

## MODULE DESCRIPTION FORM

### DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

## ME101 HEAT AND FLOW 1

|   |   |                          |                                 |
|---|---|--------------------------|---------------------------------|
| <b>Module Registrar:</b> Dr Bill Dempster<br><a href="mailto:william.dempster@strath.ac.uk">william.dempster@strath.ac.uk</a> | <b>Taught To (Course):</b> Mechanical, Electrical/Mechanical, Product Design and Man. Science |                          |                                 |
| <b>Other Lecturers Involved:</b>  | <b>Credit Weighting:</b> 10   | <b>Semester:</b> 1 and 2 |                                 |
| <b>Assumed Prerequisites:</b> Mathematics and Physics at SQA Higher level or equivalent                                       | <b>Compulsory class</b>   | <b>Academic Level:</b> 1 | <b>Suitable for Exchange:</b> N |

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

| Lecture | Tutorial | Laboratory | Groupwork | External | Online | Project | Assignments | Private Study | Total |
|---------|----------|------------|-----------|----------|--------|---------|-------------|---------------|-------|
|         | 20       |            |           |          | 20     |         | 12          | 48            | 100   |

#### Educational Aim

Knowledge of Thermodynamics, Heat and Fluid Flow are important for the understanding and design of thermal and hydraulic systems involving energy conversion and transmission, such as engines and turbines, pumps and compressors, and associated pipework. The aim of the class is to introduce the basic concepts of thermodynamics and Fluid Mechanics, and the applications thereof, as a foundation for further studies.

#### Learning Outcomes

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

LO1 Understand the basic principles of conservation of energy, work and heat transfer for a closed system.

LO2 Apply the First law of Thermodynamics to a range of problems involving isothermal, adiabatic, polytropic, constant volume and constant pressure processes, all using a perfect gas.

LO3 Understand the basic principles of fluid flow, the continuity equation, and Bernoulli's Equation.

LO4 Apply the basic equations of fluid flow (continuity and Bernoulli) to problems involving pipe flow, nozzles and jets, and siphons

#### Syllabus

The module will teach the following:

Unit and dimensions, Dimensional Homogeneity. Systems and the properties of systems such as pressure, temperature and energy. An introduction to energy conversion processes and systems involving work and heat transfer. Conversion of energy from one form to another. The First Law of Thermodynamics. Non flow processes involving perfect gases. The Continuity Equation, Bernoulli's Equation, Applications to flow in pipes, nozzles, siphons .

#### 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 basic principles of conservation of energy, work and heat transfer for a closed system**

C1 The ability to identify a suitable thermodynamic system and the energy exchanges associated with it.

C2 To recognise and draw PV diagrams and calculate the thermodynamic work for various process paths.

C3 To express heat transfer balances and calculate the heat transfer rates for simple heat transfer problems.

##### **LO2 Apply the First law of Thermodynamics to a range of closed system problems**

C1 To recognise the physical significance of a number of thermodynamic process paths.

C2 To formulate energy balances for a variety of thermodynamic processes.

C3 To calculate the work, heat transfer and energy content changes for a variety of thermodynamics processes

##### **LO3 Understand the basic principles of fluid flow, the continuity equation, and Bernoulli's Equation**

C1 To describe and draw simple flow patterns of internal and external flows

C2 To be able to write unaided and explain each term of the continuity and Bernoulli equation

**LO4 Apply the basic equations of fluid flow to problems involving pipe flow, nozzles and jets, and siphons**

C1 To calculate the flowrates in pipe flows using the continuity equation

C2 To calculate the pressures and velocity changes for changes in configuration using the Bernoulli 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/> )

General class feedback will be provided on the return of coursework and examination scripts. Overall class performance will be discussed for the Semester 1 exam and where satisfactory performance has not been achieved individual feedback will be provided.

Informal feedback will be provided at regular tutorial sessions primarily through verbal discussion with individuals or groups on tutorial exercises attempted in advance by students (note:- to receive this feedback students should participate in these tutorials but attendance is not mandatory).

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

| Examination (online quiz) |            |                  |            | Coursework        |           | Practical |           | Project |           |
|---------------------------|------------|------------------|------------|-------------------|-----------|-----------|-----------|---------|-----------|
| Number                    | Month(s)   | Duration         | Weighting  | Number            | Weighting | Number    | Weighting | Number  | Weighting |
| 2                         | Dec<br>May | 1.5hrs<br>1.5hrs | 25%<br>55% | 4                 | 20%       |           |           |         |           |
| * 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):**

Homework is an online exercise, attempted at home within a fixed time period.

**Resit Assessment Procedures:**

2 hour 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)

Online access Myplace for class notes, tutorial and previous exam papers

\*\*\* "Fundamentals of Thermal-Fluid Sciences" by Cengel , Turner & Cimbala, McGraw-Hill

**Additional Student Feedback**

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

| Date  | Time             | Room No |
|---|------------------|---------|
| By student request only: Dr W Dempster to arrange.(additional feedback - on exam or homework - will be provided on request) | Email to arrange | JW815e  |

Session: 2020/21

**Approved:**

**Course Director Signature: Dr Stuart Grey**

**Date of Last Modifications: 10 September 2020**

## MODULE TIMETABLE

**Module Code:**

**ME101**

**Module Title:**

**Heat and Flow 1**

### Brief Description of Assessment:

Students will be examined by a 1.5 hour online exam in December on topics taught in semester 1 and will include units and dimensions, Energy, Work and Heat transfer. A further 1.5 hour online exam in April/May will cover the topics, First Law of Thermodynamics, application of thermodynamics processes and fluid flow problems using the continuity and Bernoulli equations.

Four online courseworks will be issued, two per semester based on the topics covered in each semester.

### Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

**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.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Course work Submit | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Course work Submit | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. |

| Semester Two | C&D Wk                             | WK1                                | WK2                                | WK3                                | WK4                                | WK5                                | WK6                                | WK7                | WK8                                | WK9                                | WK10                               | WK11               | Exam Period                        |
|--------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------|------------------------------------|------------------------------------|------------------------------------|--------------------|------------------------------------|
|              | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Course work Submit | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Choose an item.<br>Choose an item. | Course work Submit | Choose an item.<br>Choose an item. |