Module Specification

Design of Fluid Systems

Version: 2021-22, v1.0, 10 Feb 2022

Contents

Part 1: Information

Module title: Design of Fluid Systems

Module code: UFMENU-15-M

Level: Level 7

For implementation from: 2021-22

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Engineering, Design and Mathematics

Module type: Standard

Pre-requisites: Heat Transfer, Power and the Environment 2022-23

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Not applicable

Features: Not applicable

Educational aims: See Learning Outcomes.

Outline syllabus: 1) Viscous, thermal and concentration boundary layers and their relationships, prediction of velocity/temperature/concentration profiles and heat

transfer in boundary layers for flat plates

2) Non-Newtonian fluid types and mathematical models, industrial relevance, shear rate effects, Laminar flow of Non-Newtonian fluids.
a) Unsteady incompressible viscous flows in fluid systems. Quasi-steady analysis. Rigid column theory and water hammer theory, pressure waves and time series of events, pump bypass, introduction to Navier-Stokes equations.
b) Innovative power generation technologies (e.g. cryogenic engines, supercritical CO2 & steam cycles to operate at high temperatures), heat recovery steam generators (HRSGs), combined cycle gas turbines (CCGT), carbon capture storage and transport (CCS&T).

3) Flow management in high pressure and low pressure flow applications, flow management techniques, heat transfer enhancement in channel flow, passive active & reactive flow control, turbulence promoters, controlling fluid flow through sensing and actuation.

Part 3: Teaching and learning methods

Teaching and learning methods: Lecture to whole cohort supported by small group tutorial sessions. Study time outside of contact hours will involve working through exercises and example problems.

Scheduled learning includes lectures, tutorials / lab sessions.

Independent learning includes hours engaged with essential reading, assignment preparation and completion etc...

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Analyse flow in viscous and thermal boundary layers and predict the interaction between them.

MO2 Analyse Laminar flow of non-Newtonian fluids.

MO3 Model internal and external unsteady incompressible viscous fluid flow.

MO4 Evaluate advanced power generation cycles and describe carbon capture, storage and transport techniques.

MO5 Select gas and liquid flow control systems and flow management techniques.

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Total = 150

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmenu-15-m.html

Part 4: Assessment

Assessment strategy: The module is assessed through two components of assessment.

Component A: Examination
An end of semester exam is used to assess understanding of theory and techniques. Five hours are allowed as demonstration of this understanding involves mathematical analysis and calculations that are time consuming. A longer examination should ensure that students can complete and check their submissions.

Component B: Coursework
A design problem on unsteady incompressible fluid flow, non Newtonian flow and flow control is used to assess the student's ability to apply their knowledge to an engineering context. This task will involve solving equations and computational fluid dynamics analysis. The feedback from this exercise will assist in their student's

overall development as they prepare for the examination. The output from the assignment will be 2000 word report.

Assessment components:

Examination (Online) - Component A (First Sit)
Description: Online examination: 5 hours
Weighting: 75 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

Report - Component B (First Sit)
Description: Report (2000 words)
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested: MO2, MO3, MO5

Examination (Online) - Component A (Resit)
Description: Online examination: 5 hours
Weighting: 75 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Report - Component B (Resit)
Description: Report (2000 words)
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mechanical Engineering [Sep][FT][Frenchay][1yr] MSc 2021-22

Mechanical Engineering [Sep][PT][Frenchay][2yrs] MSc 2021-22

Mechanical Engineering [Sep][PT][Frenchay][2yrs] MSc 2020-21

Mechanical Engineering [Sep][FT][Frenchay][4yrs] MEng 2018-19