

<b>Course Title:</b> Air and Noise Pollution				
<b>Course code:</b> UES 304	<b>No. of credits:</b> 4	<b>L-T-P:</b> 44-16-0	<b>Learning hours:</b> 60	
<b>Pre-requisite course code and title (if any):</b> None				
<b>Department:</b> Natural and Applied Sciences				
<b>Course coordinator:</b>		<b>Course instructor:</b>		
<b>Contact details:</b>				
<b>Course type:</b> Major		<b>Course offered in:</b> Semester 6		
<b>Course Description</b> This undergraduate course introduces students from diverse backgrounds to the fundamentals of air and noise pollution, exploring their sources, impacts, measurement, and control. It emphasizes assessment techniques, pollution management strategies, regulatory frameworks, and case studies to equip students with practical tools for mitigating environmental and health impacts effectively.				
<b>Course objectives</b> The course aims to build the following basic understanding among students: <ul style="list-style-type: none"> <li>• Fundamentals, sources, and atmospheric behavior of air pollutants.</li> <li>• Effects of air and noise pollution on human health, ecosystems, and materials.</li> <li>• Methods for measuring and analyzing air and noise pollution.</li> <li>• Pollution control technologies, management strategies, and relevant laws and case studies.</li> </ul>				
<b>Course content</b>				
Module	Topic	L	T	P
1	<b>Fundamentals of air pollution</b>			
	This module introduces the fundamentals of atmospheric science and air pollution, focusing on pollutant sources, reactions, meteorological effects, and air quality management. The contents of this module are as follows:  Historical development of air pollution and control, air pollution legislations, structure and composition of atmosphere, sources and classification of air pollutants, atmospheric reactions of pollutants – smoke, smog, ozone layer disturbance and associated chemical mechanisms, atmospheric dispersion and transport of air pollutants, effect of meteorology on air pollution, emission inventory, wind profiles and topographic effects.	12	4	0
2	<b>Effects and measurement of air pollution</b>			
	This module covers the effects of air pollutants on health, environment, and materials, along with air quality standards, indices, and methods for sampling and analyzing key pollutants. The topics covered in this module are:  Exposure Pathways (inhalation, ingestion and dermal), effects of air pollutants on human health, vegetation, animals, materials & structures, Monitoring agency (USEPA, CPCB, EEA) and air quality standards, (NAAQS, WHO guidelines), air quality index (AQI), air pollution sampling, sampling duration, selection of sampling sites, working principle of sampling instruments, measurement units, advanced techniques for measurement of fine aerosols (optical techniques, beta attenuation, TEOM etc.) sampling and analysis of SPM, RSPM, SO <sub>x</sub> , NO <sub>x</sub> , and CO. Economic impacts: health costs, productivity loss, and crop damage with examples from developing countries (e.g., India, Bangladesh).	12	4	0
3	<b>Noise Pollution</b>			
	This module covers the sources, measurement, and control of noise pollution, along with noise standards and impacts on human health. The key areas covered in this module are:  Sources, sound wave properties (frequency, wavelength, intensity, decibel scale), weighting networks, noise monitoring, measurement of noise indices (Leq, L10, L90, L50, LDN, TNI), noise dose, CPCB/WHO noise standards and occupational safety	10	4	0

	exposure limits, noise control and abatement measures: Impact of noise and vibrations on human health.			
4	<b>Control, management, and policy aspects of air and noise pollution (with case studies)</b>			
	This module includes pollution control technologies, management strategies, environmental laws, and the role of national and international frameworks, with case studies.  Control technologies for air and noise pollution, industrial emission control systems (cyclones, scrubbers, filters, ESPs); vehicular emission reduction methods and green technologies; air quality management strategies; air pollution management approaches; environmental legislations, role of national and international mechanisms, global and regional air pollution episodes (case studies).	10	4	
	<b>Total</b>	44	16	0
<b>Evaluation criteria</b>				
<ul style="list-style-type: none"> <li>• Minor Test 1: Written test [at the end of teaching of modules 1 and 2] -- 20%</li> <li>• Minor Test 2: Written test [at the end of teaching of modules 3 and 4] -- 20%</li> <li>• Major Test: Written test [at the end of the semester, full syllabus] -- 40%</li> <li>• Assignment/Presentation -- 20%</li> </ul>				
<b>Learning outcomes</b>				
<p>Upon completion of the course, the students will be able to</p> <ul style="list-style-type: none"> <li>• Explain the fundamentals of air pollution, sources, reactions, and meteorological effects. [Minor Tests, Major Test]</li> <li>• Study the effects of air pollutants on health, environment, and materials with reference to standard assessment techniques. [Tests, Assignment]</li> <li>• Analyze sources, measurement, and control methods of noise pollution and their health implications. [Assignment, Major Test]</li> <li>• Assess pollution control technologies, management strategies, and policy frameworks through case studies. [Assignment and Presentation]</li> </ul>				
<b>Pedagogical approach</b>				
<ul style="list-style-type: none"> <li>• The course will be delivered through lectures, tutorials and discussion of case studies.</li> <li>• The course will also include guided assignments and associated student presentations.</li> </ul>				
<b>Reading resources</b>				
<ul style="list-style-type: none"> <li>• De Nevers, N. (2010). Air pollution control engineering. Waveland press.</li> <li>• Fu, J. S., &amp; Davis, W. T. (2021). Air quality. CRC Press.</li> <li>• Gurjar, B. R., Molina, L. T., &amp; Ojha, C. S. (2008). Health and Environmental Concerns. Health and Environmental Impacts.</li> <li>• Jacob, D. J. (1999). Introduction to atmospheric chemistry. Princeton University Press</li> <li>• Jacobson, M. Z. (2012). Air pollution and global warming: history, science, and solutions. Cambridge University Press.</li> <li>• Khare, M., Sharma, P., Kota, S. H., &amp; Chinthala, S. (2024). Air Pollution: Science, Engineering and Management Fundamentals: Science, Engineering and Management Fundamentals. CRC Press.</li> <li>• Peavy, H. S., Matthews, D. R., &amp; Tchobanoglous, G. (1985). Environmental engineering. Mc Graw hill Education.</li> <li>• Rao, C. S. (2007). Environmental pollution control engineering. New Age International.</li> </ul>				
<b>Journals</b>				
<ul style="list-style-type: none"> <li>• Air Quality, Atmosphere &amp; Health, Springer</li> <li>• Atmospheric pollution Research, Elsevier</li> <li>• Atmospheric Environment, Elsevier</li> <li>• Aerosols and Air Quality Research, Springer</li> <li>• Noise Mapping, De Gruyter</li> </ul>				

**Student Responsibilities**

The students are required to come prepared with readings that are suggested during the class and ensure timely submission of assignments. They are also expected to participate and further strengthen their understanding of concepts through classroom discussions and case studies.

**Course Designed By:**

- Dr Adil Masood, Department of Natural and Applied Sciences, TERI School of Advanced Studies, New Delhi

**Course Reviewers**

The course is reviewed by following reviewers:

- Dr. Rakesh Kumar Atri, Associate Professor, Department of Environmental Sciences, University of Jammu
- Dr. Sayantan Sarkar, Associate Professor, School of Civil and Environmental Engineering, Indian Institute of Technology, IIT Mandi