS AND DIVERSITY:**Graduates will be able to summarize and can demonstrate about societal, economical, environmental, health and safety factors involved in infrastructural development, and shall work within multidisciplinary teams with competence in modern tool usage. | 2.43 | Tutorials |
| PSO 3 | **SELF-LEARNING AND SERVICE:**Graduates will be able to pursue lifelong learning and professional development to face the challenging and emerging needs of our society, ethically and responsibly. | 1.86 | Seminars and Projects |

**N - None** **S - Supportive** **H – Highly Related**

## VII. SYLLABUS:

**UNIT – I**

Quality requirements of boiler and cooling waters – Quality requirements of process water for Textiles – Food processing and Brewery Industries – Boiler and Cooling water treatment methods.

**UNIT – II**

Basic Theories of Industrial Waste water Management – Volume reduction – Strength reduction – Neutralization – Equalization and proportioning. Joint treatment of industrial wastes and domestic sewage – consequent problems, Industrial waste water discharges into streams. Lakes and oceans and problems.

**UNIT – III**

Recirculation of Industrial Wastes – Use of Municipal Waste Water in Industries, Manufacturing Process and design origin of liquid waste from Textiles, Paper and Pulp industries, Thermal Power Plants and Tanneries, Special Characteristics, Effects and treatment methods. Manufacturing Process and design origin of liquid waste from Fertilizers, Distillers, and Dairy, Special Characteristics, Effects and treatment methods.

**UNIT - IV**

Manufacturing Process and design origin of liquid waste from Sugar Mills, Steel Plants, Oil Refineries, and Pharmaceutical Plants, Special Characteristics, Effects, and treatment methods.

**UNIT – V**

Common Effluent Treatment Plants – Advantages and Suitability, Limitations, Effluent Disposal Methods.

**SUGGESTED BOOKS:**

**TEXT BOOKS:**

1. Waste Water Treatment by M.N. Rao and Dutta, Oxford & IBH, New Delhi.
2. Water and Waste Water technology by Mark J. Hammer and Mark J. Hammer (Jr).

**REFERENCES:**

1. Solid Waste Engineering by WA. Worrell, P.A Vesilind Cengage Learning 2012.
2. Solid and Hazardous waste Management M.N Rao and R. Sulthana. B.S Publications 2012.
3. Liquid waste of Industry by Nemerow Addison- Wesely Educational Publisher.

**MOOC'S- SWAYAM/ NPTEL:**

https://nptel.ac.in/courses/105/103/105103205/

**GATE SYLLABUS:** Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

## IES SYLLABUS:

Sources & classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial aspects of wastes, and Utilization by Civil Engineers.

## VIII. COURSE PLAN:

| lecture no. | unit no. | date | Topics covered | link for PPT | link for PDF | Course learning outcomes | Teaching methodologies | references |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | | Quality requirements of boiler and cooling waters | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand and remember quality requirements | chalk and talk | $T_1$, $T_2$ |
| 2 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Describe quality requirements | chalk and talk | $T_1$, $T_2$ |
| 3 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and remember quality requirements | chalk and talk | $T_1$, $T_2$ |
| 4 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 5 | | | Quality requirements of process water for Textiles | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand and remember quality requirements | chalk and talk | $T_1$, $T_2$ |
| 6 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Illustrate quality requirements | chalk and talk | $T_1$, $T_2$ |
| 7 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and contrast quality requirements | chalk and talk | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 9 | | | Food processing and Brewery Industries | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand and remember quality requirements | chalk and talk | $T_1$, $T_2$ |
| 10 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Illustrate quality requirements | chalk and talk | $T_1$, $T_2$ |
| 11 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and contrast quality requirements | chalk and talk | $T_1$, $T_2$ |
| 12 | | | Student Presentation | | | Able to communicate | ppt | $T_1$, $T_2$ |
| 13 | | | Boiler and Cooling water treatment methods. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Explain treatment methods and processes. | chalk and talk | $T_1$, $T_2$ |
| 14 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Explain treatment methods and processes. | chalk and talk | $T_1$, $T_2$ |
| 15 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and contrast treatment methods and process | chalk and talk | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 17 | 2 | | Basic Theories of Industrial Waste water Management. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | State theories of waste management | chalk and talk | $T_1$, $T_2$ |
| 18 | | | Volume reduction,Strength reduction | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Illustrate theories of waste management | chalk and talk | $T_1$, $T_2$ |
| 19 | | | Neutralization Equalization and proportioning. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude theories of waste management | chalk and talk | $T_1$, $T_2$ |
| 20 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 21 | | | Joint treatment of industrial wastes and domestic sewage | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Explain treatment | chalk and talk | $T_1$, $T_2$ |
| 22 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Illustrate treatment | chalk and talk | $T_1$, $T_2$ |
| 23 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and contrast treatment | chalk and talk | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 25 | | | Industrial waste water discharges into streams. Lakes and oceans and problems. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand disposal of waste water | chalk and talk | $T_1$, $T_2$ |
| 26 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Understand disposal of waste water | chalk and talk | $T_1$, $T_2$ |
| 27 | | | Problems of industrial waste water discharges. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Illustrate and contrast disposal of waste water | chalk and talk | $T_1$, $T_2$ |
| 28 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 29 | 3 | | Recirculation of Industrial Wastes. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand recycling of water | chalk and talk | $T_1$, $T_2$ |
| | **I Mid Examinations** | | | | | | | |
| 30 | 3 | | Use of Municipal Waste Water in Industries, | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand recycling of water | chalk and talk | $T_1$, $T_2$ |
| 31 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Analyze recycling of water | chalk and talk | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 32 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Analyze recycling of water | chalk and talk | $T_1$, $T_2$ |
| 33 | | Student Presentation | | | | Able to communicate | ppt | $T_1$, $T_2$ |
| 34 | | | Manufacturing Process and design origin of liquid waste from Textiles, Paper and Pulp industries, Thermal Power Plants and Tanneries, Special Characteristics, Effects and treatment methods. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand water requirement and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 35 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Describe water requirement and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 36 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Illustrate water requirement and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 37 | | | Manufacturing Process and design origin of liquid waste from Textiles, Paper and Pulp industries, Thermal Power Plants and Tanneries, Special Characteristics, Effects and treatment methods | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Contrast and conclude water requirement and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 38 | | | Student Presentation | | | Able to communicate | ppt | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 39 | | | Manufacturing Process and design origin of liquid waste from Fertilizers, Distillers, and Dairy, Special Characteristics. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand water requirements and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 40 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand water requirements and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 41 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand water requirements and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 42 | | | Student Presentation | | | Able to communicate | p p t | $T_1$, $T_2$ |
| 43 | | | Effects and treatment methods | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and remember water requirements and generation of wastewater from industries. | chalk and talk | $T_1$, $T_2$ |
| 44 | 4 | | Manufacturing Process and design origin of liquid waste from Sugar Mills, Steel Plants, Oil Refineries, and pharmaceutical Plants, | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Understand water requirement and generation of wastewater from industries. | chalk and talk, ppt | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 45 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | | chalk and talk, ppt | $T_1$, $T_2$ |
| 46 | | | Student Presentation | | | Able to communicate | ppt | $T_1$, $T_2$ |
| 47 | | | Manufacturing Process and design origin of liquid waste from Sugar Mills, Steel Plants, Oil Refineries, and pharmaceutical Plants, | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | understand water requirement and generation of wastewater from industries. | chalk and talk, ppt | $T_1$, $T_2$ |
| 48 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | | chalk and talk, ppt | $T_1$, $T_2$ |
| 49 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | | chalk and talk, ppt | $T_1$, $T_2$ |
| 50 | | | Student Presentation | | | | ppt | $T_1$, $T_2$ |
| 51 | | | Special Characteristics, Effects, and treatment methods. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Explain treatment methods | chalk and talk, pp | $T_1$, $T_2$ |
| 52 | | | | https://drive.google.com/drive/folder | https://drive.google.com/drive/fo | Able to relate treatment | chalk and talk | $T_1$, $T_2$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | s/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | lders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | methods | | |
| 53 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Conclude and remember treatment methods | chalk and talk | $T_1$, $T_2$ |
| 54 | 5 | | Student Presentation | | | Able to communicate | chalk and talk | $T_1$, $T_2$ |
| 55 | | | Common Effluent Treatment Plants. Advantages and Suitability, Limitations, Effluent Disposal Methods. | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Able to communicate | chalk and talk | $T_1$, $T_2$ |
| 56 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | Able to communicate | chalk and talk | $T_1$, $T_2$ |
| 57 | | | | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | https://drive.google.com/drive/folders/16oeLEq2q0MIwzVoKb8rvo_2fpPsfPCUF?usp=sharing | explain disposal methods | chalk and talk | $T_1$, $T_2$ |
| 58 | | | Student Presentation | | | explain disposal methods | ppt | $T_1$, $T_2$ |
| | II mid examinations | | | | | | | |

## IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| Course Objectives | | | | | | Program Outcomes | | | | | Program Specific Outcomes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| I | 3 | - | 3 | 2 | 3 | 3 | 3 | - | 3 | - | 3 | 3 | 3 | 2 | 2 |
| II | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | 2 | - | 3 | 3 | 3 | 2 | 1 |
| III | 3 | 2 | 3 | 2 | 2 | 3 | 2 | - | 3 | - | 3 | 2 | 3 | 2 | 2 |
| IV | 2 | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 3 | 2 | 1 |
| AV G | 3 | 2.5 | 3 | 2.8 5 | 3 | 3 | 3 | - | 2.7 1 | - | 2.71 | 2.71 | 3 | 2.43 | 1.86 |

**Small(S)-1 Medium(M)-2 High(H)-3**

## X. QUESTION BANK:

## DESCRIPTIVE QUESTIONS: (WITH BLOOMS PHRASES)

### UNIT- 1

### LONG ANSWER QUESTIONS-

| S.No | Question | Blooms Taxonomy Level | Program meOut come |
|---|---|---|---|
| 1. | Enumerate the quality requirements of process water for textiles. | Understand | 1 |
| 2. | Write the overview of the boiler feed water. | Understand | 1 |
| 3. | Describe the quality requirements of boiler and cooling waters. | Remember | 1 |
| 4. | Write the advantages of boiler and cooling water treatment methods. | Remember | 2 |
| 5. | Describe the origin, characteristics of the textile industry. | Remember | 2 |
| 6. | Describe feedwater? Mention typical treatment of feedwater. | Remember | 2 |
| 7 | Boiler water treatment methods? List out | Remember | 5 |
| 8 | Steps in water treatment in the textile industry | Remember | 5 |
| 9 | Explain in detail the boiler water treatment methods | Remember | 2 |
| 10 | Explain in detail the cooling water treatment methods | Remember | 2 |

## UNIT-2

**LONG ANSWER QUESTIONS-**

| S.NO | Question | Blooms Taxonomy Level | Programme Out come |
|---|---|---|---|
| 1. | Write the purpose and objectives of the neutralization of industrial waste. | Understand | 8 |
| 2. | What are the advantages and disadvantages of disposal of industrial waste water discharged into lakes? | Understand | 8 |
| 3. | Describe waste reduction alternatives. | Remember | 5 |
| 4 | What are the classification of waste? | Remember | 5 |
| 5 | Brief note for strength reduction. methods of strength reduction. | Remember | 2 |
| 6 | Acceptable Methods of Neutralization: | Remember | 2 |
| 7 | Advantages and disadvantages of joint treatment of industrial wastes and domestic sewage | Remember | 2 |
| 8 | what are the types of receiving water for dilution | Remember | 2 |
| 9 | write short note on lake and oceans pollutants | Remember | 2 |
| 10 | Write a note on industrial waste water discharge into streams. | Remember | 2 |

## UNIT-3

**LONG ANSWER QUESTIONS-**

| S.NO | Question | Blooms Taxonomy Level | Programme Outcome |
|---|---|---|---|
| 1. | Describe the theories of industrial waste water Management | Remember | 5 |
| 2. | Explain the terms volume reduction and strength reduction of industrial waste water | Understand | 6 |
| 3. | Describe in detail the principle of Biological treatment system with suitable unit process with flow chart? | Understand | 6 |
| 4. | What are the different stages in industries, the treated municipal wastewater can be used. Explain with good examples. | Understand | 6 |
| 5 | What are the three basic stages of tanning?. | Remember | 2 |
| 6 | Working principle of thermal power plant and draw the layout | Understand | 8 |
| 7 | explain two phases of manufacturing of paper. draw the flow diagram of kraft pulp and paper mill. | Understand | 8 |
| 8 | Waste water treatment of fertilizers. | Remember | 2 |
| 9 | Write a note on dairy waste and its treatment | Remember | 2 |
| 10 | Effects of the cotton textile, woolen textile and Synthetic Textile mill wastes on receiving streams / sewers: | Remember | 2 |

## UNIT-4

**LONG ANSWER QUESTIONS-**

| S.NO | Question | Blooms Taxonomy Level | Programme Out come |
|---|---|---|---|
| 1. | Explain the special characteristics, effects of liquid waste from oil refineries | Understand | 8 |
| 2. | Explain the special characteristics, effects of liquid waste from steel plant. | Understand | 8 |
| 3. | Write the uses of municipal wastewater in industries | Understand | 8 |
| 4. | Describe the origin, characteristics of pharmaceutical plant waste management. | Understand | 7 |
| 5. | Explain the special characteristics, effects of liquid waste from sugar mills. | Understand | 8 |
| 6 | Describe the flow diagram of sugar manufacturing processes | Understand | 8 |
| 7 | Explain about the treatment of sugar mill waste with a flow chart. | Understand | 8 |
| 8 | Basic refinery operation with the help of flow chart | Understand | 8 |
| 9 | Describe the manufacturing and design origin of pharmaceutical plants with schematic diagram | Understand | 8 |
| 10 | Waste treatment method of sugar mills, oil refineries | Understand | 8 |

## UNIT-5

**LONG ANSWER QUESTIONS-**

| S.NO | Question | Blooms Taxonomy Level | Programme Out come |
|---|---|---|---|
| 1. | What are the effluent disposal methods. | Understand | 10 |
| 2. | Explain in detail the unit process of CETP for textile industries with schematic diagram. | Understand | 10 |
| 3. | Discuss the quantification, characteristics of effluent. | Remember | 10 |
| 4. | Write the advantages of the common effluent treatment plant. | Understand | 9 |
| 5 | Classification of ECTP. Advantages of ECTP | Understand | 8 |
| 6 | Advantages and disadvantages of ECTP | Understand | 8 |
| 7 | Modes of disposal of effluents from ECTP | Understand | 8 |
| 8 | Sustainability of ECTP | Understand | 8 |
| 9 | what are the industrial waste water treatment schemes | Understand | 8 |
| 10 | Different types of effluent disposal methods. | Understand | 8 |

**OBJECTIVE QUESTIONS:**

**UNIT-1**

1. In India largest thermal power station is located at (c)

a)Kota b) Sarni c) Chandrapur d) Neyveli

2. Water is mainly used in boilers for the generation of _____ (c )

a) Power b) Electricity c) Steam d) Current

3. Which of the following should not be a composition of boiler-feed water? (d)

a) Hardness should be below 0.2ppm

b) Its caustic alkalinity should lie between 0.15 to 0.45 ppm

c) Its soda alkalinity should be 0.45-1 ppm

d) Its caustic alkalinity should be 1.5-2 ppm

4. Which of the following is not a result of the excess of impurity in boiler-feed? (b)

a) Scale and sludge formation

b) Decomposition

c) Corrosion, priming and foaming

d) Caustic embrittlement

5. The phenomenon during which the boiler material becomes brittle due to accumulation of caustic substances is known as _____ (d)

a) Foaming b) Priming c) Corrosion d) Caustic embrittlement

6. If the precipitate formed is soft, loose and slimy, these are _____ and if the precipitate is hard and adhering on the inner wall, it is called _____ (a)

a) Sludges, scale b) Scale, sludges c) Sludges, rodent d) Scale, rodent

7. What is the purpose of a chimney? (c)

a) To provide air ventilation

b) To eliminate noise produced in the system

c) To exhaust flue gases those is induced

d) To help in to suck the air required for system

8. What is the advantage of using flue gas inside a boiler? (d)

a) Heats up boiler water tube quickly

b) Reduces the amount of amount of exhaust

c) Speeds of the process of boiler

d) Reduces the green house of effect

9. What type of system is it when the cooling tower is preferred? (a )

a) Closed system b) Open system c) Closed loop system d) Open loop system

10. What is the alternative cooling method for the thermal plant? (c)

a) Wet cooling b) Evaporation cooling c) Dry cooling d) Central air damping

**UNIT-2**

1. Which of the following is not a physical characteristic? (b)

a) Colour b) Ph c) Odour d) Temperature

## UNIT-3

1. _____ devices remove materials which would damage equipment or interfere with a process. (b)
   a) Grit b) Screening c) Oxidation d) Reduction
2. Which of the following should be provided in the case where aeration is absent? (b)
   a) Screening devices b) Mechanical mixers c) Grit removers d) Sedimentation tank
3. Which process is employed to gain sufficient head for the wastewater? (b)
   a) Screening b) Pumping c) Oxidation d) Fermentation
4. _____ is a process which involves further removal of the nitrogen. (b)
   a) Nitrification b) Denitrification c) Ammonification d) Reduction
5. Which of the following sewerage systems carry domestic and industrial wastewater? (a)
   a) sanitary sewers b) storm sewers c) combined sewers d) storm and combined sewers
6. The upper region of the trickling filter is favorable for the growth of _____(c)
   a) fungi b) protozoa c) algae d) bacteria
7. Which of the following gases are produced in large amounts during sludge digestion? (a)
   a) methane b) carbon-dioxide c) hydrogen d) nitrogen
8. Belt filter presses are used in which of the following processes? (c)
   a) Thickening b) Stabilization c) Dewatering d) Disposal
9. The formation of ferrous sulphide leads to the blackening of water. (a)
   a) True b) False
10. What is the minimum required temperature to categorize as volatile solids? (b)
    a) 500˚C b) 600˚C c) 700˚C d) 800˚C

## UNIT -4

1. A nuisance is experienced in diluting water if dilution factor is less than (d)

a)100 b)100 c) 40 d) 20

2. The sugar mill house waste contains _____ due to the presence of sugar, and oil from the machineries. (a)
   a) high BOD b) low BOD c) high COD d) low COD
3. The production of coke involves the carbonization of bituminous coal by heating in the absence of air at a temperature range of _____ (a)
   a) 900℃- 1100℃ b) 800℃- 1500℃ c)500℃- 1000℃ d)c)400℃- 900℃
4. A waste water of the order of _____ of steel produced can be expected. (b)
   a) 5 ㎥/tonnes b)4 ㎥ /tonnes c)6 ㎥ /tonnes d)8 ㎥ /tonnes
5. The crude oil is sometimes pretreated with _____ along with water to remove _____ from the crude. (d)
   a) calcium chloride b) sodium c) nitrate d)caustic soda
6. _____ waste can neither be clarified in settling tanks, nor can be chemically coagulated to reduced BOD. (Antibiotics)
7. The treatment of acidic wastes consists of neutralization by lime to pH _____. (7)

**Unit - 5**

1. _____--are treatment systems specifically designed for collective treatment of effluent generated from small-scale industrial facilities in an industrial cluster. (Common effluent treatment plants (CETPs))
2. _____is a sewage collection system that consists of septic tanks on each property. (**Common Effluent** Disposal (CED))
3. There are three types of wastewater, or sewage _____ (domestic sewage, industrial sewage, and storm sewage.)
4. A _____places wastewater in a shallow open pool. Treated effluent from the lagoon is introduced into the environment through slow evaporation. (lagoon system)
5. _____is from showers, baths, whirlpool tubs, washing machines, dishwashers and sinks other than the kitchen sink. (Gray water)
6. _____ is from toilets and kitchen sinks. (Black water)

**XI.GATEQUESTIONS:NA**
**IES :**NA

**XII.WEBSITES:**

1. www.aerfindia.org
2. www.hcn.ogn.
3. www.inderscience.com
4. cat.org.uk

**XIII.EXPERT DETAILS:**

1. Prf. M.M. Ghangrekar
   Professor
   Department of Civil Engineering
   Indian Institute of Technology, Kharagpur
2. Dr. B. K. Dubey
   Professor
   Department of Civil Engineering
   Indian Institute of Technology, Kharagpur

**XIV.JOURNALS:**

| | | |
|---|---|---|
| 0970-1141 | Thesis Digest on Civil Engineering | 1987 |
| 0973-8061 | International Engineering and Technology Journal of Civil and Structure | 2007 |
| 0975-5314 | International journal of civil engineering | 2009 |
| 0975-6744 | Journal of information knowledge and research in civil engineering | 2009 |
| 0976-6308 | International journal of civil engineering and technology | 2010 |
| 2249-426X | International Journal of Civil Engineering and | 2011 |

| | | |
|---|---|---|
| | Applications | |
| 2249-8753 | Recent Trends in Civil Engineering and Technology | 2011 |
| 2277-5986 | World Research Journal of Civil Engineering | 2011 |
| 2277-7032 | International Journal of Structural and Civil Engineering | 2012 |
| 2278-9987 | International Journal of Civil Engineering (IJCE) | 2012 |
| | | |

**XV.LIST OF TOPICS FOR STUDENTSEMINARS:**

1. Protected water supply
2. Layout and general outline of water treatment units.
3. Types of disinfection
4. Laying and testing of pipelines.

**XVI.CASE STUDIES / SMALLPROJECTS:**

1. Water quality and testing.
2. Layouts of distribution system.
3. Sewage and storm water estimation.
4. Design of sludge digestion tanks.