

# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

# **CIVIL ENGINEERING**

# **COURSE DESCRIPTION FORM**

Course Name	:	INDUSTRIAL WASTE WATER TREATMENT
Course Code	:	A70139-R15
Class	:	IV B.TECH I SEM
Branch	:	CIVIL ENGINEERING
Year	:	2018 – 2019
Course Coordinator	:	Mr. Ch. Balakrishna, Assistant Professor, Dept of CE
Course Faculty	:	Dr. J.S.R Prasad, Mr. Ch. Balakrishna, Assistant Professor, Dept of CE

#### I. COURSE OVERVIEW:

This course provide an understanding of the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic industrial or commercial activities prior to its release into the environment or its re-use. To understand various terms used in industrial wastewater treatment and to acquaint with different steps involved in treatment of industrial wastewater

## **II. PREREQUISITE(S):**

Level	Credits	Periods/ Week	Prerequisites			
UG	4	4	Environmental Engineering			

## III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test		
There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment.		
The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks.		
The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark.	75	100
First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.		
Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking.		
Marks shall be awarded considering the average of two midterm tests in each course.		

# **IV. EVALUATION SCHEME:**

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

## V. COURSE OBJECTIVES:

#### The objective of the teacher is to impart knowledge and abilities to the students to:

- I. Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation
- II. Understand the industrial process, water utilization and waste water generation.
- III. Impart knowledge on selection of treatment methods for industrial wastewater.
- IV. Acquire the knowledge on operational problems of common effluent treatment plants.
- V. Gain knowledge on different techniques and approaches for minimizing the generation and application of Physio chemical and biological treatment methods for recovery, reuse and disposal of industrial wastewater.
- VI. Conversant about the polluting potential of major industries in the country and the methods of controlling the same

## VI. COURSE OUTCOMES:

#### After completing this course the student must demonstrate the knowledge and ability to:

- 1. Identify environmental standards that apply to both direct and indirect industrial discharges.
- 2. Identify industrial waste stream characteristics from several major industrial categories and why these characteristics are important to the design of unit processes.
- 3. Develop an overall treatment strategy for an industrial waste stream.
- 4. Specify design criteria for physical, chemical, and biological unit operations and processes necessary to treat an industrial wastewater.
- 5. Estimate capital and operating costs for industrial waste treatment systems.
- 6. Define and reason about fundamental concepts of waste water treatment.
- 7. Design, conduct experiments and the ability to analyse the waste water quality.
- 8. Design a component, system or process to meet desired needs and reduce water pollution.
- 9. Identify the suitability of the use of treated wastewater for irrigation and to evaluate the optimal method for the management of wastewater.
- 10. Select the most appropriate technique to control and treat industrial pollution
- 11. Use appropriate modern techniques skills and tools including computer applications, necessary for engineering practice.
- 12. Apply Environmental Management Systems (EMS) to an industrial activity.

# VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

	Program Outcomes	Level	Proficiency assessed by
PO1	<b>Engineering knowledge</b> : Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Н	Assignments, Exams
PO2	<b>Problem analysis</b> : Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	Н	Assignments, Exams
PO3	<b>Design/development of solutions</b> : Design solutions for complex engineering problems and design 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.	S	Assignments
PO4	<b>Conduct investigations of complex problems</b> : Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Assignments
PO5	<b>Modern tool usage</b> : Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	-	-
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	Н	Exams
P07	<b>Environment and sustainability</b> : Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	S	Exams, Assignments
PO8	<b>Ethics</b> : Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Quizzes, Discussions
PO9	<b>Individual and team work</b> : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.		Lectures, Discussions
PO10	<b>Communication</b> : 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.	S	Lectures, Discussions
PO11	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering 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.	S	Possible Projects

PO12	<b>Life-long learning</b> : Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Discussions
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**S** – Supportive

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#### VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

	Program Specific Outcomes	Level	Proficiency assessed by
PSO1	<b>ENGINEERING KNOWLEDGE:</b> Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	Н	Lectures, Assignments, Exams
PSO2	<b>BROADNESS AND DIVERSITY:</b> Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	Н	Lectures, Assignments, Exams
PSO3	<b>SELF-LEARNING AND SERVICE:</b> Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	S	Guest Lectures, Possible Group Projects, Industrial Internship

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#### IX. SYLLABUS:

#### Unit - I

Sources of pollution – Physical, Chemical, organic and Biological properties of Industrial Wastes – Difference between industrial and municipal waste waters – Effects of industrial effluents on sewers and natural water bodies.

#### Unit - II

Pre and Primary Treatment – Equalization, Proportioning, Neutralization, Oil Separation by floatation – waste Reduction – Volume Reduction – Strength Reduction

#### Unit – III

Waste Treatment Methods – Nitrification and De-nitrification – phosphorous removal – Heavy Metal removal – Membrane Separation Process – Air stripping and Absorption Processes – Special Treatment Methods – Disposal of treated Waste Water

#### Unit - IV

Characteristics and Composition of waste water and Manufacturing Processes of Industries like Sugar, Characteristics of Industries like Food Processing Industries, Steel, Petroleum Refineries

#### Unit - V

Characteristics and Composition of Industries like Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries – Joint Treatment of Raw Industrial Waste Water and Domestic Sewage – Common Effluent Treatment Plants (CETP) – Location, Design, Operation and Maintenance Problems.

#### **Textbooks:**

- 1. Metcalf & Eddy, "Wastewater engineering Treatment disposal reuse", Tata McGraw Hill.
- 2. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill

#### **Reference Books:**

- 1. M.N. Rao and Dutta Industrial Waste.
- 2. Mark J. Hammer, Mark J. Hammer, Jr., "Water & Wastewater Technology", Prentice Hall of India.
- 3. N.L. Nemerrow Theories and practices of Industrial Waste Engineering.
- 4. C.G. Gurnham Principles of Industrial Waste Engineering.

# X. COURSE PLAN:

#### At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	References
	Introduction to IWWT & Sources of	Define different terms of IWWT	T1: 1-3,
1-2	pollution	and Understand the different	
		sources of pollution	
	Physical, Chemical, organic and Biological	Understand the physical chemical	T1: 1-4 T1: 2-3,
3-4	properties of Industrial Wastes	and biological properties of IWWT	2-4, 2-6,2-8
	Difference between industrial and municipal	Analyse and understand the	T1: 2.6-14
5-6	waste waters	difference of Industrial and	
		municipal waste waters	
7.0	Effects of industrial effluents on sewers and	Understand the effect of effluents	T1: 2.15-20
/-8	natural water bodies	on the disposal areas	
		Understand the different stages of	T1: 3.13
9-10	Pre and Primary Treatment	pre and primary treatment of	
		Industrial wastewater	
	Equalization, Proportioning	Define and understand the terms	T1: 3.5-14
11-12		Equalization, Proportioning and	
		the processes	
	Neutralization, Oil Separation by floatation	Define and understand the terms	T1: 6.1-5
13-14		Neutralization and the processes,	
		Oil separation Method	
	waste Reduction – Volume Reduction	Define and understand the terms	T1: 9.1-5
15-16		waste Reduction, volume reduction	
		and the processes	
	Strength Reduction	Define and understand the terms	T1: 9.6-7
17-18		strength Reduction and the process	
		involved in it	
10.20		Understand the importance of	T1: 9.7-15
19-20	Introduction to Waste Treatment Methods	WTM and different types	
	Nitrification and De-nitrification	Understand the process involved in	T1: 9.15-20
21-22		Nitrification and De-nitrification	
		stages of waste water treatment	
	Phosphorous removal – Heavy Metal removal	Understand the process involved in	T1:9.21-25
23-24		phosphorous removal and Heavy	
		Metal removal	

	Membrane Separation Process	Understand the process involved in	T1: 10.1-5
25-26	-	Membrane Separation Process	
		1	
	Air stripping and Absorption	Understand the process involved	T1: 10.5-7
27-28	Processes	in Air stripping and Absorption	
		techniques in treatment method	
20.20	Special Treatment Methods	Understand and Analyse the	T1: 10.7
29-30	•	special Treatment Methods	
	Disposal of treated Waste Water	Understand the procedure and	T1: 10.8-10
31-32	T	process of disposing treated waste	
		water	
		Analyse and understand the	T1· 11 1-7
33 34	Characteristics and Composition of waste	Characteristics and Composition of	11.11.1-7
55-54	water	wasta watar	
	Water		<b>T</b> 1. 4.1
35-36	Manufacturing Processes of Industries like	Understand the Manufacturing	11:4.1
	Sugar,	Processes of Industries like Sugar,	
37-38	Characteristics of Industries like Food	Understand the Manufacturing	T1: 4.2-8
57 50	Processing Industries	Processes of Industries like Sugar,	
30.40	Characteristics of Industries like Steel,	Understand the Characteristics of	T1: 5.1-8
39-40		Industries like Steel,	
	Characteristics of Industries like Petroleum	Understand the Characteristics of	T1: 7.1-3
41-42	Refineries	Industries like Petroleum	
		Refineries	
10.11		C Understand the haracteristics	T1: 7.4-7
43-44	Characteristics and Composition of Industries	and Composition of Industries like	
	Characteristics and Composition of Industries	Inderstand the Characteristics and	T1. 12 1 2
45-46	like Tanneries	Composition of Industries like	11: 12.1-3
15 10	like rumenes	Tanneries	
	Characteristics and Composition of Industries	Understand the Characteristics and	T1: 12.4-11
47-48	like Atomic Energy Plants	Composition of Industries like	
		Atomic Energy Plants	
	Characteristics and Composition of Mineral	Understand the Characteristics and	T1: 13.1-10
49-50	Processing Industries	Composition of Mineral	
		Processing Industries	<b>T</b>
	Joint Treatment of Raw Industrial Waste	Understand the need and process	T1: 14.1-8
51-52	water and Domestic Sewage	of Joint Treatment of Raw	
		Domestic Sewage	
	Common Effluent Treatment Plants (CETP) –	Design requirements of Common	T1: 15-18
52-53	Location	Effluent Treatment Plants (CETP,	110 10 10
		Location Selection	
	Common Effluent Treatment Plants (CETP) –	Design requirements of Common	T1: 15-19-25
54-55	Design	Effluent Treatment Plants (CETP,	
		Location Selection	
56.60	Common Effluent Treatment Plants (CETP) –	Understand the operation and	T1: 15-25-28
56-60	Operation, Maintenance	Maintenance of Common Effluent	
	Common Effluent Treatment Directs (CETD)	Ireatment Plants (CETP	T1, 15 20 21
60-65	Maintenance	Maintenance of Common Effluent	11: 13-29-31
00-05		Treatment Plants (CETP	

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

Course	Program Outcomes													Program Specific Outcomes		
Objectives	<b>PO1</b>	<b>PO2</b>	PO3	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3	
Ι	S	Н											Н		S	
Π	Н	S											Η	S		
III				Н			S						Н	S		
IV											S		S	Н		
V			Н	S						S			S	Н	S	

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

Course		Program Outcomes													Program Specific Outcomes		
Outcomes	<b>PO1</b>	<b>PO2</b>	PO3	PO4	PO5	PO6	<b>PO7</b>	<b>PO8</b>	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
1	S						Н						Н		S		
2		S					S						Н	S			
3				Н		S							Н	S			
4			S			S					S		S	Н			
5		S								S			S	Н	S		
6	S			Н		0							Н		S		
7			S				Н						S				
8			S			Н								S	Н		
9													Н				
10						U	Н							S	Н		
11					S								S		S		
12				S		U			Н				Н	S			

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**Prepared by:** Mr. Ch. Balakrishna Assistant Professor

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