<table>
<thead>
<tr>
<th>Module Code</th>
<th>MEU22E05</th>
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</thead>
<tbody>
<tr>
<td>Module Name</td>
<td>Thermo-fluids</td>
</tr>
<tr>
<td>ECTS Weighting</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>Semester taught</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Module Coordinator/s</td>
<td>Assistant Prof. Seamus O’Shaughnessy (<a href="mailto:OSHAUGSE@tcd.ie">OSHAUGSE@tcd.ie</a>)</td>
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</tbody>
</table>

**Module Learning Outcomes**

On successful completion of this module, students should be able to:

- **LO1.** Analyse, solve problems, and communicate the solutions of simple fluid-based engineering problems.
- **LO2.** Understand the principal of basic fluid measurement devices.
- **LO3.** Determine forces generated in systems such as jets and propellers.
- **LO4.** Distinguish between ideal and real flows and evaluate practical problems associated with pipe flow systems.
- **LO5.** Conceptualise and describe practical flow systems such as boundary layers and their importance in engineering analysis.
- **LO6.** Evaluate thermo-fluid properties and solve basic problems using property tables, property diagrams and equations of state.
- **LO7.** Analyse, solve problems, and communicate the solutions to practical closed systems and steady-flow devices by applying the conservation of energy principle.
- **LO8.** Understand the limitations of engineering devices and systems based on the 2nd law of thermodynamics.
- **LO9.** Understand the concept of thermal efficiency and coefficient of performance and the environmental and socio-economic implications associated with desired system output (i.e. power/cooling) verses required ‘cost’ in.
- **LO10.** Understand basic laboratory procedure and safety.
- **LO11.** Acquire, tabulate and analyse useful data in the laboratory, and communicate information and provide physical interpretation of measurements in technical laboratory reports.

**Graduate Attributes: levels of attainment**

- To act responsibly - Introduced
- To think independently - Enhanced
- To develop continuously - Enhanced
- To communicate effectively - Enhanced
**Module Content**

**Fluid Mechanics**

- Introduction: Definition of a fluid, fluid properties, equation of state.
- Principles and Equations of Fluid Motion and their applications: Description of fluid flow, continuity equation, Euler and Bernoulli equations, Pitot total head and static tubes, venturi-meters, orifice plates.
- Momentum Equation & its application: Momentum equation for steady flow, applications to jet flows, impinging flows in pipe bends, momentum theory of propellers.
- Boundary Layers and Wakes: Description of the boundary layer, laminar and turbulent boundary layers, physical, displacement & momentum thickness, effect of pressure gradient – separation and wake formation, drag forces.

**Thermodynamics**

- Introduction: Properties of matter, the state postulate, forms of energy, processes, thermodynamic systems,
- Properties of Pure Substances: property tables, property diagrams, phase change, equations of state (ideal gas), specific heats.
- Energy: Energy transfer by heat, work and mass, flow work.
- The First Law of Thermodynamics: Closed system, open system, steady-flow engineering devices.

**Teaching and Learning Methods**

The module encompasses a diverse variety of teaching and learning strategies. This is accomplished by coordinating formal lectures with teamwork-based problem-solving tutorial sessions supplemented by ‘hands-on’ laboratory experimentation and technical report writing. Students can avail of self-assessment online quizzes for every section of the module.

**Associated laboratory/project programme**

- Spark Ignition Engine Test.
### Assessment Details

Please include the following:

- **Assessment Component**
- **Assessment Description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Assessment Description</th>
<th>LO Addressed</th>
<th>% of total</th>
<th>Week due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam</td>
<td>End of Semester Written or Real Time Online Exam</td>
<td>1 - 9</td>
<td>70</td>
<td>Exam Period</td>
</tr>
<tr>
<td>Continuous Assessment</td>
<td>Lab Report</td>
<td>10 - 11</td>
<td>10</td>
<td>2 weeks after lab</td>
</tr>
<tr>
<td>Continuous Assessment</td>
<td>Online Quizzes</td>
<td>1 - 9</td>
<td>20</td>
<td>Teaching Weeks 3,6,9,12</td>
</tr>
</tbody>
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### Reassessment Requirements

The reassessment mode for this module is a written or real time online examination worth 100% of the reassessment grade.

### Contact Hours and Indicative Student Workload

**Contact hours:** 45 total (33 lectures, 10 tutorials, 1 x 2 hour laboratory sessions)

**Independent Study (preparation for course and review of materials):** 35

**Independent Study (preparation for assessment, incl. completion of assessment):** 45

### Recommended Reading

See Blackboard for further information

### Module Pre-requisite

None

### Module Co-requisite

None

### Module Website

https://www.tcd.ie/Engineering/assets/module-descriptors/sf/MEU22E05.pdf

### Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.

None

### Module Approval Date

Approved by

Academic Start Year

Academic Year of Date 2021/2022

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1 [TEP Guidelines on Workload and Assessment](#)