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## Definitive Module Document (DMD)

## MODULE

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2AAD0011 (A 05/6)

Thermofluid Mechanic...

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**Module Code:**2AAD0011

**Title of Module**

**Full Title:** Thermofluid Mechanics

**Short Title:** Thermofluid Mech

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**Version:** 1

**Credit Points:** 15

**Level / ECTS Level:** 2

**First Offered:** 1/9/2004 00-00-00

**6. Home Department:**

AAD

**7. Departments(s) contributing to teaching:**

**9. Module Aims:**

- \* further their understanding of the principles and practical applications of thermodynamics
- \* further their understanding of the principles and practical application of fluid mechanics

**10a. Learning Outcomes: Knowledge and Understanding:**

- \* understand the practical implications of the second law of thermodynamics and concept of entropy
- \* appreciate the limitations of heat engines efficiency and heat pumps coefficient of performance
- \* understand the nature and behaviour of semi-perfect gases, gaseous mixtures and 3-phase pure substances
- \* understand a range of practical applications of the vapour and power and refrigeration cycles
- \* understand viscous flow of incompressible fluids

**10b. Learning Outcomes: Skills and Attributes:**

- \* be able to analyse viscous incompressible fluid flow in a range of applications
- \* be able to apply the second law of thermodynamics to heat engines and heat pumps
- \* be able to analyse and characterise the performance characteristics of heat pumps and heat engines in a laboratory environment
- \* be able to utilize water/steam tables & charts and analyse simple water/steam power systems

**11. Module Content**

**11a Module Content:**

This course is a single unit of study, covering both Thermodynamics and Fluid Mechanics. The proportioning between these two is approximately 2/3-1/3.

The thermofluid mechanics syllabus covers-

- the second law of thermodynamics
- viscous flow systems for incompressible fluids
- the nature and behaviour of semi-perfect gases, gaseous mixtures and 3-phase pure substances
- water/steam fundamentals and applications to power systems
- consideration of a range of practical applications of fluid power cycles
- flow round immersed objects, cross stream forces

**11b. Further details on how the learning outcomes of the module will be achieved:**

Semi-perfect gas- Internal energy as a function of temperature, linear relationship between specific heat capacities and temperature. Equations for the change in entropy for a perfect and semi-perfect gas. Isentropic processes for a perfect gas. Isentropic efficiency.

The second law of thermodynamics- Direct and reversed heat engines, supporting evidence and corollaries. Thermodynamic temperature scale, absolute temperature scale. Efficiency of a reversible heat engine in terms of absolute temperature. Definition of entropy as a property of a system. Entropy changes in reversible and irreversible adiabatic processes.

Viscous flow- Boundary layer growth, mass flow and momentum of fluid at a section of boundary layer.

Displacement and momentum thickness, their practical significance and relevance to numerical schemes. Momentum integral equation. Laminar and turbulent boundary layers. Transition. Flow separation. Factors affecting transition and separation.

Flow round immersed bodies- Pressure gradient across a curved streamline. The generation of cross-stream forces. Lift. Drag. Sources of drag and means of reduction. Vortex system of lifting bodies. Free and forced vortices. Vapour power cycles- Carnot and Rankine cycle, relevance to vapour power plants. Refrigeration cycles. Properties of refrigerants. Vapour compression refrigeration cycles involving superheat and undercooling. Heat pumps, use for space heating and cooling.

**12. Language of Delivery:**

English

**13. Language of Assessment:**

English

**14. Assessment Details (Academic):**

Coursework: 30

Exam: 70

Other: Typically, assessment will consist of-

One 3-hour end-of-course examination 70%

Two 1-hour class phase tests 20%

One laboratory report 10%

**Assessment Notes:**

Separate passes are required in both the coursework and examination elements of assessment

**15. Locations(s):**

UH HATFIELD

**16. Pre and Co-Requisite:**

**Pre-Requisite**

**Co-Req**

**Prohibited**

**17. Subject Board of Examiner/s:****18. Comments**

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