Module specification

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Module Code	ENG5B1
Module Title	Fluid Mechanics and Thermodynamics
Level	5
Credit value	20
Faculty	FAST
HECoS Code	100431
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng/MEng Mechanical Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	20 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	10 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**30** hrs
Placement / work based learning	0 hrs
Guided independent study	170 hrs
Module duration (total hours)	**200** hrs

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Initial approval date	22/08/2022
With effect from date	September 2022
Date and details of revision	
Version number	1

Module aims

- To further develop principles and applications of fluid momentum, flow in ducts and dimensional analysis. Apply Bernoulli's equation and identify pressure distribution and forces in fluids.
- To develop an in-depth understanding of non-flow and flow processes, liquids, vapours and two phase substances, polytropic processes using gases and vapours, the first and second laws of thermodynamics pressure and flow measurement.

Module Learning Outcomes - at the end of this module, students will be able to:

1	Apply the basic laws of fluid mechanics (Bernoulli's / incompressible fluids), the concepts of pressure distribution and forces in a fluid and identify and apply the theory of heat dissipation between fluids.
2	Define integral relations for a control volume. Apply dimensional analysis and definition of non-dimensional parameters. Solve viscous flow in ducts.
3	Define the properties of working fluids and hence analyse two phase systems using tables and represent processes on property diagrams
4	Apply the first and second laws of thermodynamics and compare the performance of real and ideal cycles.

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C2.

Assessment

Indicative Assessment Tasks:

Assessment 1 is by means of a coursework with several exercises applying the laws of fluid mechanics and the flow of incompressible fluids. The word count for the coursework is 2000 words.

Assessment Two is by means of an examination covering all other outcomes. It is an unseen time-constrained examination (2 hours).

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1	Coursework	30
2	2, 3, 4	Examination	70

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Learning and Teaching Strategies

The module is taught through a combination of lectures and workshops. An active and inclusive approach is used to engage learners in the topics and will involve individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.

The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

Detailed printed lecture notes provided for the student will allow the optimisation of lecture time, with good opportunity for self-study and tutorials. The module will also contain practical laboratory-based exercises supported by introductory lectures and demonstrations.

This module will be presented to students through a series of lecture materials including videos, demonstrations and structured technical visits to suitable establishments (e.g.: RAF, Cosford). Laboratory investigations and tutorials will be used to support lectures and to provide an opportunity for students to work on problems with individual attention if needed.

Indicative Syllabus Outline

- Basic Concepts and properties of fluids: Pressure distribution, forces and integral relations for a given control volume.
- Dimensional analysis and viscous flow in a duct.
- Basic Concepts and the First Law.
- Properties of Pure Substances and Use of Property Diagrams and Tables.
- The relationships between the properties of a perfect gas.
- Description and analysis of polytropic processes: polytropic law.
- The relationship between ideal and actual power plant cycles.
- Analysis of heat pump and refrigeration cycles.
- Laws of mechanics, Bernouilli's equation and the momentum equation to the flow of incompressible fluids.
- Gas turbine and jet engine cycles.

Indicative Bibliography:

Essential Reads

Y.A. Cengel, and R.H. Turner, *Fundamentals of Thermal-Fluid Sciences*, 5th ed. Singapore: McGraw-Hill Higher Education, 2016.

Other indicative reading

W. Janna, Introduction to *Fluid Mechanics*, 6th ed. CRC Press, 2020

C.T. Crowe, *Engineering Fluid Mechanics*, 9th ed. John Wiley and Sons, 2009.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

Core Attributes
Engaged
Enterprising
Creative
Ethical

Key Attitudes
Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets
Digital Fluency
Organisation
Leadership and Team working
Critical Thinking
Emotional Intelligence
Communication