GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Environmental Engineering (13), Environmental Science & Engineering (37)
SUBJECT NAME: Air Pollution Control and Management
SUBJECT CODE: 2171302
B.E. 7TH SEMESTER

Type of course: Applied science

Prerequisite: Knowledge of Fundamentals of Air Pollution

Rationale: This course provides fundamentals for selection and design of the most appropriate and sustainable air pollution control equipments. It also provides the basics on treatment options and technology selection for specific industrial applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	2	0	6	70	20	10	30	0	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Emission Quality Requirements:** Air quality and emission standards	01	2
2	**Control of Particulates:** Particulate control mechanisms, gravity settler, venturi scrubber, cyclone separator, bagfilters electrostatic precipitator.	13	23
3	**Control of gaseous pollutants:** (i) Control of Sulphur Oxides: Introduction: thermo dynamics and kinetics of sulphur dioxide formation; Control methods: Pre combustion :Low sulphur fuel firing, Desulphurization of fuel ; Post combustion :Tall stack dispersion , Flue gas desulphurization :Non regenerative process; Regenerative process ;dry process : carbon adsorption & spray dryer scrubbing (ii) Control of Nitrogen Oxides: Introduction : mechanism of formation of nitrogen oxides	12	21

	Control methods: Precombustion or combustion control methods Post combustion : Catalytic decomposition , Catalytic reduction :selective non catalytic reduction and selective catalytic reduction ; Adsorption; Absorption (iii) Control of VOCs Introduction , sources and control mechanisms		
4	**Air Pollution Episodes and Atmospheric Photochemical Reaction:** Introduction, thermodynamics of photo chemical reactions, monoatomic oxygen and ozone formation. Role of oxides of nitrogen in photo oxidation, hydro carbon in atmospheric photo chemistry, oxidants in photo chemical smog, hydro carbon reactivity.	**08**	14
5	**Mobile Sources:** IC engine and cycle, A/F ratio, sources of air pollutants, control by process change, engine design change, Stratified charge engines, Rotary combustion engines, control by fuel change, catalytic converters, air pollution by diesel engines and turbojet engines.	**10**	19
6	**Sources and Air Pollution control systems for following industries:** (i) Mineral Processing industry. (ii) Cement industry (iii) Fertilizer industry (iv) Chemical industry (v) Thermal Power plant (vi) Foundry and induction furnace metal industries	**12**	21

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
15	**15**	**25**	**25**	**20**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's 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.

Reference Books:

1) Air Pollution Control – by Wark & Warner
2) Air Pollution – by M N Rao
3) Air Pollution – by Henry Perkins
4) Air Pollution and control – by Noel De nevers

Course Outcome:

After learning the course the students should be able to:

1. Select the most appropriate technology to purify and/or control emission of particulate emission.
2. Suggest the applicable technology to prevent , control or scrub the oxide of sulfur from the gas and design the control equipment. .
3. Apply the best technologies for control of NOx.
4. Propose the measures to control the emission from mobile sources.
5. Devise the techniques to control gases and vapors from industries using concepts of absorption, adsorption and condensation.

List of Tutorials

1. Assignment based on Air quality and emission standards, Air pollution indices
2. Tutorial based on A/F ratio and Vehicle Pollution
3. Air Pollution Control Equipments for particulate control: Working principle, Construction, applications.
4. Assignments on different techniques for control of sulphur oxides
5. Assignments on different techniques for control of Nitrogen oxides.
6. Assignments on Control of gases and vapours.
7. Assignments on Atmospheric Photochemical reactions.

Design based Problems (DP)/Open Ended Problem:

1. Term paper on Air Pollution control systems for industries including identification and characterization of sources of air pollution, treatment and control of air pollutants including waste minimization with flow diagram.

Major Equipment:

1. Respirable Dust sampler.
2. PM $_{10}$ and PM $_{2.5}$ monitor.
3. Stack monitoring kit.
4. Auto exhaust analyzer.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.