GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Environmental Science & Technology
SUBJECT NAME: Design of Air Pollution Control
System & Air Quality Modeling

SUBJECT CODE: 2173510
B.E. Semester: VII

Type of course: Environmental Science & Technology

Prerequisite: Knowledge of various air pollutants, their characteristics and impact. Introductory knowledge of control equipment air quality modeling.

Rationale: This subject is intended to make students thorough with the control mechanism of air pollutants and control technologies for specific pollutants. This subjects also include details about air quality modelling.

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		
3	1	3	7	70	20	10	20	10	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.	Topic	Teaching Hours	Module Weightage (%)
1.	**Introduction to Air Pollution Control:** Various mechanisms to control gaseous pollutants and particulate matter. Control Equipment design: Gravity chamber, Cyclone separator, Electrostatic precipitator, fabric filter, and absorption towers and others.	10	25
2.	**Control technologies for Specific pollutants:** Control of Sulphur dioxide emission (extraction from fuel, sulphur reduction during combustion, desulphurization, Processes using metal oxides and activated carbon, wet scrubbing), control of nitrogen oxides (modification of operating condition, modification of design condition, treatment of effluent gas), control of carbon mono oxide (CO), HC Control.	10	25

3.	**Air Quality Modeling:** Introduction to Air Quality Modeling. Necessity, application and limitation of air quality modelling. Introduction to Dispersion Modeling, Photochemical Modeling and Receptor Modeling. Different air quality Dispersion models and their limitations.		10		25		
4.	**Gaussian Plume model and modeling software:** Introduction to Gaussian Plume modelling, its assumption and limitation. GLC determination. Introduction to commonly used software based models such as AERMOD, CALPUFF, ISCST3 and CALINE4 etc.		10		25		

Suggested Specification table with Marks (Theory):

Unit No	Unit Title			Distribution of Theory Marks				
		R Level	U Level	A Level	N level	E level	Total	
1	Introduction to Air Pollution Control	3	9	7	3	3	25	
2	Control technologies for Specific pollutants	4	8	7	3	3	25	
3	Air Quality Modeling	8	5	4	4	4	25	
4	Gaussian Plume model and modeling software	6	6	7	3	3	25	

Legends: R: Remembrance; U = Understanding; A = Application; N= Analyze; 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 Modeling and its application, Borrego, C and Miranda, A.I. Springer. 2007.
2. Planning and managing regional air quality (Modeling and measurement studies), Solomon, P.A., Lewis Publishers, 1994.
3. Environmental Pollution Control and Engineering, Rao C.S.,New Age International (P) Limited, 1991.
4. Principles and Practices of Air Pollution Control and Analysis, Mudakavi, J.R. I.K International Publishing House Pvt Ltd. 2010.
5. Catalytic Air Pollution Control commercial Technology, Heck. R.M., Farrauto, R.J. and Gulati, S.T. Willey 3rd Ed.

6. Air Pollution Control Equipment, Brauer, H and Varma, Y.B.G. Springer Verlag. 1981.
7. Air Quality Modeling: Theories, Methodologies, Computational Techniques, and Available Databases and Software, Anfossi, D. EnviroComp, Volume 1, 2003.
8. Air Pollution Control Engineering, Licht, W. Marcel Dekker, INC.2nd Ed.
9. Air Pollution Control Equipment Calculation, Theodore, L. Willey Publication. 2008.

Course Outcome: After learning this course the students would have:
1. Proper understanding about various control mechanisms for gaseous pollutants and particulate matter
2. Sound knowledge of different technologies available for controlling specific pollutants.
3. Awareness about air quality modeling and air dispersion modeling.
4. Understanding about different software used for air quality modeling and GLC determination using Gaussian Plume model.

List of Experiments:

1.	Sampling of PM 2.5 in ambient air.
2.	Sampling of Respirable Suspended Particulate Matter PM10 in ambient air.
3	Sampling of Suspended Particulate Matter in ambient air.
4.	Sampling and analysis of nitrogen dioxide in ambient air.
5.	Sampling and analysis of sulphur dioxide in ambient air.
6.	Measurement of Noise using Sound Level Meter.
7.	Demo of Stack monitoring kit.
8.	Demo of weather monitoring station.
9.	Demo of handy air sampler

Major Equipment:

- Respirable dust sampler
- PM2.5 Sampler
- Stack monitoring kit
- Sound level meter
- Handy air sampler etc.

Open ended Projects:

- Design of Cyclone separator.
- Design of Electrostatic Precipitators.
- GLC Determination

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.