Subject Description Form

<table>
<tr><td>Subject Code</td><td>ME564</td></tr>
<tr><td>Subject Title</td><td>Principles and Design of Air Pollution Control Devices</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>5</td></tr>
<tr><td>Pre-requisite/
Co-requisite/
Exclusion</td><td>Students should have basic knowledge in Thermofluids and Air Pollution.

Exclusion: ME539 Treatments of Dust, Fume and Wastewater</td></tr>
<tr><td>Objectives</td><td>To provide the student with an in-depth understanding of the working principles and design features of air pollution control devices.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a. possess state-of-the-art knowledge and skills in the area of air pollution control;
b. apply their knowledge, skills and hand-on experience to evaluate different methods for reducing gaseous emission and reducing particulate emission;
c. extend their knowledge of air pollution control to different situations of engineering context and professional practice; and
d. have recognition of the need for, and an ability to engage in life-long learning.</td></tr>
<tr><td>Subject Synopsis/
Indicative Syllabus</td><td>Nature of Gaseous and Particulate Pollutants in Air: 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.

Principles and Design of Gaseous Pollution Control Devices: 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.

Principles and Design of Particulate Control Devices: 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.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for air pollution control devices.
3. Technical/practical examples and problems will be raised and discussed in class/tutorial sessions.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Intended subject learning outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Tutorial</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Homework assignment</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
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Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Homework assignment	15%	√	√	√	√
2. Test	35%	√	√		√
3. Examination	50%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

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.

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.

Student Study Effort Expected

Class contact:	
▪ Lecture	30 Hrs.
▪ Tutorial/Case study/Laboratory	9 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

1. Nevers N. D., *Air Pollution Control Engineering*, McGraw-Hill, latest edition.
2. Heinsohn R. J. and Kabel R. L., *Sources and Control of Air Pollution*, Prentice Hall, latest edition.
3. Toole-O'Neil B., *Dry Scrubbing Technology for Flue Gas Desulfurization*, Kluwer Academic Publisher, latest edition.
4. Lewandowski, D. A., *Design of Thermal Oxidation Systems for Volatile Organic Compounds*, Lewis Publishers, latest edition.
5. Dickenson, T. C., *Filters and Filtration Handbook*, 4th edition, Elsevier Advanced Technology, latest edition.
6. Crittenden B. and Thomas, W. J., *Adsorption Technology and Design*, Butterworth Heinemann, latest edition.

Journals

- Environmental Science and Technology
- Separation and Purification Technology
- Aerosol Science and Technology
- Journal of Aerosol Science
- Process Safety and Environmental Protection
- AICHE Journal