Subject Description Form

<table>
<tr><td>Subject Code</td><td>ME565</td></tr>
<tr><td>Subject Title</td><td>Prevention and Control of Vehicular Emissions</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.</td></tr>
<tr><td>Objectives</td><td>To provide students with in-depth knowledge in prevention and control of vehicular emissions.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a. possess the knowledge of vehicle emission trends and control, transport and dispersion of vehicle-generated emissions, and advanced engine technologies and devices for vehicular emission reduction;
b. extend their knowledge of prevention and control of vehicular emissions to different situations of engineering context and professional practice; and
c. 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>Vehicle Emission Trends: Background. Environmental and health aspects associated with motor vehicle emissions; worldwide emissions control programmes.
Atmospheric Transport and Dispersion of Air Pollutants Associated with Vehicular Emissions: Definition of transport and dispersion; meteorological parameters; scales of motion; theory of transport and dispersion in open highway and urban street canyons.
Vehicular Emissions: Driving cycle and behavior; driving cycles for emission testing; development of driving cycle; vehicle emission testing on chassis dynamometers; testing procedures; effect of driving mode and driving behavior on vehicle emissions; analysis of vehicle emission test data.
Advanced Engine Technology for Vehicular Emission Reduction: Advanced design features of gasoline engines: lean burn combustion, gasoline direction injection; advanced design features of diesel engines: air-handling system, fuel handling system and combustion system; Homogeneous charge compression ignition engine.
Advanced Aftertreatment Devices for Vehicular Emission Reduction: Catalytic converter with preheating; lean NOx catalyst and NOx absorber; continuously regenerative trap; selective catalytic reduction (SCR) of NOx; SCR-Trap system; non-thermal plasma.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test, case study report and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for prevention and control of vehicular emissions.
3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="3">Intended subject learning outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td></tr>
<tr><td>1. Lecture</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Tutorial</td><td>√</td><td>√</td><td></td></tr>
<tr><td>3. Homework assignment</td><td>√</td><td>√</td><td></td></tr>
<tr><td>4. Case study report and presentation</td><td>√</td><td>√</td><td>√</td></tr>
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</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
1. Homework assignment	20%	√	√	
2. Test	20%	√	√	
3. Case study report and presentation	10%	√	√	√
4. 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 consists of three components: homework assignments, test, and case study report & presentation. 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 is 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	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

1. Eastwood P., *Critical Topics in Exhaust Gas Aftertreatment*, Research Studies Press Ltd., latest edition.
2. European Conference of Ministers of Transport, *Vehicle Emission Reductions*, OECD, latest edition.
3. Heck R. M., Farrauto R. J. and Guklati S. T., *Catalytic Air Pollution Control-Commercial Technology*, John Wiley & Sons, Inc., latest edition.
4. IMechE Seminar Publication, *Future Engine and System Technology*, Professional Engineering Publishing Limited, latest edition.
5. Khare M. and Sharma P., *Modelling Urban Vehicle Emissions*, WIT Press, Southampton, latest edition.

Journals:

1. Atmospheric Environment, Elsevier Science Ltd.
2. Journal of Aerosol Science, Elsevier Science Ltd.
3. SAE Technical Paper, Society of Automotive Engineers International, USA.
4. The Science of the Total Environment, Elsevier Science Ltd.
5. Transport Research Part D: Transport and Environment, Elsevier Science Ltd.
6. Journal of the Air and Waste Management Association, Air & Waste Management Association