MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME405 HEAT AND FLOW 4

Module Registrar: Dr P Capobianchi **paolo.capobianchi@strath.ac.uk**	**Taught To (Course): Cohorts for whom class is compulsory / optional**		
Other Lecturers Involved:	**Credit Weighting: 10 (ECTS 5)**	**Semester: 1 & 2**	
Assumed Prerequisites: **ME101, ME203, ME301 Heat and Flow 1, 2 and 3**	**Compulsory/ optional/ elective class**	**Academic Level: 4**	**Suitable for Exchange: Y**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
20	20						10	50	100

Educational Aim

An understanding of heat, mass and momentum transfer processes is a basic requirement for practising engineers. This class aims to build upon the students' previous exposure to the basic transfer mechanisms of conduction, convection, mass and momentum, so that multi-dimensional, steady state and transient problems encountered in thermofluids engineering problems can be recognised and analysed.

Learning Outcomes

A general objective of the class will be to deepen the students' understanding of general transport phenomena of mass, momentum and heat transfer processes and to show and give practice in the available solution techniques applied to engineering systems.

On completion of the module the student is expected to be able to:

LO1 understand the fundamental concepts of conduction, convection, momentum and mass transfer

LO2 understand the main formulation methods and the limitations of the equations derived from them

LO3 be able to carry out simple calculations in boundary layer theory

LO4 be able to carry out engineering calculations involving conduction and convection by writing simple computer programs

Syllabus

Fundamentals of Fluid Mechanics (Mass and Momentum Transfer):

Eulerian, Lagrangian viewpoints; derivation of mass, momentum, and energy equations for differential control volumes and their applications in simple flow problems.

Fundamentals of Heat Transfer:

Conduction: Unsteady conduction theory. Numerical analysis of simple two-dimensional problems.

Convection: the convection boundary layers. Order of magnitude analyses; important dimensionless groups; elementary solutions of governing equations; heat and mass transfer analogy; laminar forced convection on a flat plate; Reynolds analogy, introduction to turbulence; external and internal flows; free and forced convection correlations.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Understanding the fundamental concepts of heat, momentum and mass transfer
C1 Students should demonstrate understanding of the differences between the various transfer phenomena and be able to perform calculations to demonstrate the key principles.

LO2 Understanding the main formulation methods and the limitations of the equations derived.C1 Students will comprehend the most important factors in the derived formulae and will be able to modify the general equations to suit particular engineering circumstances.

LO3 To be able to carry out engineering calculations involving conduction and convection
C1 Students will have a thorough appreciation of the physics involved in each mode of heat transfer and be able to accurately assess which mode is pertinent in any given situation.

LO4 To be able to carry out numerical calculations involving two dimensional heat conduction equation and compare the result to analytical solution
C1 Students will gain a basic understanding in the nature of numerical algorithms for solving PDEs relevant to heat transfer to provide reasonable engineering approximations as to what happens in nature.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/professionalservices/staff/policies/academic/)

Students are encouraged to collaborate in the calculations and models provided in the tutorial exercise and demonstration calculations provided during the course.

Informal feedback will be provided at regular tutorial sessions primarily through verbal discussion with individuals or groups on tutorial exercises attempted in advance by students.

Guidance to the solution of certain tutorial questions will be discussed in lectures/tutorial sessions.

Formal, summative feedback will be provided by the return of examination marks to students after assessment (note: exam scripts will not be returned to students and no collective discussion of exam performance will be facilitated). Individual feedback on the exam may be arranged if appropriate.

Immediate feedback will be provided following the on-line assessment.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)*

Examination				Coursework		Practical		Project	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
1	May	2 hours	60%	2	40% (20% each)				
* LO1, LO2, LO3 and LO4				*LO1 and LO2		*		*	

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

Coursework / Submission deadlines (*academic weeks*):

An on-line assessment will be given in week 9 (sem1) counting as 20% of the final mark.
An on-line assessment will be given in week 9 (sem2) counting as 20% of the final mark.

Resit Assessment Procedures:
2 hour examination in July/August diet

PLEASE NOTE:
Students must gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-assessed during the July/August exam diet. This re-assessment will consist entirely of exam. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference**

** Fundamentals of Heat & Mass Transfer by Frank P. Incropera
** Fluid Mechanics by P. K. Kundu
** Advanced Transport Phenomena by L. Gary Leal
* Boundary Layer Theory by H. Schlichting

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
TBC	TBC	TBC

Session: 2024/25

Approved:

Programme Lead/Director Signature: Dr A McLaren

Date of Last Modifications: 04/08/2024

(MAE template updated July 2024)

MODULE TIMETABLE

Module Code:	**ME405**	**Module Title:**	**Heat & Flow 4**

Brief Description of Assessment:

2 Time Constrained Quizzes (Online Test) worth 40% and a summative exam worth 60% at end of semester 2.

Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment.

Please note: Timings could change during unforeseen periods of disruption; this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Online Test	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Online Test	Choose an item. Choose an item.	Choose an item. Choose an item.	Exam