	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM

Programme	**Master of Technology**	Year of Regulation	**2025**
Department	**Civil Engineering**	Semester	**II**

Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
CE 536	**Air Quality Monitoring and Control Technologies**	**NIL**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	1. To provide in-depth knowledge of air pollution sources, dispersion, and its environmental and health impacts. 2. To familiarize students with the principles and instrumentation used in air quality monitoring. 3. To analyze and interpret ambient air quality data using standard protocols. 4. To examine various air pollution control technologies for gaseous and particulate pollutants. 5. To understand regulatory frameworks and air quality management strategies.	Course Outcomes	CO1	Able to Identify major air pollutants, their sources, and effects on health and the environment.
			CO2	Be able demonstrate knowledge of air sampling methods and monitoring instruments for ambient and stack emissions.
			CO3	Be able to analyze air quality data using standard indices and assess pollution trends.
			CO4	Be able to design and evaluate control devices for particulate and gaseous pollutants.
			CO5	Be able to interpret national and international air quality standards and formulate mitigation strategies.

SYLLABUS

No.	Content	Hours	COs
I	**Fundamentals of Air Pollution:** Classification and sources of air pollutants; Atmospheric chemistry and transformation of pollutants; Effects on human health, ecosystems, and materials; Indoor vs. outdoor air pollution; Air quality indices (AQI)	**5**	CO1, CO 2
II	**Air Quality Monitoring and Instrumentation:** Ambient air sampling methods: high-volume sampler, $PM_{2.5}$ & PM_{10} samplers; Stack sampling techniques (isokinetic sampling); Continuous Emission Monitoring Systems (CEMS); Gas analyzers: NDIR, chemiluminescence, FID; Real-time and low-cost sensors	**7**	CO2, CO3, CO4
III	**Data Analysis and Dispersion Modeling:** Statistical analysis of air quality data; Source apportionment techniques; Dispersion modeling: Gaussian Plume Model; AERMOD, CALPUFF basics; Uncertainty and error analysis in monitoring	**9**	CO2, CO3, CO4
IV	**Particulate Control Technologies:** Gravity settling chambers, cyclones, baghouse filters; Electrostatic precipitators (ESP); Wet scrubbers and inertial separators; Design and efficiency evaluation; Case studies from industries	**7**	CO4, CO5
V	**Gaseous Pollutant Control Technologies:** Absorption towers and wet scrubbers; Adsorption systems (activated carbon, zeolites); Catalytic and thermal incinerators; Flue gas desulfurization (FGD) and NOx reduction techniques; Control of VOCs and odorous gases	**7**	CO4, CO5
VI	**Regulatory Framework and Management:** National Ambient Air Quality Standards (NAAQS – India); WHO air quality guidelines; Emission standards and CPCB/State PCB norms; Air Quality Management Plans (AQMPs); Role of policy, public awareness, and emerging technologies (IoT, AI)	**7**	CO4, CO5
	Total Hours	**42**	

Essential Readings

1. C. S. Rao, *Environmental Pollution Control Engineering*, 4th ed. New Delhi, India: New Age International, 2022.
2. R. Kumar and M. Gupta, Air Quality Management: Monitoring, Control and Health Impacts, 1st ed., Elsevier, 2022.
3. Y. Wang, W. Zhang, and Y. Chen, Air Pollution Monitoring and Control: Recent Advances and Future Directions, 1st ed., Springer, 2023.

Supplementary Readings

1. CPCB, USEPA, WHO reports and technical guidelines, recent publications.
2. M. G. Rasul and A. N. Akbarzadeh, Environmental Pollution Control: Air, Water, and Soil, 2nd ed., CRC Press, 2024.
3. P. Kumar and L. Morawska, Low-Cost Sensors for the Measurement of Atmospheric Composition: Overview, Applications, and Challenges, 1st ed., Elsevier, 2021.