DEN5208

Heat Transfer and Fluids Mechanics 1 for 2017/18

If something needs editing on this page (apart from the reading list), please contact one of the programme and course editors: Sandra, Martin, David, Jonathon, Henri, Julia

Units: 1 **Credits:** 15 **Semesters:** B **Level:** 5 **Fulltime:** Yes **QM Model Compliant:** TBC	
Organiser:	Dr Adrian Briggs
Deputy Organiser:	Dr Hicham Adjali
Prerequisites:	DEN4101, DEN107
Description:	This module introduces the basic concepts of heat transfer i.e. conduction, convection and radiation. It will develop the ideas introduced in DEN4101Fluid Mechanics and extends these to look at the closely interrelated subjects of fluid friction and convective heat transfer. It also analyses conduction-convection in conjugate systems, transient heat transfer, heat transfer enhancement using extended surfaces and the importance of dimensional analysis in Fluid Mechanics and Convective Heat Transfer.
Method of Delivery (Teaching and Learning Profile):	
Course Type:	Taught
Approx hours to be spent by students in:	**Lectures:** 33 **Seminars:** 0 **Fieldwork/visits:** 0 **Lab work:** 2 **Timetabled project/coursework:** 0 **Problem Solving Classes:** 11
Formative Feedback	
Methods of Assessment:	
	Examination Papers: 1 **Duration:** 2.5 hours
	Coursework or other Assessment: **Formative Assessment:** **Summative Assessment:**

Percentage Credit for Examination: 70% **Credit for Coursework:** 30%	
Organising Dept:	SEMS
Board of Examiners:	Engineering
Sub-board:	0600
Aims:	1. To enable students to quantitatively model and analyse heat transfer in a variety of systems including conduction, convection and radiation and combinations thereof. 2. To enable students recognise the fundamental connections between fluid flow and convective heat transfer.
Objectives:	The fundamental modes of heat transfer and the laws and empirical relationships underpinning them The interrelationship between concepts in fluid mechanics and convective heat transfer The calculation of the heat transfer rates and the thermal resistances in a variety of engineering situations and geometries Apply Newton's law of cooling and Fourier's conduction law in the analysis of systems involving conduction and/or convection Calculate pressure drops and flow rates through pipes and pipe networks and apply these results to the correct selection of pumps Calculate heat transfer enhancement due to addition of extended surfaces and calculate fin efficiency and fin effectiveness Identify the common dimensionless groups in convective heat transfer and use these to correlate experimental data Apply the basic concepts of radiation heat transfer Write a standard laboratory report Analyse and correlate data by the use of dimensional analysis
Syllabus:	Modes of Heat Transfer Conduction convection and radiation and their inter-relationship Conduction Conduction in stationary media, thermal conductivity, steady conduction in solids (including source term) with plane, cylindrical and spherical isothermal surfaces. Compound slabs, cylinders and spheres, interfacial resistance. Convection Description of principles underlying theory of convection. The surface heat transfer coefficient. Boundary layer theory. Laminar flow and its transition to turbulent flow. Effects on surface shear stress and heat transfer coefficient.

	Internal flow in a pipe with and without heat transfer, entrance effects. External flow around a cylinder in cross flow, with and without heat transfer. Conjugate Heat Transfer Radial heat transfer between fluids inside and outside plane walls and pipes with uniform surface heat-transfer coefficients, overall heat transfer coefficient. Pipe networks Flow in serial and parallel networks of pipes Characteristics of pumps within the context of pump and pipeline systems. Pumps and turbo machinery Dimensional analysis Application to forced and free convection. Reynolds, Prandtl, Nusselt, Stanton, Grashof and Rayleigh numbers. Non-dimensional correlations of experimental data. Radiation Electromagnetic wave spectrum. Absorption and emission at solid surfaces. Black surface, Stefan-Boltzmann equation, grey surface, Kirchhoff's Law. Diffuse emitter, Lambert's law. Radiation between black surfaces separated by non-absorbing medium, view factor.