# Subject Description Form

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| **Subject Code** | ME6404 |
| **Subject Title** | Advanced Thermofluids |
| **Credit Value** | 3 |
| **Level** | 6 |
| **Pre-requisite/ Co-requisite/ Exclusion** | Nil |
| **Objectives** | 1. To provide both fundamental and advanced concepts and methods in thermofluids.<br>2. To introduce the state-of-the-art advances in thermofluids. |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to:<br><br>a. Formulate and solve thermofluid problems by applying fundamental principles.<br>b. Keep pace with the time on the advances in thermodynamics, fluid mechanics and heat transfer.<br>c. Communicate effectively through completing written reports and oral presentation.<br>d. Conduct a comprehensive survey on selected topics in thermofluids through completing a project. |
| **Subject Synopsis/ Indicative Syllabus** | ***Thermodynamics*** – Re-examination of classical thermodynamics; nature of thermodynamics, further development directions; basic concepts; Carnot principles; temperature; Clausius inequality; entropy; fundamental laws; logical reasoning approaches.<br><br>***Fluid Mechanics*** – Newtonian and non-Newtonian fluids; continuity and momentum equations; differential analysis of fluid flow; Coutte flow; fluid film; Poiseuille flow; dimensional analysis; boundary layer equations; closure problem; turbulence modeling; fundamental constraints; invariance; realizability; principle of material frame indifference; physics-preserving models; linear and quadratic models.<br><br>***Heat Transfer*** – Heat flux; conduction and convection; general analytical approach for heat conduction problems; general empirical approach for convection problems; constitutive relations; fundamental laws; generalized Fourier law; decomposition theorem of motion; linear theory of heat flux; overall heat transfer coefficient; LMTD method; effectiveness – NTU method. |
| **Teaching/Learning Methodology** | Lectures are used to deliver the fundamental and advanced knowledge of thermofluids.<br><br>Tutorials are used to illustrate the applications of thermofluids knowledge.<br><br>A project is designed to have students learn how to collect, analyze and summarize up-to-date research information on selected topics in thermofluids. |

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<td>Assessment Methods in Alignment with Intended Learning Outcomes</td>
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<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Project Report / Presentation</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Assignment</td><td>20%</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Examination</td><td>30%</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
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<br>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:<br>
Overall Assessment: 0.7 (Continuous Assessment) + 0.3 (Examination)<br>
Continuous Assessment: Project Report + Project Presentation + Assignment<br><br>
Examination is adopted to assess students on the overall understanding and the ability of applying fundamental concepts and principles. It is supplemented by the project report, presentation and assignment, which provide timely feedback to both lecturers and students on various topics in the syllabus.
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<td>Student Study Effort Expected</td>
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<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>33 Hrs.</td></tr>
<tr><td>▪ Tutorials</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Project (reports and presentation)</td><td>45 Hrs.</td></tr>
<tr><td>▪ Self-learning</td><td>40 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>124 Hrs.</td></tr>
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<td>Reading List and References</td>
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<ol>
<li>Cengel Y. A. and Boles M. A., Thermodynamics: An Engineering Approach, McGraw-Hill, latest edition.</li>
<li>Cengel Y. A. and Cimbala J. M., Fluid Mechanics: Fundamentals and Applications, McGraw-Hill, latest edition.</li>
<li>Holman J. P., Heat Transfer, McGraw-Hill, latest edition.</li>
<li>Publications in Nature, Science and Cell journals on thermodynamics, fluid mechanics, heat and mass transfer, and related topics.</li>
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March 2024