

# **AIR POLLUTION AND CONTROL**

Subject code: **CE611PE**

Regulations: R16-JNTUH

Class: III Year B. Tech CE II Sem



DEPARTMENT OF CIVIL ENGINEERING  
BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY  
Ibrahimpatnam - 501 510, Hyderabad

**AIR POLLUTION AND CONTROL (CE611PE)**  
**(Professional Elective - I)**  
**COURSE PLANNER**

**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	Prerequisite
UG	4	4	Environmental Engineering

**III. 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.

**IV. COURSE OUTCOMES:**

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

S.No	Course Outcomes	Blooms Taxonomy level
1	Have a firm foundation and knowledge of mathematics, science and engineering principles and the ability to apply the knowledge.	<b>L2: Understanding</b>
2	Define and reason about fundamental concepts of waste water treatment	<b>L3: Apply</b>

3	Design and conduct experiments and the ability to analyse the data, interpret results and draw conclusions.	<b>L2: Understanding</b>
4	Design a component, system or process to meet desired needs and imposed constraints.	<b>L2: Understanding</b>
5	Think logically, critically and creatively.	<b>L3: Apply</b>

#### V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program outcomes		Level	Proficiency assessed by
PO1	<b>Engineering knowledge:</b> To Apply the knowledge of mathematics, science, engineering fundamentals/principals, and civil engineering to the solution of complex engineering problems encountered in modern engineering practice.	1	Assignments
PO2	<b>Problem analysis:</b> Ability to Identify, formulate, review research literature, and analyze complex engineering problems related to Civil Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1.4	Exercise, Exams
PO3	<b>Design/development of solutions:</b> Design solutions for complex engineering problems related to Civil Engineering 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.	0.6	Exercise
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.	1	Discussion, Seminars
PO5	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	0.6	Discussion, Seminars
PO6	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Civil Engineering professional engineering practice.	-	Discussions
PO7	<b>Environment and sustainability:</b> Understand the impact of the Civil Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	0.6	-----
PO8	<b>Ethics:</b> Apply ethical principles and commit to	-	-----

	professional ethics and responsibilities and norms of the engineering practice.		
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.	-	-----
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.	0.4	-----
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.	0.4	-----
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.	-	Prototype, Discussions

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

Program outcomes		Level	Proficiency assessed by
PSO 1	<b>ENGINEERING KNOWLEDGE:</b> 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.	2.6	Lectures and Assignments
PSO 2	<b>BROADNESS AND DIVERSITY:</b> 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.	1.8	Tutorials
PSO 3	<b>SELF-LEARNING AND SERVICE:</b> 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	Seminars and Projects

N - None

S - Supportive

H – Highly Related

#### VII. SYLLABUS:

## **JNTUH SYLLABUS**

### **UNIT – I:**

Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non-Point, Line and Areal Sources of air pollution- stationary and mobile sources.

### **UNIT – II**

Effects of Air pollutants on man, material and vegetation; Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes etc.

### **UNIT - III**

Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like SO<sub>x</sub>; NO<sub>x</sub>; CO; HC etc., air-fuel ratio. Computation and Control of products of combustion. Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity; Influence of Meteorological phenomena on Air Quality wind rose diagrams.

### **UNIT - IV**

Lapse Rates, Winds and moisture plume behavior and plume Rise Models; Gaussian Model for Plume Dispersion. Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control. Equipment's – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

### **UNIT – V**

General Methods of Control of NO<sub>x</sub> and SO<sub>x</sub> emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling. Air Quality Management – Monitoring of SPM, SO<sub>x</sub>; NO<sub>x</sub> and CO Emission Standards.

**SUGGESTED BOOKS:****TEXT BOOKS:**

1. Air pollution By M. N. Rao and H. V. N. Rao – Tata McGraw Hill Company.
2. Air pollution by Wark and Warner. - Harper & Row, New York.

**REFERENCE BOOKS:**

1. Air pollution and control By K.V.S.G. Murali Krishna, Kaushal Publishers. Kakinada.

**MOOC'S- SWAYAM/ NPTEL**

<https://nptel.ac.in/courses/105104099/>

<https://nptel.ac.in/courses/105104099/3>

**GATE SYLLABUS:**

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

**IES SYLLABUS:**

Sources and effects of air pollution, monitoring of air pollution.

**VIII. COURSE PLAN:**

Lecture No.	Week	Unit	Topics to be covered	Learning Objective	References																																											
1.	1	1	Definitions, Scope, Significance and Episodes.	<b>To learn:</b> Define different terms of Air Pollution and Understand the different sources of pollution	T1: 1-3																																											
2.	1	1				3.	1	1	Classifications – Natural Air Pollution	<b>To understand:</b> Classification of Natural Air Pollution, identifying different parameters	T1: 2-3, 2-4, 2-6,2-8	2	1	2	1	2	1	4.	3	1	Primary and Secondary air pollutants	<b>To learn:</b> Classification of Primary and Secondary air pollutants, identifying different parameters	T1: 2.6-14	3	1	5.	3	1	Stationary and mobile sources.	<b>To understand:</b> Classification of Stationary and mobile sources, identifying different parameters	T1: 3.1-.3	4	1	6.	4	2	Effects of Air pollutants on man, material and vegetation	<b>To learn:</b> Effects of Air pollutants on man, material and vegetation. Its impact on the environment	T1: 3.5-14	4	2	5	2	7.	5	2	Global effects of air pollution Green House effect	<b>To understand:</b> Global effects of air pollution Green House effect, Its impact on the
3.	1	1	Classifications – Natural Air Pollution	<b>To understand:</b> Classification of Natural Air Pollution, identifying different parameters	T1: 2-3, 2-4, 2-6,2-8																																											
	2	1																																														
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4.	3	1	Primary and Secondary air pollutants	<b>To learn:</b> Classification of Primary and Secondary air pollutants, identifying different parameters	T1: 2.6-14																																											
	3	1																																														
5.	3	1	Stationary and mobile sources.	<b>To understand:</b> Classification of Stationary and mobile sources, identifying different parameters	T1: 3.1-.3																																											
	4	1																																														
6.	4	2	Effects of Air pollutants on man, material and vegetation	<b>To learn:</b> Effects of Air pollutants on man, material and vegetation. Its impact on the environment	T1: 3.5-14																																											
	4	2																																														
	5	2																																														
7.	5	2	Global effects of air pollution Green House effect	<b>To understand:</b> Global effects of air pollution Green House effect, Its impact on the	T1: 6.1-5																																											
	5	2																																														

				environment	
8.	6	2	Heat Island, Acid rains, Ozone Holes	<b>To understand:</b> Understanding the Heat Island, Acid rains, Ozone Holes	T1: 9.1-5
	6	2			
	6	2			
9.	7	3	Thermodynamics and Kinetics of Air-pollution	<b>To understand:</b> Understanding the Thermodynamics and Kinetics of Air-pollution	T1
10.	7	3	Applications in the removal of gases like SO <sub>x</sub> ; NO <sub>x</sub> ; CO; HC etc.	<b>To learn:</b> Applications of SO <sub>x</sub> ; NO <sub>x</sub> ; CO; HC etc	T1
	7	3			
	8	3			
11.	8	3	Air fuel ratio, computation and control of products of combustion.	<b>To understand:</b> Control of the components of combustion	T1
	8	3			
12.	9	3	Meteorology and plume dispersion, properties of atmosphere- heat, pressure wind forces moisture and relative humidity	<b>To learn:</b> Property of atmosphere	T1
	9	3			
13.	9	3	Influence of meteorological phenomena on Air Quality- wind rose diagram	<b>To understand:</b> phenomena on Air Quality	T1
	10	3			
14.	10	4	Lapse rates, pressure systems, winds and moisture plume behavior and plume rise models	<b>To learn:</b> Air quality Parameters	T1
	10	4			
15.	11	4	Gaussian model for plume dispersion. Control of particulates- control at sources, process changes, equipment modifications- design , operation and control	<b>To understand:</b> Gaussian model for plume dispersion- operation and control	T1
	11	4			
	11	4			
16.	12	4	Equipments- settling chambers, centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators	<b>To understand:</b> Air pollution control Equipments	T1
	12	4			
	12	4			
17.	13	5	General Methods of control of NO <sub>x</sub> and SO <sub>x</sub> emission	<b>To learn:</b> Control measures of NO <sub>x</sub> and SO <sub>x</sub> emission	T1
	13	5			
18.	13	5	In plant control measures, process, changes	<b>To understand:</b> Methods of in plant control measures	T1
	14	5			

19.	14	5	Dry and wet methods of removal and recycling.	<b>To understand:</b> methods of removal and recycling.	T1
	14	5			
	15	5			
20.	15	5	Air quality Management-Monitoring of SPM, SO <sub>x</sub> , NO <sub>x</sub> , and CO emission Standards	<b>To understand:</b> Air quality monitoring with standards	T1
	15	5			
	16	5			
21.	16	5	Revision	Pervious exam papers solving	
22.	16	5	Revision	Pervious exam papers solving	

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

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
<b>I</b>	2	3	-	-	2	-	-	-	-	-	-	-	2	-	2
<b>II</b>	3	2	-	-	1	-	-	-	-	-	-	-	3	2	-
<b>III</b>	-	2	-	3	-	-	3	-	-	-	-	-	3	2	-
<b>IV</b>	-	-	-	-	-	-	-	-	-	-	2	-	2	3	-
<b>V</b>	-	-	3	2	-	-	-	-	-	2	-	-	3	2	3
<b>Average</b>	1	1.4	0.6	1	0.6	-	0.6	-	-	0.4	0.4	-	2.6	1.8	1

1=Small

2=Supportive 3= Highly related

**X. QUESTION BANK: (JNTUH)**

**DESCRIPTIVE QUESTIONS: (WITH BLOOMS PHRASES)**

**UNIT-I**

**SHORT ANSWER QUESTIONS-**

S.NO	Question	Blooms Taxonomy Level	Programme Out come
1.	Define different terms of Air Pollution	Remember	1
2.	What are the sources of air pollution	Understand	2
3.	Give the Classifications of Artificial causes of Air Pollution	Remember	1



4.	What is meant by Pollution	Remember	1
5.	What is meant by Global warming	Remember	1
6.	What is meant by Ozone layer depletion	Remember	1
7.	What is meant by acidification	Remember	1
8.	What is meant by eutrophication	Remember	1
9.	Define air pollution	Remember	1
10.	What is the difference between stationary and mobile source of air pollution	Remember	2

### LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	Define Air pollution and explain the Primary and secondary pollutants	Remember	1
2.	How are secondary pollutants formed? Which parameters do influence their formation	Remember	1
3.	Explain the reactionary pattern for Photochemical Smog	Remember	1
4.	Explain effects of air pollution on atmosphere	Remember	1
5.	Give comparative picture of natural and artificial sources of air pollution.	Remember	1
6.	Discuss the effects of toxic substances on human health	Remember	1
7.	Discuss the natural and artificial production of oxides of sulphur.	Remember	1
8.	How natural sources are responsible for creation of oxides of carbon	Remember	1
9.	Discuss the role of wind in air pollution dispersion	Remember	1
10.	Explain the causes of acid rain and control measures	Remember	1

### UNIT-2

### SHORT ANSWER QUESTIONS-

S.N	Question	Blooms Taxonomy Level	Programme Out come
1.	Define acid rain	Remember	1
2.	Effects of air pollution on man	Remember	1
3.	How can we reduce the heat island effect	Remember	1
4.	Remedies/ methods to control air pollution	Remember	1
5.	What is meant by ozone hole? How to prevent the ozone hole formation	Remember	1
6.	What is meant by heat of islands	Remember	1
7.	Give examples for air pollution caused by point and	Remember	1

	Non-Point sources		
8.	Define Areal Sources of air pollution	Remember	1
9.	How air pollution is caused by mobile sources	Remember	1
10.	Give the example for Natural and Artificial source of air pollution	Remember	1

### LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Outcome
1.	In the natural 'Carbon cycle', explain the meaning of sink and its significance.	Remember	2
2.	Discuss photochemistry of Ozone depletion in	Remember	2
3.	How natural sources are responsible for creation of oxides of carbon	Remember	2
4.	Discuss the following terms with reference to air pollution effects on metals: i. Abrasionii. Absorptioniii. Corrosion	Remember	2
5.	Discuss the effects of ozone and PAN on plants.	Remember	2
6.	Write briefly explain about ozone holes?	Remember	2
7.	In the natural 'Carbon cycle', explain the meaning of sink and its significance	Remember	2
8.	Write a short note on Green house effect	Remember	2
9.	Explain in detail how the heat islands are formed	Remember	2
10.	Explain how humans are been affected by ozone depletion	Remember	2

### UNIT-3

### SHORT ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Outcome
1.	What is ozone?	Remember	1
2.	Define green house effect	Remember	1
3.	List the gases which causes green house effect	Remember	1
4.	What is air-fuel ratio?	Remember	1
5.	What are the products of combustion?	Remember	1
6.	Define Meteorology?	Remember	1
7.	What plume Dispersion?	Remember	1
8.	List properties of atmosphere	Remember	1
9.	What is meant by Air Qualitywind rose diagrams?	Remember	1
10.	What is relative Humidity?	Remember	1

### LONG ANSWER QUESTIONS-

S.No	Question	Blooms	Programme
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		<b>Taxonomy Level</b>	<b>Out come</b>
1.	What are the pollution controlling strategies for industrial waste water management	Remember	3
2.	Explain the terms i. Environmental lapse rate ii. Adiabatic lapse rate	Remember	3
3.	Discuss the role of natural gas its availability and eco-friendly nature in India	Understand	3
4.	Discuss the thermodynamics of formation of Nitrogen oxide	Remember	3
5.	What do you mean by 'Pollution Roses'? Enlist the types.	Remember	3
6.	Discuss different types of environmental lapse rates	Remember	3
7.	Design a tubular ESP to treat 10,000 m <sup>3</sup> /hr of a gaseous stream from a paper mill for an efficiency of 90%. Assume an effective migration velocity of 0.075 m/sec	Understand	3
8.	Discuss the role of Heat and temperature in governing changes in atmosphere.	Remember	3
9.	How LPG is produced? Explain the uses and formation of air pollutants	Remember	3
10.	Explain the role of oxides of sulphur as oxidizing and reducing agent	Understand	3

#### UNIT-4

#### SHORT ANSWER QUESTIONS-

<b>S.No</b>	<b>Question</b>	<b>Blooms Taxonomy Level</b>	<b>Programme Out come</b>
1.	What is Lapse Rates?	Remember	1
2.	Why Gaussian Model is used?	Remember	2
3.	Why Centrifugal separators is needed?	Remember	1
4.	List different types of Lapse Rates	Remember	1
5.	Why filters Dry are used?	Remember	2
6.	What are Electrostatic precipitators?	Remember	1
7.	Why Settling Chamber used?	Remember	1
8.	What are plume Rise Models?	Remember	2
9.	Define Pressure Systems	Remember	1
10.	Define Plume Dispersion	Remember	1

#### LONG ANSWER QUESTIONS-

<b>S.No</b>	<b>Question</b>	<b>Blooms Taxonomy Level</b>	<b>Programme Out come</b>
1.	Calculate the number of cyclones required to treat a flow of 50m <sup>3</sup> /sec with an inlet velocity of 15m/sec. The diameter of cyclone is 1.	Understand	4
2.	What are the assumptions in the in the Gaussian Model.	Remember	4

3.	Describe the Gaussian plume model with a neat sketch in detail	Remember	4
4.	What are the applications of electro static precipitators in various industries	Remember	4
5.	Cylindrical electrostatic precipitator of diameter 0.3m is used for separating pulverized coal fly ash particles from a furnace gas stream. If the volumetric flow rate of the gas is 0.05 m <sup>3</sup> /sec, what will be the length of precipitator for obtaining a collection efficiency of 99.9%. What percent change in electrode Collection area is required to increase the collection efficiency from 99.9 to 99.95% ?	Understand	4
6.	What are the Advantages and Disadvantages of electro static precipitators	Remember	4
7.	Explain stack gas emission standards for different industries	Remember	4
8.	Explain the various methods of filter cleaning with neat sketches	Remember	4
9.	A thermal power plant burns 100 tonnes of coal with 5.5% sulphur content. Calculate minimum stack height required. The particulate concentration in flue gases is 8000 mg/m <sup>3</sup> and the gas flow rate is 20m <sup>3</sup> /se	Understand	4
10.	Explain the cyclonic spray scrubber with a neat sketch	Remember	4

#### UNIT-5

#### SHORT ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy Level	Programme Out come
	List out the Air quality standards	Remember	1
1.	List out the various methods of removal and recycling	Remember	1
2.	Define SPM	Remember	1
3.	Define CO emission Standards	Remember	1
4.	List In-plant Control Measures	Remember	3
5.	Define NO <sub>x</sub>	Remember	1
6.	Define SO <sub>x</sub>	Remember	1
7.	Define air quality Index	Remember	1
8.	Define the wet method	Remember	1
9.	Define dry method of removal	Remember	1

#### LONG ANSWER QUESTIONS-

S.No	Question	Blooms Taxonomy	Programm
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		Level	Outcome															
1.	List the Indian Air quality Standards	Remember	5															
2.	Give the Classifications of Artificial causes of Air Pollution	Remember	5															
3.	Explain details of control methods of NO <sub>x</sub> emission	Remember	5															
4.	what are the various types of Air Quality Indices? What are the use of Air Pollution Indices?	Remember	5															
5.	Explain details of control methods of CO emission	Remember	5															
6.	Explain the in-plant control measures	Remember	5															
7.	Explain the wet method of recycling and removal	Remember	5															
8.	Find the effective stack height if a 40m stack releases SPM at a rate of 1.25grams/sec. The atmospheric pressure is 10.8m of water. The temperatures of ambient air and gas are 27°C and 400°C. The stack diameter is 2.3m, stack gas velocity is 6m/sec and the wind velocity is 1.8m/sec. Also find the ground level concentrations at 1 km, 2km, 5 km and 10 km distances in the direction of wind. <table border="1" data-bbox="337 1073 667 1171"> <tr> <td>X(km)</td> <td>1</td> <td>2</td> <td>5</td> <td>10</td> </tr> <tr> <td><math>\sigma_y</math></td> <td>4</td> <td>133</td> <td>300</td> <td>510</td> </tr> <tr> <td><math>\sigma_z</math></td> <td>30</td> <td>50</td> <td>95</td> <td>150</td> </tr> </table>	X(km)	1	2	5	10	$\sigma_y$	4	133	300	510	$\sigma_z$	30	50	95	150	Understand	5
X(km)	1	2	5	10														
$\sigma_y$	4	133	300	510														
$\sigma_z$	30	50	95	150														
9.	Write short notes on Ambient Air quality monitoring	Remember	5															
10.	Explain how do you control the emission of SO <sub>x</sub> using (a) Natural dispersion by dilution (b) Desulphurization (c) Alternate fuels	Understand	5															

## XII. OBJECTIVE QUESTIONS

### UNIT-I

1. The Pollution Standard Index (PSI) scale has span from

- a) 0-200      b) 0-300      c) 0-400      d) 0-500

2. Air pollution causes

- a) Global warming    b) Respiratory problem      c) Soil erosion      d) None of these

3. What is an example of natural air pollution?

- a) Industrial Emissions    b) Cigarette Smoke    c) Vehicle Exhaust    d) Volcanic Ash

4. Primary Pollutants

- a) are put directly into the atmosphere b) mix with something else before becoming a problem  
c) Cause instant death when inhaled d) include smog
5. What is an example of secondary pollutant?  
a) Smog      b) Cigarette Smoke      c) Industrial Emissions      d) Vehicle Exhaust
6. What causes pollution  
a) Human activities      b) Trees      c) Both of these      d) None of these
7. The Taj Mahal is being affected by  
a) Noise pollution      b) Air pollution      c) Water pollution      d) None of these
8. People who are least likely to be bothered by air pollution are:  
a) healthy people      b) elderly people      c) infants      d) people with asthma
9. The law that regulates air pollution is the  
a) Oh No Ozone Hole      b) Air Quality Control Act  
c) Atmospheric Pollution Law      d) Clean Air Act
10. Which of the following is/are inorganic gas (es)?  
a) Carbon monoxide      b) Hydrogen sulphide      c) Chlorine      d) All of the above

## UNIT-II

1. The major contributor of Carbon monoxide is  
a) Motor vehicle      b) Industrial processes      c) Stationary fuel combustion      d) None
2. Ozone is found in  
a) Mesosphere      b) Ionosphere      c) Stratosphere      d) Exosphere
3. Ozone is formed in the upper atmosphere by a photochemical reaction with  
a) Ultra violet solar radiation      b) Infra red radiation      c) Visible light      d) All of the above
4. Acid Precipitation affects all but the following:  
a) Burns the skin of humans outside      b) Weathers rock  
c) Changes lakes for aquatic life      d) Changes soil for plants
5. Which of the following is a greenhouse gas?  
a) Carbon Dioxide      b) Nitrogen      c) Argon      d) Oxygen
6. Chlorofluorocarbon is used in  
a) Refrigerators      b) Air conditioners      c) Perfumes      d) All
7. CFCs are responsible for:

a)Global Warming b) Auroras c) Creating the hole in the ozone layer d)Creating Smog

8. Which of the following diseases are caused by the smog?  
a)Rickets b)Throat Cancer c)Skin Cancer d)Breathing Problem

9. What is Air Quality Index?  
a)It tells about the sound pollution.  
b)It measures air pollution mainly sulphur content in the air.  
c)It measures ozone levels in your area.d)It checks the colour of the air

10.What type of precautions will be taken to survive when ozone level is high?  
a) Drive less b) Stay hydrated c) Avoid using gas powered engines. d) All of the above

### UNIT-III

1. A technique used to determine the concentration of odour compounds in a sample is known as.

a)Stripping b)Settling c)Flushing d)Chlorination

2. Wet scrubbers are classified into \_\_\_\_ types.

a) 2 b) 3 c) 5 d) 6

3. The centrifugal collectors are classified into how many types?

a) 3 b) 4 c) 5 d) 2

4. Which of the following fluid is used in web scrubbers?

a) Lime b)  $MgSO_4$  c) NaCl d)  $K_2Cr_2O_7$

5. The threshold concentration of sulphur dioxide in any industrial activity should not be permitted beyond

a) 2ppm b)3ppm c)4ppm d)5ppm

6.The maximum efficiency of electrostatic precipitator is

a) 95% b) 80% c) 99% d) 100%

7. Which of the following air pollution control device has maximum efficiency?

a) Electrostatic precipitator b) Dynamic precipitator  
c) Spray tower d) Wet cyclonic scrubber

8. Which of the following greenhouse gas is contributed by cattle farming?

a) Nitrous oxide b) Methane c) Carbon monoxide d)

All of the mentioned

9.Which of the following removes both gaseous and particulate contaminants?

a) Venturi scrubber b) Gravitational settling chamber c) Dynamic precipitator d)  
Wet scrubber

10.The maximum efficiency of electrostatic precipitator is

a) 95% b) 80% c) 99% d) 100%

## UNIT-IV

1. Identify the correct statement regarding Electrostatic precipitator.  
a) Minimum particle size removal is  $<0.5\mu\text{m}$     b) They can be operated at high temperature  
c) It has low maintenance cost    d) It does not cause any freezing problem
2. Which of the following is incorrect regarding fabric filter?  
a) They can remove very small particles    b) They are liable to chemical attack  
c) They have low efficiency in comparison to venturi scrubber  
d) They can handle large volume of gas at relatively high speed
3. How many parameters are taken into consideration when measuring air quality, in India?  
a) 4    b) 3    c) 8    d) 9
4. Which of the following pollutants are considered when measuring air quality?  
a)  $\text{CO}$ ,  $\text{O}_3$ ,  $\text{PM}_{2.5}$     b)  $\text{NH}_3$ ,  $\text{PM}_{10}$ ,  $\text{Pb}$     c)  $\text{NO}_2$ ,  $\text{SO}_2$     d) All of the mentioned
5. What range of air quality index has the most severe impact on human health?  
a) 101-200    b) 201-300    c) 301-400    d) 401-500
6. Which of the following devices is NOT used to control particulate emissions?  
a) Electrostatic precipitator    b) Bag filters  
c) Catalytic converters    d) All of the mentioned
7. Which of the mentioned devices are used for removing vapour phase/ gaseous pollutants?  
a) Absorption towers    b) Catalytic converters  
c) Thermal oxidisers    d) All of the mentioned
8. Hazardous pollutants are those pollutants for which air quality standards have been devised.  
a) True    b) False    c) None    d) Both a) & b)
9. Greater the Air Quality Index of a region, more polluted is the air. True or false?  
a) True    b) False    c) None    d) Both a) & b)
10. Which plant helps in detection of pollution from automobile exhaust?  
a) Neem    b) Tulsi    c) Lichen    d) Lettuce

## UNIT-V

1. Which of the following pollutants are included to measure Air Quality index?  
1) Sulphur dioxide.    2) Carbon Dioxide.    3) Carbon monoxide  
a) Only 1 and 3    b) Only 2 and 3  
c) Only 1 and 2    d) All of the Above
2. What type of precautions will be taken to survive when ozone level is high?  
a) Drive less    b) Stay hydrated    c) Avoid using gas powered engines.  
d) All of the above
3. Fugitive emissions consist of





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**XV. JOURNALS:**

1. **Journal of Environmental Pollution and Control (JEPC)**
  - a. Journal on pollution effects and control
  - b. Journal of the Air Pollution Control Association

**XVI. LIST OF TOPICS FOR STUDENT SEMINARS:**

1. Global effects of air pollution
2. Green house effect
3. Air quality standards
4. Air pollution control act

**XVII. CASE STUDIES / SMALL PROJECTS:**

1. Water quality and testing.
2. Effects of air pollutants on man, material and vegetation
3. Dry and Wet methods of removal and recycling