Subject Description Form

<table>
<tr><td>Subject Code</td><td>ME540</td></tr>
<tr><td>Subject Title</td><td>Fuels and Engines</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.

Exclusion: ME5106 Green Automotive Engine Technology</td></tr>
<tr><td>Objectives</td><td>To provide students with knowledge of fuel quality and engine technology effects on emissions.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a. have the knowledge of fuel thermochemistry and fuel quality effects on emissions, engine technologies, engine combustion-related emissions and control technologies;
b. extend their knowledge of fuels and engines 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>Fuels: Fuels and their characteristics; hydrocarbon chemistry; automotive, alternative and aviation fuels; fuel cell; fuel quality; fuel effects on emissions.
Engines: Engine cycles and operating parameters; compression ignition, spark-ignition, liquefied petroleum gas, natural gas and aircraft jet engines.
Heat and Mass Transfer in Engines: Engine cooling systems; engine energy balance; finite heat release in engine cycles; cylinder heat transfer measurements; heat transfer modeling; heat transfer correlations; radiation heat transfer.
Air, Fuel and Exhaust Flow in Engines: Valve flow, intake and exhaust flow; fluid flow in the cylinder; turbulent flow; superchargers and turbochargers; fuel injectors.
Combustion-related Emissions and Control Technologies in Engines: Review of current and projected engine emissions concerns and legislative requirements; steady-state and transient emissions; fuel supply system and electronic control for engines; exhaust after treatment.
Engine Testing and Control: Dynamometers; fuel and air flow measurement; exhaust gas and particulate emission analysis; residual fraction; pressure-volume measurement and combustion analysis; vehicle emission testing; engine sensors and actuators in vehicles; engine control systems; effect of ambient pressure and temperature.</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 fuels and engines.
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="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 × End of Subject Examination + 0.50 × Continuous Assessment

The continuous assessment consists of three components: homework assignments, interim 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. Bosch R.G., *Gasoline-Engine Management*, Bosch, latest edition.
2. Bosch R.G., *Diesel-Engine Management*, Bosch, latest edition.
3. Elvers B., *Handbook of Fuels*, Wiley-Vch, latest edition.
4. European Conference of Ministers of Transport, *Vehicle Emission Reductions*, OECD, latest edition.
5. Ferguson C.R. and Kirkpatrick A. T., *Internal Combustion Engines*, John Wiley & Sons Inc., latest edition,
6. Guibet J.C., *Fuels and Engines- Technology, Energy and Environment*, Vol. 1 & 2, Technip, Paris, latest edition.
7. Hoag K.L., *Vehicular Engine Design*, Springer-Verlag, latest edition.
8. Klingenberg H., *Automobile Exhaust Emission Testing*, Springer, latest edition.
9. Pulkrabek W.W., *Engineering Fundamentals of the Internal Combustion Engine*, Pearson Prentice Hall, latest edition.
10. Sher E., *Handbook of Air Pollution from Internal Combustion Engines*, Academic Press, latest edition.

Journals/Magazines:

- Atmospheric Environment, Elsevier Science Ltd.
- Automotive Engineering International (Chinese Edition), Society of Automotive Engineers International, USA.
- Energy and Fuels, American Chemical Society Publications, USA.
- Fuel, Elsevier Science Ltd.
- Journal of Automobile Engineering, Institution of Mechanical Engineers, UK.
- SAE Technical Papers & Automotive Engineering International Magazine, Society of Automotive Engineers International, USA.
- Transport Research Part D: Transport and Environment, Elsevier Science Ltd.