**Module Title:** 4B3 Thermodynamics

**Code:** ME4B03

**Level:** Senior Sophister

**Credits:** 5

**Lecturer(s):** Professor Darina Murray (dmurray@tcd.ie)

**Module Organisation**
This module runs for the 12 weeks of semester one (except during study/assignment week) and comprises three lectures plus one one-hour tutorial per week. Total contact time is 44 hours.

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<th>Semester</th>
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<th>End Week</th>
<th>Associated Practical Hours</th>
<th>Lectures</th>
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**Total Contact Hours: 44**

**Module Description, Aims and Contribution to the Programme**
This module aims to enhance the students’ understanding of thermodynamic principles by applying them to advanced vapour and combined power cycles and combustion processes. The aim is to instil within the students an awareness of the environmental and social implications of engineering technology, especially with regard to energy efficiency and safety. Students also gain an appreciation of a broad range of renewable energy sources and an understanding of their current and potential contribution to meeting Ireland’s energy requirements. Lifelong learning is fostered by providing a diverse and interactive learning environment.

**Learning Outcomes**
On completion of this module, the student will be able to:
1. analyse combustion processes, with and without dissociation, and generate mathematical models from conservation principles;
2. recognise, classify and describe the operating functions and thermodynamic principles of the devices and components that comprise vapour (with reheat and regeneration) and gas-vapour power plants and combined heat and power plants;
3. estimate the Thermal Efficiency (vapour or combined gas-vapour power plant) or Utilisation Factor (Cogeneration plant);
4. recognise the environmental and socio-economic implications associated with desired system output (power/ process heat) versus required ‘cost’ input (fuel/energy source);
5. evaluate thermodynamic processes and cycles from an exergy and second law efficiency perspective;
6. describe a broad range of renewable energy sources and assess their current and potential contribution to meeting Ireland’s energy requirements;

7. utilise internet resources for general module material, individual research assignment and lab report preparation.

Module Syllabus
- vapour and combined power cycles: Rankine cycle with reheat, Rankine cycle with feed heating, exergy and second law efficiency, cogeneration, gas and combined cycles;
- combustion of fuels and dissociation: theoretical combustion, air-fuel ratio, products of combustion, dew point temperature, 1st law analysis of combustion, adiabatic flame temperature, dissociation;
- energy sources and renewable energy technologies: energy market, nuclear energy, solar energy collectors, wind power, wave and tidal power, bioenergy.

Teaching Strategies
The module encompasses a diverse range of teaching and learning strategies. This is accomplished by coordinating formal lectures with problem-solving tutorial sessions supplemented by technical report writing and an individual research assignment. The module is delivered in a technologically up-to-date fashion by providing access to computerised module notes and by encouraging the use of modern software packages.

Recommended Text(s)
- *Thermodynamics and Transport Properties of Fluids*, SI Units, GFC Rogers and YR Mayhew, Blackwell

Assessment
This module is assessed by a formal written two-hour examination (80% of final mark) together with a written assignment (20% of final mark).

Assignment
*Renewable Energy term paper*