INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**AIR POLLUTION AND CONTROL**			
Course Code	**A70136**			
Regulation	**R15– JNTUH**			
Course Structure	**Lectures**	**Tutorials**	**Practicals**	**Credits**
	4	**-**	**-**	**4**
Course Coordinator	**Mr. Srinivas Angadi, Asst. Professor, Department of Civil Engineering**			
Team of Instructors	**Mr. Srinivas Angadi, Asst. Professor, Department of Civil Engineering**			

I. COURSE OVERVIEW:

The course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat pollution in three environmental compartments i.e. air, water and soil. The course will also be dealing about the sources of pollution in air, soil, water, solid-waste and noise and the impacts these sources on the environment and health. In addition, the students will be given the training to develop the particular skills required in pollution related structured research.

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 of20minutes 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. 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.	75	100

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. Understand the basic concepts of air pollution and its effects on human and ecosystem health

II. Explore how atmospheric chemical composition both drives and responds to changes in the earth system, including climate change.

III. Look at the major air pollutants, their sources, chemical transformations in the atmosphere and impacts.

IV. Know how to interpret meteorological data for atmospheric stability and air pollutant transport and dispersion

V. Get an insight into the fundamentals of some of the most widely used commercial and freely available air quality models

VI. Present detailed information about the design characteristics of technology for particulate matter control, including electrostatic precipitators, fabric filters, cyclones, spray towers and Venturi washers.

VI. COURSE OUTCOMES:

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

1. Have a firm foundation and knowledge of mathematics, science and engineering principles and the ability to apply the knowledge.
2. Define and reason about fundamental concepts of waste water treatment
3. Design and conduct experiments and the ability to analyse the data, interpret results and draw conclusions.
4. Design a component, system or process to meet desired needs and imposed constraints.
5. Think logically, critically and creatively.
6. Identify, formulate and solve civil engineering problems
7. Use appropriate modern techniques skills and tools including computer applications, necessary for engineering practice.
8. Demonstrates the knowledge about Air pollution control which is essential for environmental protection and it gives a particular solution to the life threating problem.
9. Communicate both the design and planning of the air pollution control devices in different modes which used for environment perseverance.
10. Develop the design principle of the types of spillways, and can able to design of aqueduct, siphon aqueduct and super passage.
11. Develop confidence for self-education and ability for life-long learning.
12. Participate and succeed in competitive examinations like GATE, PSU.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Exams
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments, Exams
PO3	**Design/development of solutions**: 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.	-	-
PO4	**Conduct investigations of complex problems**: 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	**Modern tool usage**: 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.	-	-
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms oft he engineering practice.	-	-
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	-
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.	S	Lectures, Discussions
PO11	**Project management and finance**: 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.	-	-

PO12	**Life-long learning**: 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.	-	-

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VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**ENGINEERING KNOWLEDGE:** 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.	H	Lectures, Assignments, Exam
PSO2	**BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economic, 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.	S	Projects
PSO3	**SELF-LEARNING AND SERVICE:** 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.	-	-

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IX. SYLLABUS:

Unit – I

INTRODUCTION

Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary air pollutants, Point, Line and Areal Sources of air pollution – Stationary and mobile sources. Effects of Air pollutants on man, material and vegetation; Global effects of air pollution – Green House effect, Heat Island, Acid rains,Ozone Holes etc.

Unit – II

BASIC ATMOSPHERIC PROPERTIES

Meteorology and plume Dispersion; Properties of atmosphere; Heat, Pressure System, Winds and moisture, plume behaviour and plume Rise Models; Gaussian Model for Plume Dispersion.

Unit – III

CONTROL OF PARTICULATES

Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control. Equipment's – setting chambers, cyclone separators, filters, Dry and Wet scrubbers, Electrostatic precipators.

Unit – IV

CONTROL OF GASEOUS EMISSIONS

Control of gaseous emissions – General Methods of control of NOx and SOx emissions – In plant Control Measures, process changes, dry and wet methods of removal and recycling – Adsorption – Absorption – Combustion.

Unit - V

Air Quality Management – Monitoring of SPM, SOx; NOx and CO Emission standards – Air sampling – Sampling Techniques – High volume air sampler – stack sampling – Analysis of Air pollutants- Air quality standards – Air pollution control act.

Textbooks:

1. Metcalf & Eddy, "Wastewater engineering Treatment disposal reuse", Tata McGraw Hill.
2. Air pollution By Wark and Warner – Harper & Row, New York.

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
1-2	UNIT - I Definitions, Scope, Significance and Episodes.	Define different terms of Air Pollution and Understand the different sources of pollution	T1: 1-3,
3-4	Classifications – Natural and Artificial of Air Pollution	Classification of Natural and Artificial of Air Pollution, identifying different parameters	T1: 2-3, 2-4, 2-6,2-8
5-6	Primary and Secondary air pollutants	Classification of Primary and Secondary air pollutants, identifying different parameters	T1: 2.6-14
7-8	Point, Line and Areal Sources of air pollution	Classification of Point, Line and Areal Sources of air pollution identifying different parameters	T1: 2.15-20
9-10	Stationary and mobile sources.	Classification of Stationary and mobile sources, identifying different parameters	T1: 3.1-.3
11-12	Effects of Air pollutants on man, material and vegetation	Effects of Air pollutants on man, material and vegetation. Its impact on the environment	T1: 3.5-14
13-14	Global effects of air pollution Green House effect	Global effects of air pollution Green House effect, Its impact on the environment	T1: 6.1-5

15-16	Heat Island, Acid rains, Ozone Holes	Understanding the Heat Island, Acid rains, Ozone Holes	T1: 9.1-5
17-18	UNIT - II Meteorology and plume Dispersion, Properties of atmosphere	Understanding the Meteorology and plume Dispersion, Properties of atmosphere	T1: 9.6-7
19-20	Heat, Pressure System, Winds, moisture, plume behaviour	Understanding the Heat, Pressure System, Winds, moisture, plume behaviour	T1: 9.7-15
21-22	Plume Rise Models	Study of plume Rise Models	T1: 9.15-20
23-24	Gaussian Model for Plume Dispersion	Study of Gaussian Model for Plume Dispersion	T1:9.21-25
25-26	Gaussian Model for Plume Dispersion	Study of Gaussian Model for Plume Dispersion	T1: 10.1-5
27-28	UNIT -III Control of particulates – Control at Sources	Understanding the Control of particulates – Control at Sources	T1: 10.5-7
29-30	Design and operation of control.	Understanding the Design and operation of control.	T1: 10.7
31-32	Equipment's – setting chambers	Study of Equipment's – setting chambers	T1: 10.8-10
33-34	Cyclone separators, filters, Dry and Wet scrubbers, Electrostatic precipators.	Study of Cyclone separators, filters, Dry and Wet scrubbers, Electrostatic precipators.	T1: 11.1-7
35-36	UNIT IV Control of gaseous emissions	Methods or measures of Control of gaseous emissions	T1: 4.1
37-38	General Methods of control of NOx and SOx emissions	Study of General Methods of control of NOx and SOx emissions	T1: 4.2-8
39-40	In plant Control Measures and process changes	Study of plant Control Measures and process changes	T1: 5.1-8
41-42	Dry and wet methods of removal	Study of dry and wet methods of removal	T1: 7.1-3
43-44	Recycling – Adsorption, Absorption – Combustion.	Study of Recycling – Adsorption, Absorption – Combustion.	T1: 7.4-7
45-46	UNIT V Air Quality Management – Monitoring of SPM	Understanding the Air Quality Management – Monitoring of SPM	T1: 12.1-3
47-48	SOx; NOx and CO Emission standards	Understanding the SOx; NOx and CO Emission standards	T1: 12.4-11
49-50	Air sampling – Sampling Techniques –	Understanding the Air sampling – Sampling Techniques	T1: 13.1-10
51-52	High volume air sampler	Study of High volume air sampler	T1: 14.1-8
52-53	Stack sampling	Study of Stack sampling	T1: 15-18
54-55	Analysis of Air pollutants	Analysis of Air pollutants	T1: 15-19-25
56-60	Air quality standards	Study of Air quality standards	T1: 15-25-28
60-65	Air pollution control act	Study of Air pollution control act	T1: 15-29-31

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

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H	S								S			S	S	
II		H												S	
III	H			H									H		
IV	S									S				H	
V	H			H						S			H	H	

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

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

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