Course Code	:	CE706
Title of the Course	:	**Air Pollution Control Engineering**
Designation as a required or elective	:	Core
Prerequisites	:	Basic Knowledge in Air Pollution
Contact Hours, Type of Course	:	36
Course Assessment Methods	:	Continuous Assessment, Semester Examination

Course Learning Objectives

1. To provide general understanding of air quality and its impact on the environment and human health
2. To study the fate and transport of air pollutants and its measurement technique
3. To discuss the different control methods and design principles for gaseous and particulate pollutant
4. To learn the control technologies for specific air pollutants
5. To explain the principles of biological air pollution control technologies and its limitations

Course Content

Air pollutants - Sources - classification of pollutants - effect on human health vegetation and property - Reactions of pollutants and their effects - Smoke, smog and ozone layer disturbance - Greenhouse effect - Ambient and stack sampling - pollution measurement methods - Criteria pollutants - Ambient air quality and emission standards - Air pollution indices - Air Act - Industrial sources of air pollution - Behavior of pollutants in atmosphere - Emission factors - regulations – control strategies and policies - Choosing appropriate air pollution control technology - Particulate Pollutant Control - Settling chambers - Filtration – Electrostatic precipitation - Cyclone separation - Wet collectors - Design of various particle control devices – Gaseous Pollutant Control - Gas absorption in tray and packed towers - Absorption with/without chemical reaction - Adsorption in fixed beds - Breakthrough - Wet scrubbers - Design of various pollutant control devices - Control technologies for removal of SO_2, NOx, VOC - Control technologies for motor vehicles - Biological air pollution control technologies – bioscrubers - biofilters - Integrated air pollution control systems.

References

1. Wark Kenneth and Warner C.F, Air pollution its origin and control. Harper and Row Publishers, New York, 1997.
2. Rao C.S., Environmental pollution control Engineering, New age international Ltd, New Delhi, 2007.
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York, 1985.
4. de Nevers, N., Air Pollution Control Engineering, McGraw Hill, New Delhi, 1995

Course Outcomes

At the end of the course student will be able:

1. To classify the types and sources of air pollutants and to understand their effects on human health and the broader environment.
2. To differentiate and design various air pollution control technologies for particulates & gaseous pollutants.
3. To choose appropriate technologies for removal of selective pollutants.
4. To establish and implement air quality management components.

COURSE OUTLINE

Course Title	Air Pollution Control Engineering		
Course Code	CE706	**No. of Credits**	3
Department	Civil Engineering	**Faculty**	Mr. S.KRISHNA PRASHANTH
Pre-requisites Course Code	-		
Course Coordinator(s) (if, applicable)	Dr.S.T.Ramesh		
Other Course Teacher(s) / Tutor(s)	-	**E-Mail**	prashanth@nitt.edu

√	**Programme Core (PC)**
	Programme Elective (PE)
	Open Elective (OE)
	Essential Laboratory Requirement (ELR)

COURSE OVERVIEW

This course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat air pollution. The course provides an introduction to major aspects of air quality science and its control technology, including an overview of many current air pollution problems, from local to continental scales; a discussion of air pollutant characteristics, natural and anthropogenic sources, transport and transformations in the atmosphere; and finally a review of the strategies and key technologies for controlling emissions of gaseous pollutants and particulate matter. Participants will also learn to design air pollution control devices in removal of SO_2, NO_x, and VOC's.

COURSE LEARING OBJECTIVES

The objectives of the course are:
1. To provide general understanding of air quality and its impact on the environment and human health
2. To study the fate and transport of air pollutants and its measurement techniques
3. To discuss the different control methods and design principles for gaseous and particulate pollutants
4. To learn the control technologies for specific air pollutants
5. To explain the principles of biological air pollution control technologies and its limitations

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)

After successful completion of the course, the students should be capable :

CO1	to classify the types and sources of air pollutants and to understand their effects on human health and the broader environment
CO2	to differentiate and design various air pollution control technologies for particulates and gaseous pollutants
CO3	to choose appropriate technologies for removal of selective pollutants
CO4	to establish and implement air quality management components

	1	2	3	4	5	6	7	8	9	10	11
CO1	H			M		H				H	
CO2	H	H		M		L			M		
CO3	M	H	M	M	M						
CO4	M	L	L			L	L		H	H	M

1.	Scholarship of Knowledge	2.	Critical Thinking
3.	Problem Solving	4.	Research Skill
5.	Usage of modern tools	6.	Collaborative and Multidisciplinary work
7.	Project Management and Finance	8.	Communication
9.	Life-long Learning	10.	Ethical Practices and Social Responsibility
11.	Independent and Reflective Learning		

COURSE TEACHING AND LEARNING ACTIVITIES

Sl. No.	Week	Topic	Mode of Delivery
1.	2nd week of January 2018 (2 Contact Hours)	Introduction of air pollution, various factors contributing to air pollution, history of air pollution	Lecture PPT or any suitable mode
2.	3rd week of January 2018 (2 Contact Hours)	Classification of Air pollutants and their effects on human health and environment	Lecture / Tutorial
3.	4th week of January 2018 (2 Contact Hours)	Reactions of pollutants and their effects – Smoke, Smog and Ozone layer disturbances	Lecture / Tutorial Chalk & Talk / Power Point Presentation

	5th week of January 2018 (2 Contact Hours)	Greenhouse Effect onto the environment with reference to atmosphere	Lecture / Videos Chalk & Talk / Power Point Presentation
5.	1st week of February 2018 (2 Contact Hours)	Pollution Measurement Methods and Ambient and stack sampling	Lecture / Videos Chalk & Talk / Power Point Presentation
6.	2nd week of February 2018 (3 Contact Hours)	Criteria Pollutants and Ambient air quality and emission standards – Air pollution indices Frameworks devised in Air act 1981	Lecture / Videos Chalk & Talk / Power Point Presentation / Demonstrations
7.	3rd week of February 2018 (3 Contact Hours)	Industrial Sources of air pollution, behaviour of pollutants in atmosphere, Emission factors, control strategies and policies	Lecture / Tutorial Chalk & Talk / Power Point Presentation
8.	4th week of February 2018	ASSESSMENT 1	
9.	5th week of February 2018 (2 Contact Hours)	Design of Particulate pollutant control technologies viz., Settling chambers, Filtration	Lecture / Tutorial Chalk & Talk / Power Point Presentation
10.	2nd week of March 2018 (3 Contact Hours)	Design of Particulate pollutant control technologies viz., Electrostatic Precipitator, Cyclonic Separators, Wet Collectors	Lecture / Tutorial Chalk & Talk / Power Point Presentation
11.	3rd week of March 2018 (2 Contact Hour)	Design of particle control technologies viz., Gaseous pollutant control using gas absorption in tray and packed towers, with or without chemical reaction	Lecture / Tutorial Chalk & Talk / Power Point Presentation
12.	4th week of March 2018 (2 Contact Hours)	Design of various pollutant control devices for removal of SO2, NOX and VOC's	Lecture / Tutorial Chalk & Talk / Power Point Presentation
13.	5th week of March 2018 (2 Contact Hours)	Biological Air pollution control technologies viz., bioscrubbers and biofilters	Lecture / Tutorial Chalk & Talk / Power Point Presentation
14.	1st week of April 2018	ASSESSMENT 2	
15.	2nd week of April 2018 (3 Contact Hours)	Vehicular Emissions and Control technologies for motor vehicles Integrated Air pollution control systems	Lecture / Tutorial Chalk & Talk / Power Point Presentation

COURSE ASSESSMENT METHODS

Sl. No.	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Assessment 1	4th week of February 2018	60 Minutes	20%
2.	Assessment 2	1st week of April 2018	60 Minutes	20%
3.	Assessment 3 (Assignments / Group / Presentation)	Before the Assessment 1 & 2	–	10%
4.	End Semester Examination	5th week of April 2018	180 Minutes	50%

Note:
1. Attending all the assessments (Assessment 1 to 4) is MANDATORY for every student.
2. If any student is not able to attend Assessment-1 / Assessment-2 due to genuine reason, student is permitted to attend the compensation assessment (CPA) with 20% weightage (20 marks).
3. At any case, CPA will not be considered as an improvement test.
4. Every student is expected to score minimum 40% (i.e., 40 marks) to pass the course. Otherwise the student would be declared fail and 'F' grade will be awarded.

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Wark Kenneth and Warner C.F, Air pollution its origin and control. Harper and Row Publishers, New York, 1997.
2. Rao C.S., Environmental pollution control Engineering, New age international Ltd, New Delhi, 2007.
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York 1985.
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COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

The purpose of this survey is to find out from you about your learning experiences and your thoughts about the course. Your replies are very important to assist us in better serving our graduate students. Be assured that your comments will remain absolutely confidential and I will not be able to identify you from other participants.
- Direct feedback from the students by face-to-face meeting individually and as the class as a whole.
- Feedback from the students during class committee meetings
- Exit survey from the students at the end of the session through questionnaire

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

DISHONEST / PLAGIARISM means knowingly presenting another person's ideas, findings or work as one's own by copying or reproducing them without due acknowledgement of the source, with intent to deceive the examiner into believing that the content is original to the student. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work.

All of the following are considered plagiarism:

- turning in someone else's work as your own
- copying words or ideas from someone else without giving credit
- failing to put a quotation in quotation marks
- giving incorrect information about the source of a quotation
- changing words but copying the sentence structure of a source without giving credit
- copying so many words or ideas from a source that it makes up the majority of your work, whether you give credit or not (see our section on "fair use" rules)
- Failing to give credit via footnotes for ideas and concepts, date and information, statements and phrases, and/or interpretations and conclusions derived by another.
- Including references in the Bibliography that were not examined by the student.

Attendance

The attendance will be taken in all the contact hours. Students are encouraged to attend all the classes without absence. Also, the students are encouraged to participate in various co-curricular and extracurricular activities to enrich the academic / campus life. The percentage of attendance is calculated up to 3 days before the last working day in the respective session. The minimum attendance for appearing for the end semester examination is 75%. In some circumstances with reasonable cause for non attendance, the students should inform the faculty within one week after their absence or feasibly in a week prior. In that case, the students will be given the opportunity to make up the missed classes or quiz or assignment. Those students, whose attendance falls below 75% but above 50% in a subject, shall attend mandatory classes after the closure of the attendance of the current session. Only those students who have completed the mandatory classes will be eligible and be permitted to appear for end semester examination.

The percentage of attendance in a subject shall be computed as:

(a) For calculation of attendance in normal cases:

$$\text{Percentage of Attendaance} = \frac{\text{Actual no. of classes attended}}{\text{Total no. of classes held till date of compilation of attendance}} \times 100$$

This should be 75% for the student to appear for semester examinations.

(b) For calculation of attendance in case of prolonged illness and/or hospitalization with medical certificate:

$$\text{Percentage of Attendaance} = \frac{\text{Actual no. of classes attended}}{\text{Total no. of classes held till date of compilation of attendance} - \text{No. of classes held during the days of prolonged illness and or hospitilization}} \times 100$$

Under any case, a student should have more than 50% attendance calculated as per (a) above to be eligible for appearing in end semester examination.
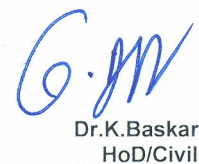
ADDITIONAL COURSE INFORMATION

1. All the students are advised to check their NIT-T webmail regularly to know the updates. All the correspondence (schedule of classes / schedule of assessment / course material / any other information regarding this course) will be communicated through webmail.
2. Queries / Clarifications / Discussions (if required) may be E-mailed to me / contact me during 4.00 PM to 5.00 PM on Monday and Friday with prior intimation.

FOR APPROVAL

Mr. S. Krishna Prashanth
Course Faculty

Dr. Deendayal
Chairman (Class Committee)

Dr.K.Baskar
HoD/Civil