Course title: Air Quality Management				
Course code: NRE 134	**No. of credits:** 3	**L-T-P:** 29-16-0		**Learning hours:** 45
Pre-requisite course code and title (if any): Either NRE 137 Environmental Monitoring Laboratory or NRE 131 Environmental Chemistry and Microbiology				
Department: Natural and Applied Sciences				
Course coordinator:		**Course instructor:**		
Contact details:				
Course type: Elective		**Course offered in:** Semester 2		

Course Description

This course aims to provide the interested with a variety of perspective on the air pollution issues: both ambient and indoor. We attempt to present the problems of air pollution as a potpourri of scientific, human, ecological, social, economic, political, legal and medical disciplines. The intention of this course is to provide a solid basis for assembling a common approach focusing on problem solving and appreciation of the vast subject branches and disciplines of air pollution and will be the mode of teaching in this course. It makes better understanding of the nature and parameters of the Indian air emission and ambient air quality standards. Field trips to plants and public utility services will also be organized for students to gain real-life insights leading to enrichment of insights and horizons.

Course objectives

1. The course objectives has three components i.e., sources of air pollution, pathways (air pollutants transformation and transport) and receptors.
2. Students would get an insight into the dispersion of air pollution in the atmosphere
3. This life cycle of air pollution will enable the student to first identify the pollutants and their sources and then the transport mechanisms of the pollutants followed by the affected population and there control mechanisms.

Course content

Module	Topic	L	T	P
1.	**Air-pollution-definition, sources, classification** Introduction to air pollution, types of air pollutants, sources & classification of air pollutants and air pollution effects (the impacts of air pollution on human health, materials and ecosystem)	2	1	
2.	**Air pollution monitoring, standards and regulations** Ambient air quality monitoring techniques, Selection of monitoring locations, Air pollution indices, standards, norms, rules and regulations and air quality management plan	3	1	
3.	**Air pollution meteorology** Composition and structure of the atmosphere, atmospheric energy balance, humidity, condensation, lapse rate and atmospheric stability, Wind rose diagram, Potential temperature	6	2	
4.	**Dynamics of pollutant dispersion and disposal** Basic understanding of chemical and physical processes that transform and transport pollutants in the atmosphere, mechanism that lead to the formation and emissions of air pollutants, dispersion of air pollutants and Gaussian plume models.	7	4	
5.	**Air pollution control and removal** Methods for monitoring and control; selection of control equipment's, engineering control concepts; process change, fuel change; pollutant removal and disposal of pollutants; control devices and systems, removal of dry particulate matter, liquid droplets and mist removal, gaseous pollutants and odor removal, control of stationary and mobile sources.	7	4	

6.	**Indoor air pollution** Introduction to indoor air pollution, types of pollutants, sources & classification of indoor air pollutants and their effects. Introduction of modelling of indoor air pollutants.	4	2	
7.	**Demonstration** Air quality modelling using AERMOD software (case study)		2	
	Total	29	16	

Evaluation criteria
- Tests 1 and 2: 15% (written test based on module 1, module2 and module 3)
- Assignments/Quizzes: 10% (MCQ based questions to assess learning of different modules along with small assignments on application of techniques/models discussed in module 4 and 5
- Field Visit or/Term Paper: 10% (term papers based on field work or air pollution data analysis work)
- Test 3: 50% (written test covering entire syllabus of the course)

Learning outcomes
- After attending the course, the students shall have acquired knowledge and understanding to evaluate air quality management and analyze the causes and effects of air pollution. (Module 1 and module 2)
- Students would be able to understand the type and nature of air pollutants, the behaviour of plumes and relevant meteorological determinants influencing the dispersion of air pollutants. (Module 3 and 4)
- Students will understand the importance of household air pollutants and its impacts (Module 6)
- The basic understanding of methods available for controlling point, line and area sources and first-hand experience of using most widely used air quality models such as AERMOD (module 5 and 7)

Pedagogical approach

Materials
Required text
1. De N.N. (2000) *Air Pollution Control Engineering*, McGraw-Hill International Edition.
2. Gammage R.B. and Berven B.A. (1996) *Indoor Air Pollution and Health*, Eds. 2nd, Lewis Publishers.
3. Godish T. (2004) *Air Quality*, Lewis Publishers, New York.
4. Griffin R.D. (2007) *Air Quality Management*, Taylor & Francis Publication.
5. Lutgens F.K. and Tarbuck E.J. (1996) *The Atmosphere an Introduction to Meteorology*, Printice Hall Publisher, New Jersey.
6. Stern A.C. (editor) (1976) *Air Pollution (Vol. I-VIII)*, Academic Press, New York.
7. Turner D.B. (1994) *Workbook of Atmospheric Dispersion Estimates*, 2nd ed., Ann Arbor, MI, Lewis Publishers.
8. Vesilind A. and Morgan S.M. (2004) *Introduction to Environmental Engineering*, Eds. 2nd, Thomson Brooks/Cole.
9. Work K. and Warner S. (1980) *Air Pollution: Sources and Control*, M.: Myr.

Suggested readings
1. Boubel R.W., Turner D.B., Fox D.L. and Stern A.C. (1994) *Fundamentals of Air Pollution*, 3rd edition, Academic Press, Inc.
2. Buonicore A.J. and Davis W.T. (1994) *Air Pollution Engineering Manual, Air and Waste Management Association*, New York, Van Nostrand Reinhold.
3. Lodge J.P. (Ed.) (1988) *Methods of Air Sampling and Analysis*, Lewis Publishers, Inc., Michigan.
4. Lutgens F.K. and Tarbuck E.J. (1998) *The Atmosphere*, Prentice Hall, New Jersey.
5. Perkins H.C. (1974) *Air Pollution*, McGraw-Hill, International Student Edition.
6. Rao C.S. (1991) *Environmental Pollution Control Engineering*, New Age International (P) Ltd., Publishers, New Delhi.

7. Seinfield J.H. and Pandis S.N. (1998) *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change*, Wiley, New York.

Case studies
Websites

Journals
1. Atmospheric Environment
2. Environment Science & Technology
3. Journal of Air and Waste Management Association
4. Journal of Environmental Management
5. Journal of Environmental Modelling & Software
6. Journal of Environmental Pollution
7. Science of the Total Environment
8. Transportation Research Part D: Transport and Environment

Advanced Reading Material

Additional information (if any)

Student responsibilities
The students are expected to submit assignments in time and come prepared with readings when provided