MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME203 (ME205 sem1 / ME204 sem2) HEAT AND FLOW 2

Module Registrar: Dr Monica Oliveira monica.oliveira@strath.ac.uk	**Taught To (Course): Cohorts for whom class is compulsory**		
Other Lecturers Involved: Dr Stephanie Ordonez Sanchez	**Credit Weighting: 20 (ECTS 10)**	**Semester: 1 and 2**	
Assumed Prerequisites: ME101 Heat and Flow 1	**Compulsory class**	**Academic Level: 2**	**Suitable for Exchange: Y**

Alternative codes and credit values for students taking only one semester:
Semester 1: ME205 Fluid Mechanics (10 Cr/ECTS 5)
Semester 2: ME204 Thermodynamics (10 Cr/ECTS 5)

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

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
40	36		7				10	107	200

Educational Aim

This module aims to deliver fundamental knowledge on fluid mechanics and thermodynamics and illustrate their importance to engineering systems. Thermodynamics is the science devoted to understanding energy in all its manifestations and how energy can change form. Fluid mechanics is the discipline concerned with the study of fluids and related energy and mass transfer processes. In the first semester the underlying physics of fluid flow and its application to simple systems is presented. The aim of the second semester is to supply additional analytical tools to study energy changes in situations of practical interest or engineering relevance, in particular for transportation and power production.

Learning Outcomes

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

LO1 Understand the behaviour of different fluids in a range of applications and to understand how to investigate their properties both experimentally and numerically.

LO2 To understand and analyse the influence of fluid properties on the behaviour of engineering systems and to be able to analyse systems using the concepts of conservation of mass, energy and momentum.

LO3 To understand the fundamentals of the laws of thermodynamics and how they can be used to both design, and assess the performance of engineering power systems.

LO4 To understand the thermodynamic behaviour of different fluids and their importance in power cycles.

Syllabus

The module will teach the following:

Fluid Mechanics
a) the influence of fluid properties on the behaviour of engineering systems
b) the concepts of conservation of mass, energy and momentum
c) dimensional analysis of an engineering process
d) significance of dimensionless parameters such as Reynolds and Mach numbers, and dimensional analysis.
e) design of simple pipe systems

Thermodynamics
a) 1st law of thermodynamics applied to non-flow and steady flow systems
b) the properties of perfect gases
c) the properties of liquids and vapours
d) the 2nd law of thermodynamics, its implications and thermal efficiency
e) entropy and the concepts of the principle of increasing entropy, isentropic efficiency
g) assessment of the performance of vapour and gas power cycles

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 Understand the behaviour of different fluids in a range of applications and to understand how to investigate their properties both experimentally and numerically.
C1 Demonstrate ability to identify how to identify different fluids, apply appropriate assumptions for their properties and determine their behaviour through calculations.
C2 Determine key parameters that quantify properties of a fluid (e.g. Viscosity etc.) and that affect the fluid behaviour (e.g. Mach number, Reynolds number etc.)
C3 Demonstrate understanding of dimensional analysis and how it can be used to compare fluids and fluid behaviour in engineering systems.

LO2 To understand and analyse the influence of fluid properties on the behaviour of engineering systems and to be able to analyse systems using the concepts of conservation of mass, energy and momentum.
C1 Perform calculations to demonstrate understanding of how conservation of mass, energy and momentum determine the performance of an engineering system.
C2 Demonstrate understanding of the principles of conservation of fundamental quantities by making appropriate assumptions when undertaking analysis of systems.

LO3 To understand the fundamentals of the laws of thermodynamics and how they can be used to both design, and assess the performance of engineering power systems, .
C1 Demonstrate ability to select correct energy equation for the problem and perform calculations to determine how properties change during a process due to energy transfers
C2 Be able to perform calculations of heat and work for various fundamental processes, demonstrating understanding of how different processes use differing assumptions to determine correct energy transfer.
C3 Demonstrate understanding of how laws of thermodynamics affect engineering cycles power through calculations of how properties varying during cycle, of energy transfers and by determining appropriate measures of cycle performance.

LO4 To understand the thermodynamic behaviour of different fluids and their importance in power cycles.
C1 Demonstrate ability to determine appropriate assumptions and analysis procedures for calculations using different fluids
C2 Demonstrate ability to determine thermodynamic property changes for a perfect gas using Gas Law and energy equation.
C3 Demonstrate ability to determine thermodynamic property changes for liquids and vapours using thermodynamic property tables and energy equation.

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/staff/policies/academic/)

Assessment is given in multiple forms: online quizzes, group work and class tests.

Deliver high quality feedback information that helps learners self-correct.
Immediate self-assessment & feedback to online quizzes/assignments, with solutions given to questions along with reasons for correct answers and why certain approaches are incorrect.

Informal feedback will be provided at tutorial sessions or through online discussion boards on tutorial exercises attempted in advance by students.

Solutions to selected tutorial questions will be presented and discussed.

Ensure that summative assessment has a positive impact on learning.
Feedback from quizzes and tutorials will enable students to reflect on their understanding of the subject material along the year and prior to each semester class test.

Formal, summative feedback will be provided by the return of class test marks to students after assessment.

Encourage interaction and dialogue around learning (peer and teacher-student)
Discussion of the course material between teacher-student and also amongst peers will be encouraged in tutorial Sessions or online discussion boards. Students will also be encouraged to discuss works with their peers to improve Learning.

Students are encouraged to collaborate in the calculations and models provided in the tutorials and demonstration calculations provided during the course. However, it is emphasised that online quizzes and class tests submitted must be entirely their own work.

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

Examination				**Coursework**		**Practical**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
				Online Quizzes	Sem 1 20% Sem 2 20% (ME204/ME205 40%)				
				Class Test	Sem 1 25% Sem 2 25% (ME204/ME205 50%)				
				Group Assignment	Sem 1 or 2 10%				
* LO1, LO2, LO3, LO4				* LO1, LO2, LO3, LO4					

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

Coursework / Submissions deadlines (*academic weeks*):

Online assignments/quizzes: usually weekly or bi-weekly.

Class tests: week 11 of each semester.

Group assignment: Released on week 5 and due on week 9 in Sem 1 or 2 + Peer assessment.

Resit Assessment Procedures:
2hr examination in 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 August 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 (do NOT purchase)**

*** **Fluid Mechanics:** Purchase recommended:
"Fundamentals of Fluid Mechanics" by Munson, Young & Okiishi, John Wiley & Son,
ISBN 0471517461

* **Fluid Mechanics:** Simply for reference (do NOT purchase)
"Fluid Mechanics" by Douglas, Gasiorek & Swaffield, Pitman, ISBN 0 273 02134 6
"Mechanics of Fluids" by Massey, Van Nostrand Reinhold, ISBN 0278 00047 9
"Thermal Convection: Patterns, Evolution and Stability", by M. Lappa, John Wiley & Sons, ISBN: 0470699949.
"Rotating Thermal Flows in Natural and Industrial Processes" , by M. Lappa, John Wiley & Sons, ISBN: 1119960797.

*** **Thermodynamics:** Purchase recommended:
"Fundamentals of Thermal-Fluid Sciences" by Cengel, Cimbala & Turner, McGraw-Hill, ISBN 9780071325110

** **Thermodynamics:** Highly recommended reading:
"Introduction to Thermal Systems Engineering" by Moran, Shapiro, Munson & Dewitt, Wiley,
ISBN 0-471-20490-0
"Fundamentals of Thermodynamics" by Sonntag, Borgnakke & Van Wylen, Wiley, ISBN 0-471-15232-3
"Thermal-Fluid Sciences – An integrated approach" by Turns, Cambridge Press, ISBN 978-0-521-85043-8

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

Date	Time	Room No
		Check timetable webpages for details

Session: 2020/21

Approved:

Course Director Signature: Dr Stuart Grey
Date of Last Modifications: 10 September 2020

(Updated August 2020)

MODULE TIMETABLE

Module Code:	**ME203 / 205 / 204**	**Module Title:**	**Heat and Flow 2 / Fluid Mechanics / Thermodynamics**

Brief Description of Assessment:

Online quizzes throughout the year (marked below as online tests).
Group coursework (marked below as Coursework submit) – 1 video with presentation/animation/experiment about a specific theme covered in the class (different groups may have different themes) in SEM 1 or 2.
Class tests in week 11 of Sem 1 and Sem 2.

Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment. Dropdowns may be left blank. Add extra notes below the dropdowns where relevant.

Please note: Timings can and will change, 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.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Course work Submit	Choose an item. Choose an item.	Class Test 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.	Online Test Choose an item.	Choose an item. Choose an item.	Online Test Choose an item.	Choose an item. Choose an item.	Online Test Choose an item.	Choose an item. Choose an item.	Online Test Choose an item.	Course work Submit Choose an item.	Choose an item. Choose an item.	Class Test Choose an item.	Choose an item.