



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3161309

Semester – VI

Subject Name: AIR QUALITY MODELLING

Type of course: Professional Elective Course

Prerequisite: Fundamentals of Air Pollution Systems

**Rationale:** To understand the dynamics of air pollution control systems and control the parameters causing deterioration of air quality.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	0	4	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	<b>Introduction</b> Air Pollution, Some Definitions, Primary and Secondary Pollutants, A Short History of Air Pollution Modeling, Air Pollution Regulations, Need of air quality modeling, Modeling Categorized, Modeling the Atmosphere, Modeling Alternatives, Evaluation of Model Performance, and Uses of Models.	2
2	<b>Emissions Modeling and Inventory:</b> Introduction to Emissions Inventory and Emissions Modeling, Overview of Inventories, Emissions Estimation Techniques, Characterization of Emissions, Characterization of Point Sources, Area Sources, Available Emissions Models, Estimating Emissions for Use in Air Quality Modeling, Pollutant Monitoring and Fuel Analysis Methodologies, Emissions Inventory Terms	4
3	<b>Meteorological Modeling:</b> <b>Meteorological Modeling for Air Quality Applications:</b> Introduction, Modeling Approaches, Dynamical and Thermo dynamical Processes, Model Numeric, Model Verification and Validation <b>Large-Eddy Simulations of the Atmospheric Boundary Layer:</b> Introduction, Introduction, The ABL Simulations	10
4	<b>Plume Rise:</b>	8



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	Introduction, Semi-Empirical Formulations, Advanced Plume Rise Models, Particle Models for Plume Rise, Special Cases	
5	<b>Introduction to Gaussian Plume Models and puff model:</b> <b>Plume model:</b> Introduction, The Point Source in the Atmospheric Boundary Layer, The Atmospheric Boundary Layer, Dispersion in the Atmospheric Boundary Layer, Modifications to the Gaussian Framework <b>Puff Model:</b> Introduction, Theoretical Background, Puff Model Enhancements <b>Special Applications of Gaussian Models</b>	8
6	<b>Other Models:</b> Receptor Models, Indoor Air Pollution Modeling, Lagrangian Particle Models, Odor Modeling, Atmospheric Transformations, Eulerian Dispersion Models	4
7	<b>Available Software:</b> Short-Range Models, Meteorological Models, Urban and Regional Photochemical Models, Long-Range Transport Models, Visibility, Impairment and Complex Terrain, Dense gas Model	6

### Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	20	10	10	5

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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:

**Air Quality Modeling by Paolo Zannetti**

**Air Pollution Measurement, Modelling and Mitigation, By Abhishek Tiwary, Ian Williams**

### Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the importance and need of air quality modelling	5



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CO-2	Prepare emission inventory for estimating emissions	20
CO-3	Carry out Meteorological modeling and predict the plume rise	35
CO-4	Make air quality predictions using different air quality models and softwares	40

### Tutorials:

1. Assignments based on Emission modeling and inventory.
2. Assignments based on Eddy Diffusion.
3. Enlist application of Gaussian Dispersion Modeling.
4. Assignment based on Plum Rise.
5. Assignment based on applications of other models.
6. Give detailed description of different types of model.