Liverpool John Moores University

Title:	FLUID MECHANICS AND POWER ENGINEERING
Status:	Definitive
Code:	**5040ENG** (105778)
Version Start Date:	01-08-2016
Owning School/Faculty:	Maritime and Mechanical Engineering
Teaching School/Faculty:	Maritime and Mechanical Engineering

Team	Leader
Allan Carrier	Y

Academic Level: FHEQ5 **Credit Value:** 24 **Total Delivered Hours:** 69

Total Learning Hours: 240 **Private Study:** 171

Delivery Options

Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	40
Practical	6
Tutorial	20

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	60	3
Essay	AS2	Laboratory assignments in Fluid Mechanics	12	
Essay	AS3	Laboratory assignments in Thermodynamics	12	
Essay	AS4	Tutorial assignment in Fluid Mechanics	8	
Essay	AS5	Tutorial assignment in Thermodynamics	8	

Aims

To appreciate the difference between ideal and real fluid flow
To be able to analyse complex pipeline flow problems
To introduce compressible flow and its analysis in one dimension
To analyse multi-mode heat transfer
To apply the second law of thermodynamics to simple processes
To analyse combustion processes
To analyse simple refrigeration processes
To analyse real vapour and gas based power cycles
To demonstrate the advantages and disadvantages of differing power generation schemes
To demonstrate and understanding of the practical requirements of various power plant.

Learning Outcomes

After completing the module the student should be able to:

1. Apply dimensional analysis to practical problems.
2. Evaluate pressure losses due to friction and fittings in pipeline systems
3. Determine the flow and pressure distribution in subsonic and supersonic nozzles.
4. Analyse multimode heat transfer in plane, cylindrical and spherical geometries.
5. Apply the second law of thermodynamics to simple systems and calculate entropy changes
6. Analyse combustion processes and apply the first law of thermodynamics to combustion processes.
7. Analyse simple refrigeration cycles.
8. Calculate power developed in different types of power plant, calculate thermal efficiencies and account for energy losses.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

EXAM	1	2	3	4	5	6	7	8
CW	2	3						
CW	6	8						
CW	1	2	4					
CW	5							

Outline Syllabus

Descriptive treatment of real fluid flow. Dimensional analysis and model testing. Laminar and turbulent pipe flow. Reynolds number. Friction and minor losses in pipes and pipe networks. Use of the Moody chart.
1-d compressible flow. Mach no., isentropic flow, stagnation conditions, use of tables. Flow through nozzles. Choked conditions. Critical pressure ratio.

Multimode heat transfer and resistance analogy.

The second law of thermodynamics.
T-S diagrams and entropy changes for gases, vapours and liquids.
Stoichiometry, application of the first law to combustion processes, exhaust emissions and associated pollution.
Power plant, energy balances and auxiliary requirements.
Refrigeration and heat pumps, properties of refrigerants and operating cycles.

Learning Activities

Combination of lectures, tutorials and laboratory assignments.

Notes

This module aims to develop an understanding of real fluid flow. Compressible flow and its effect on the conservation equations is considered. Heat transfer is extended to cover multimode effects and more general geometries.
The second law of thermodynamics and the property entropy are introduced. The laws of thermodynamics are then applied to a range of processes, including combustion, refrigeration, and power cycles. The power cycles covered include vapour and gas cycles.