GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: AIR POLLUTION AND CONTROL
(COURSE CODE: 3361303)

Diploma Programme in which this course is offered	Semester in which offered
Environment Engineering	Sixth

1. RATIONALE

The air pollution levels in some of our cities have reached to such a level that it is causing health related problems and very poor visibility in winter months resulting in traffic accidents. It is therefore very important to monitor and control air pollution. The course will provide a detailed knowledge of air quality management with an emphasis on the sources of air pollution, including the effects on humankind, plants and animals. In depth awareness of central, state, and local regulatory requirements in respect of air pollution laws and regulations will be provided. Principles of air pollution prevention and control, equipment and technology used for the purpose will be dealt with description of control of specific gaseous emissions. This course is therefore a key course for environment engineers.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in students so that they are able to acquire following competency:

- **Measure different components of air pollution and suggest strategies to minimize them.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

i. Identify sources, causes and effects of air pollution.
ii. Analyse the environmental effects of air pollution on humankind, plant and animal kingdoms.
iii. Identify the meteorological components
iv. Take basic actions to minimise air pollution, prevention and control
v. Maintain scrubbing system to control specific gaseous emission.
vi. Follow the laws and regulations of air pollution prevention and control at the local, state and country level.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+P+T)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

Legends : L-Lecture ; **T**-Tutorial /Teacher Guided Student Activity ; **P**-Practical ; **C**-Credit ; **ESE**-End Semester Examination ; **PA** –Progressive Assessment

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
Unit-I Air Pollutants	1a. Describe the major atmospheric pollutants 1b. Describe different sources of atmospheric pollution. 1c. Interpret the effects of air pollution on humankind, plants and animal kingdoms. 1d. Describe the effects of air pollution on society	1.1 Air pollution an Environmental problem. 1.2 Classification of air pollutants: Natural contaminants, Particulate, Gases and vapors, Primary and secondary air pollutants 1.3 Sources of Air pollution: Stationary sources, Mobile sources. 1.4 Effects of air pollution on: human health, animals, plants, Properties, Society
Unit-II Meteorology	2a. Explain dispersion phenomenon of air pollutants covering diffusion, meteorological components, stability of atmosphere and corresponding plume shapes. 2b. Describe the process and instruments used for measuring of wind speed, direction and ambient temperature 2c. Explain the process of determining the stack height 2d. Describe the stability classes and their significance	2.1 Meteorological factors influencing air pollution: Dispersion, Temperature Lapse Rates and Stability. 2.2 Measurement of wind speed, direction and temperature 2.3 Effect of meteorological parameters on Plume behaviour 2.4 Regalement chart for plume behaviour 2.5 Dispersion of air pollutants 2.6 Determination of Stack height based on these parameters 2.7 Stability classes
Unit-III Air Pollution Sampling and Measurements	3a. Describe different method of sampling 3b. Select the sampling location 3c. Interpret characteristics of the sample measured. 3d. Describe the criteria of selection of sampling location	3.5. Sampling methods 3.6. Duration of Sampling 3.7. Ambient Sampling and its location: Collection of Gaseous Air Pollution, Collection of Particulate Matter 3.8. Stack Sampling and selection of sampling location
Unit- IV Air Pollution Control Methods and Equipment	4a. Explain principles of air pollution prevention and control measures with various control equipments at source. 4b. Discuss specific features and meaning of air pollution control laws, regulations at central, state and local bodies' level.	4.1 Types of collection methods. 4.2 Particulate Emissions Control Equipments: Gravity settling, cyclones, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers 4.3 Selection of Collectors. 4.4 Control of Gaseous Emissions: Absorption by Liquids, Adsorption

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
	4c. Describe the selection criteria for collectors 4d. Describe the control of different types of gaseous emissions	by Solids 4.5 Air pollution control laws/acts at different central, state and local levels and by regulatory bodies.
Unit-V Control of Specific Gaseous Emissions	5a. Describe the different process for control of SO_2 and NO_2 5b. Perform basic operation of scrubbing system in the lab or at field location in industry.	5a. Control of SO_2: Chemistry of SO_2, Lime and Limestone Scrubbing, Wet lime scrubbing, Single Alkali scrubbing and Double Alkali scrubbing, Dry process 5b. Control of NO_2: Combustion control methods

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Air pollutants	06	05	03	02	10
II	Meteorology	10	06	06	06	18
III	Air Pollution Sampling and Measurements	08	02	04	06	12
IV	Air Pollution Control Methods and Equipment	12	04	08	08	20
V	Control of Specific Gaseous Emissions	06	03	03	04	10
Total		**42**	**20**	**24**	**26**	**70**

Legends: R = Remember**, U** = Understand**, A=** Apply and above Level (Bloom's revised taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED PRACTICAL / EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Note*: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of* ***Course Outcomes*** *related to affective domain. Thus over all development of* ***Programme Outcomes*** *(as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes in the Psychomotor Domain)	Approx. Hours Required
1	I	Solve given problems based on classification of air pollution	02
2	II	Solve given problems based on sources of pollution and its effect	02
3	III	Solve given problems based on meteorology	04
4	IV	Solve given problems based on air pollution sampling and measurements	04
5	IV	Perform practical based on air pollution sampling and measurements	06
6	V	Solve given problems based on air pollution control methods and equipment	04
7	VI	Solve given problems based on control of specific gaseous pollutants	04
8	VII	Present seminar on a given topic and submit report (Students may be given topics in the group of five)	02
Total Hours			28

8. SUGGESTED STUDENT ACTIVITIES (Home/Field Assignment)

i. Make a report after gathering information about the values of ambient air pollution in your town or city and compare them with that of other cities.
ii. Prepare sketches for: Different types of Plume behaviour.
iii. Industrial visit for stack and ambient air quality monitoring and for operation of scrubbing system with requisite permission from authorities.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

i. Arrange Expert Lectures,
ii. Arrange field visits to to collect samples and to measure Air Pollution from ambient and stack.
iii. Ask students to prepare reports/mini projects on different causes of air pollution in a given location and suggested remedial measures

10. SUGGESTED LEARNING RESOURCES

(A) Books

S. No.	Title of Books	Author	Publication
1	Air Pollution and Control	Rao, M.N and Rao, H.N.	Tata McGraw Hill, New Delhi 1989
2	Environmental Engineering and Management	Suresh, l. S.	2nd addition 2005,kartaraiand Sons
3	Air pollution	Wark and Warner	Addison-Wesley Publications 1988

4	IS:5182 , Methods for measurements of air pollution(Part-I,II,IV,V,X)		

(B) Software/Learning Websites

http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/ Environmental Air Pollution

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof M.C. Sanandiya**, Lecturer in Environmental Engineering, K.J .Polytechnic, Bharuch
- **Prof Jini Sunil**, Lecturer in Environmental Engineering, Shri K. J. Polytechnic, Bharuch

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