

Subject Description Form

Subject Code	ME564																											
Subject Title	Principles and Design of Air Pollution Control Devices																											
Credit Value	3																											
Level	5																											
Pre-requisite/ Co-requisite/ Exclusion	Students should have basic knowledge in Thermofluids and Air Pollution. Exclusion: ME539 Treatments of Dust, Fume and Wastewater																											
Objectives	To provide the student with an in-depth understanding of the working principles and design features of air pollution control devices.																											
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> possess state-of-the-art knowledge and skills in the area of air pollution control; apply their knowledge, skills and hand-on experience to evaluate different methods for reducing gaseous emission and reducing particulate emission; extend their knowledge of air pollution control to different situations of engineering context and professional practice; and have recognition of the need for, and an ability to engage in life-long learning. 																											
Subject Synopsis/ Indicative Syllabus	<p><i>Nature of Gaseous and Particulate Pollutants in Air:</i> Nature and composition of the atmosphere. Sources of air pollutants. Common gaseous pollutants in air and their chemical properties. Common particulates in air. Physical and chemical properties of aerosols.</p> <p><i>Principles and Design of Gaseous Pollution Control Devices:</i> Processes for removal of pollutant gases and vapours. Adsorption: adsorption material, breakthrough time, adsorption zone velocity, regeneration. Absorption: packed bed scrubber, mass transfer process, NTU and HTU. Catalytic converter: catalysts, catalyst requirements for different applications, typical catalytic reactions for reducing pollutants. Design of absorber, absorber and catalytic converter.</p> <p><i>Principles and Design of Particulate Control Devices:</i> Motion of particles: drag forces, equations of particle motion, settling velocity. Filters: surface filter and depth filter, filtering mechanisms, determination of filtering efficiencies. Cyclones: axial flow and tangential flow cyclones, equations governing motion of particles in the cyclone, determination of collection efficiency. Electrostatic precipitation: principle of electrostatic precipitation, equations governing motion of particles in electrostatic precipitator, determination of collection efficiency. Air purifiers: analysis of the design and function of air purifiers.</p>																											
Teaching/Learning Methodology	<ol style="list-style-type: none"> The teaching and learning methods include lectures/tutorial sessions, homework assignments, test and examination. The continuous assessment and examination are aimed at providing students with integrated knowledge required for air pollution control devices. Technical/practical examples and problems will be raised and discussed in class/tutorial sessions. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 50%;">Teaching/Learning Methodology</th> <th colspan="4">Intended subject learning outcomes</th> </tr> <tr> <th style="width: 12.5%;">a</th> <th style="width: 12.5%;">b</th> <th style="width: 12.5%;">c</th> <th style="width: 12.5%;">d</th> </tr> </thead> <tbody> <tr> <td>1. Lecture</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> </tr> <tr> <td>2. Tutorial</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> </tr> <tr> <td>3. Homework assignment</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> </tr> </tbody> </table>				Teaching/Learning Methodology	Intended subject learning outcomes				a	b	c	d	1. Lecture	√	√	√	√	2. Tutorial	√	√	√	√	3. Homework assignment	√	√	√	√
Teaching/Learning Methodology	Intended subject learning outcomes																											
	a	b	c	d																								
1. Lecture	√	√	√	√																								
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3. Homework assignment	√	√	√	√																								

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks		Intended subject learning outcomes to be assessed			
	Specific assessment methods/tasks	% weighting	a	b	c	d
	1. Homework assignment	15%	√	√	√	√
	2. Test	35%	√	√		√
	3. Examination	50%	√	√	√	√
	Total	100%				
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:</p> <p style="text-align: center;">$0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}$</p> <p>The continuous assessment will consist of two components: homework assignments and test. They are aimed at evaluating the progress of students study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.</p> <p>The examination will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.</p>						
Student Study Effort Expected	Class contact:					
	▪ Lecture		24 Hrs.			
	▪ Tutorial/Case study/Laboratory		15 Hrs.			
	Other student study effort:					
	▪ Self Study		45 Hrs.			
	▪ Case study report preparation and presentation		21 Hrs.			
	Total student study effort		105 Hrs.			
Reading List and References	<ol style="list-style-type: none"> Heinsohn R. J. and Kabel R. L., <i>Sources and Control of Air Pollution</i>, Prentice Hall, latest edition. Nevers N. D., <i>Air Pollution Control Engineering</i>, McGraw-Hill, latest edition. Toole-O'Neil B., <i>Dry Scrubbing Technology for Flue Gas Desulfurization</i>, Kluwer Academic Publisher, latest edition. Lewandowski, D. A., <i>Design of Thermal Oxidation Systems for Volatile Organic Compounds</i>, Lewis Publishers, latest edition. Dickenson, T. C., <i>Filters and Filtration Handbook</i>, 4th edition, Elsevier Advanced Technology, latest edition. Crittenden B. and Thomas, W. J., <i>Adsorption Technology and Design</i>, Butterworth Heinemann, latest edition. <p>Journals</p> <ul style="list-style-type: none"> • Aerosol Science and Technology • AIChE Journal • Environmental Technology • Journal of Aerosol Science • Separation Science and Technology 					