GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Civil Engineering
Subject Code: BE05006071
Subject Name: Air and Noise Pollution

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Elective Course - 2

Prerequisite:	Environmental Science, Sustainability and Renewable Energy
Rationale:	This subject is intended to make students aware about the noise and air pollution, degradation of air quality through various sources of air pollution, assessment of air quality through air quality index, and various air pollution control methods and equipment

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Identify the major air pollutants including primary, secondary and specific pollutants and their effects.	20
CO-2	Analyze meteorological factors influencing air pollution dispersion, including temperature profiles, atmospheric stability, wind patterns, and plume behavior.	30
CO-3	Apply standard methods for air quality monitoring, sampling, and analysis of stack to interpret air quality standards,	25
CO-4	Evaluate air and noise pollution control techniques considering pollution prevention in industrial and urban environments.	25

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/CA (I)	PBL (I)	ESE (V)	
45	0	30	15	90	3	70	30	20	30	50	200

**** Problem-Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.***

Content:

Sr. No.	Content	Total Hrs
1	**Introduction:** Major air Pollutants and their characteristics, Primary and secondary air pollutants, Specific group of pollutants such as CFC, GHG etc. Air pollution from automobiles, photochemical oxidants and smog, indoor air pollution. Effects of air pollution on human health and vegetation, animals and materials.	8
2	**Meteorology and Dispersion of Pollutants:** Temperature effect in atmosphere, lapse rates, stability conditions, Wind velocity profile, maximum mixing depth, wind rose diagram, turbulence, general characteristics of stack plumes, heat island effect.	8
3	**Air Quality Monitoring and Emission Standards:** Sampling and analysis of stack gases and ambient air, Procedure of Sampling and analysis of stack gases as per relevant IS codes, Units of measurement of Air Pollution. National ambient air quality standards, Air Quality index, Salient features of Air pollution Control Act and rules.	11
4	**Air Pollution Control Methods and Equipment**: Introduction to control methods and equipment for Particulate matter and gases. Construction and working of scrubbers, Electrostatic Precipitator, Gravity settlers, Cyclone separator, Filter bags etc. catalytic converters. Greenbelt requirement and the role of trees in air pollution control.	10
5	**Noise Pollution and its Control:** Characteristics of sound, Noise Measurement and monitoring – Levels and the decibels, Sources of Noise, Effects of Noise on people, Indian Standards, urban noise pollution issues, noise pollution control and prevention in industries and construction sites.	8
	TOTAL	**45**

Suggested Specification table with Marks (Theory): (For B.E. only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**30**	**15**	**20**	**10**	**10**

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.

The syllabus of Air and Noise Pollution directly contributes to

SDG 3	**Good Health and Well-being-** Air pollution directly impacts respiratory and cardiovascular health. Noise affects mental health, hearing, and stress levels. Monitoring AQI protects public health.
SDG 9	**Industry, Innovation and Infrastructure -** Stack design, emission dispersion modeling, and industrial planning rely on meteorology. Pollution control equipment represents technological innovation.
SDG 11	**Sustainable Cities and Communities -** Urban air pollution, automobile emissions, and indoor pollution as well as noise pollution affect livability which is major factor in sustainability. Air quality standards are essential for sustainable urban heat island effect and pollution dispersion which are key urban planning concerns in communities for environment.
SDG 13	**Climate Action -** Greenhouse gases (GHGs), CFCs, and smog contribute to climate change. Atmospheric behavior influences pollutant dispersion and climate patterns. Reducing emissions helps mitigate climate change.
SDG 15	**Life on Land -** Greenbelts and trees help control pollution and protect ecosystems. Air pollutants damage vegetation, crops, and ecosystems.

Reference Books:

1. Environmental Pollution Control and Engineering, Rao C.S., New Age International (P) Limited, 2nd Ed., 2006.
2. Air Pollution, Perkin, H.G. McGraw Hill 1974.
3. Air Pollution – by M N Rao and H V N Rao, Tata McGraw Hill 2007
4. Air Pollution- Physical and Chemical Fundamentals, Sainfeld, J.H. McGraw Hill, N.Y. 1975.
5. Air Pollution: Measurement, Modelling and Mitigation, A Tiwari and J Colls, Taylor & Francis, 2010
6. Sources and Control of Air Pollution, R J Heinsohn and R L Kabel, Prentice Hall, 1999
7. Air Pollution Control Equipment Calculations, L Theodore, John Wiley and Sons, 2008
8. Catalytic Air Pollution Control, Hack, Furraoto and Gulati,John Wiley and Sons, 2009
9. Engineering Noise Control by D A Bies and C H Hansen
10. Environmental Engineering by H S Peavy and D R Row

List of Experiments:

1. Sampling of Suspended Particulate Matter in ambient air.
2. Sampling of Respirable Suspended Particulate Matter in ambient air.
3. Sampling and analysis of sulphur dioxide in ambient air.
4. Measurement of pollutants from vehicle exhaust
5. Measurement of Noise using Sound Level Meter.
6. Demo of Stack monitoring kit.

Standards and acts:

1. National Ambient Air Quality Standards (NAAQS)
2. IS 5182-

-IS 5182 (Part 23): PM10 measurement
-IS 5182 (Part 4): SO_2
-IS 5182 (Part 6): NOx

3. IS 11255 – Stack emission monitoring
4. Bharat Stage norms- BS-VI
5. Noise Pollution (Regulation and Control) Rules, 2000
6. IS 4954 – Measurement of noise
7. IS 9989 – Sound level meters
8. IS 3028 – Acoustics and noise control
9. Air (Prevention and Control of Pollution) Act, 1981
10. Environment (Protection) Act, 1986

List of learning website and Open Source Software

1. http://nptel.ac.in/
2. Websites of Central Pollution Control Board and State Pollution Control Board
3. Envizom
4. Scilab (https://www.scilab.org/) – An open-source alternative to MATLAB
5. TRANEX Road Traffic Noise Model
6. Suggested Course Practical/Assignment List: Students should follow the DTE laboratory manual for assignments and practical

List of suggested activities for Problem-based Learning (PBL):

Sr. No.	PBL Category	Name of the activity	No. of hours	Evaluation Criteria
1	Industry / Research Laboratory Visit	Industry visit –visit of industry for studying production and chimney site visit for sampling and monitoring	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2	Video Based Learning	Technical Video based learning related to air pollution in Industrial areas.	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3	Assignment/ Technical Writing / Research Writing	Assignment writing. Numerical based assignment related to plume profile of stack and its design	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4	Complex Problem-Solving targeting relevant SDGs. / Mini Project	Problem solving/Coding using any programming language or application of professional software related to air pollution	5 small coding-based assignments of 2h each. Total = 10h	Based on the coding solution submitted.

5	Research Paper Review / Analysis	Discussion on research paper based on relevant subject (SCOPUS Index/any reputed Journal)	3 research paper = 10 hrs	Summarize research paper and evaluation critical parameters
6	Poster/ Chart/ Power point presentation	Poster/chart/power point presentation on topics related to advanced air pollution and noise pollution control devices.	Duration = 6 h	Based on poster/chart preparation and presentation skills
7	Micro Project*	Working/non-working model on air and noise, study of air pollutants on field, indoor or outdoor air quality and AQI levels	Working = 5 hrs Non-working = 5 hrs	Based on internal departmental/external evaluation
8	Group Discussion / Quiz / Simulation	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 hrs each	Based on performance in group discussion, technical depth, knowledge etc.
		Online Technical Quizzes/Simulations	Multiple quizzes summing up to 10hrs	Based on quiz scores and reflection report after each quiz.
9	Case Study Analysis / Seminar	Real world case studies-based learning for state-of-the-art/new technology in air pollution control	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
10	Other	Patent Search and Innovation Gap Identification	10hrs (Search + Report)	Based on number of relevant patents analyzed and identification of innovation scope.

Note:

1. In alignment with Outcome-Based Education (OBE) and NBA accreditation requirements, the subject Air and Noise Pollution incorporates;

   * Compulsory-Micro Project – 5 Marks and other PBL activities of – 25 Marks

These activities are incorporated as integral Project-Based Learning (PBL) components. These activities are designed to foster experiential learning, encourage innovation, and strengthen problem-solving skills by engaging students in practical applications. The inclusion of PBL ensures that learners develop higher-order cognitive abilities mapped to Bloom's taxonomy, while simultaneously enhancing teamwork, communication, and research competencies essential for professional engineering practice.

2. The hours allocated to specific activities should be proportionate to the total no. of PBL hours and marks.

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