Module Code	MEU44B04
Module Name	Heat Transfer
ECTS Weighting	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Assistant Professor Tim Persoons
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Classify and explain the parameters affecting radiative heat exchange between two surfaces and solve practical heat transfer problems involving radiation. LO2. Explain the fundamental scientific principles underlying the conduction equation and determine the thermal resistance for both conduction and convection processes. LO3. Explain the fundamental scientific principles underlying the governing equations (continuity, momentum, energy) for convective heat transfer. LO4. Analyse and solve practical problems related to conduction, forced convection (internal and external flows), natural convection and convection with phase change. LO5. Analyse the thermal performance of heat exchangers and recognise and evaluate the conflicting requirements of heat transfer optimisation and pressure drop minimisation. LO6. Conduct a (virtual or real-life) laboratory experiment and analyse the performance of a heat transfer device. LO7. Communicate information and provide physical interpretation of measurements in technical laboratory reports. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced

Module Content	This module aims to enhance the students' understanding of heat transfer principles by applying them to a range of thermal systems and processes. Concepts in conductive, radiative and convective heat transfer are introduced; various techniques are explained for the solution of heat transfer problems, emphasizing real life problems such as practical heat exchangers and heat sinks. The aim is also to instil within the students an awareness of the environmental and social implications of engineering technology, especially regarding energy efficiency and safety. Students also gain experience of the use of practical measurement techniques and modern computer-based presentation and analysis. The module content is structured as follows: • Conduction • Radiation • Forced Convection Fundamentals • Forced Convection for External Flows • Forced Convection for Internal Flows • Free Convection • Boiling and Condensation • Heat Exchanger Performance and Design
Teaching and Learning Methods	This module uses Blackboard, podium or online lectures, a self-directed assignment, and tutorials to help students achieve the required learning outcomes. There are 3 lectures and one tutorial per week. In the current Covid-19 situation, the following changes to the normal teaching methods apply, and the same will apply in case of a new possible lockdown scenario during teaching term: • All lectures and tutorials will be delivered online using Blackboard Collaborate Ultra. These sessions will be recorded and available for viewing via Blackboard at a later time. • The lab will be entirely online, with support provided in an online tutorial session. An alternative online assignment replacing the lab altogether is also possible. This continuous assessment component is worth 20% of the module mark. • The end of semester exam modalities will probably be online/remote, although this is subject to change and will follow College guidelines (80% of the module mark).

Assessment Details
Please include the following:

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

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Laboratory/ assignment	Online/virtual heat exchanger lab, analysis and report, or equivalent online assignment	6,7	20	2 weeks following lab session
Written examination	End of semester examination	1-5	80	Exam period

Reassessment Requirements

100% written examination

Contact Hours and Indicative Student Workload

Contact hours: 46
Independent Study (preparation for course and review of materials): 45
Independent Study (preparation for assessment, incl. completion of assessment): 20

Recommended Reading List

- *Introduction to Heat Transfer*, T.L. Bergman, A.S. Lavine, D.P. DeWitt, F.P. Incropera, Wiley OR
- *Foundations of Heat Transfer*, T.L. Bergman, A.S. Lavine, D.P. DeWitt, F.P. Incropera, Wiley OR
- *Fundamentals of Heat and Mass Transfer*, T.L. Bergman, A.S. Lavine, D.P. DeWitt, F.P. Incropera, Wiley

Optional other textbooks:

- *Heat Transfer: A Practical Approach*, Y.A. Cengel, McGraw Hill
- *Heat Transfer*, A. Bejan, Wiley
- *Heat Transfer Handbook*, A. Bejan & A. D. Kraus, Wiley
- *A Heat Transfer Textbook*, J. H. Lienhardt, MIT (https://ahtt.mit.edu/)

Module Pre-requisite

3B2 Fluid Mechanics or equivalent

Module Co-requisite

N/A

Module Website

https://www.tcd.ie/Engineering/undergraduate/baiyear4/

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

No

Module Approval Date

Approved by

Academic Start Year
Academic Year of Date