## MODULE DESCRIPTION FORM

**DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING**

# ME978 ADVANCED MATERIALS PROCESSING AND MANUFACTURING

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| **Module Registrar: Dr Reda Felfel** Reda.felfel@strath.ac.uk | **Taught To (Course): Cohorts for whom class is compulsory/Optional** | |
| **Other Lecturers Involved:** | **Credit Weighting: 10** | **Semester: 1** |
| **Compulsory/ optional class** | **Academic Level: 5** | **Suitable for Exchange: N** |

## Required prerequisites

**Note: It is the responsibility of ALL students to ensure that they satisfy the prerequisite knowledge for this module BEFORE adding as part of curriculum selection. If unsure, please contact the Module Registrar or discuss with your Programme/Year Adviser of Studies.**

**Materials Science Knowledge Including:**

- Fundamentals of mechanical behaviour of materials;
- Understanding of basic microstructure/property relationships;
- Basic understanding of simple crystal structures;
- An understanding of how processing can influence microstructure.

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

| Lecture | Tutorial | Laboratory | Groupwork | External | Online | Project | Assignments | Private Study | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 10 | | | | | 20 | 10 | 50 | 100 |

**Educational Aim**

This module aims to provide knowledge and experience of advanced processing and manufacturing techniques that will underpin the UK's future advanced materials manufacturing base. The unit will provide a technical insight into the underlying principals and limitations of techniques such as traditional methods of manufacture, additive manufacturing, joining/welding, machining, sheet forming, NDE inspection methods and life cycle analysis. Emerging techniques such as additive layer manufacturing and electron beam welding and their impact on sustainability are included. Specific aims include;

- Provide an understanding of the effect of such techniques on design constraint, microstructure and properties.
- Exploring the opportunities to develop and exploit advanced manufacturing processes through research.
- An appreciation of the manufacturing landscape in the UK, including the High Value Manufacturing Catapult Centres.

**Learning Outcomes**

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

LO1 Decide on the most appropriate manufacturing technique for a particular material and its application balancing cost, productivity, technology provision and sustainability innovation.

LO2 Quantify the microstructure and properties when different manufacturing techniques are applied and the impact they will have on inspection and in-service performance.

LO3 Describe the importance of advanced manufacturing techniques in providing a step change in economics of production and sustainability.

LO4 Predict the implications of applying disruptive technologies into the supply chain.

**Syllabus**

The module will teach the following:

Lectures – lectures will cover the underlying principles and applications of a range of advanced processing and manufacturing methodologies, life cycle analysis and sustainability supported by a number of case studies.

Industrial Seminars – industrial practitioners from a range of manufacturing companies will present an overview and specific case studies of advanced manufacturing techniques and quality control in their organisations.

**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: Identify the appropriate processing or manufacturing technique for a particular material and its application.**
C1: Able to appreciate the effects of processing on length scales from atomic defects to macroscopic segregation on microstructure
C2: Be able to describe, in a general way, how processing influences mechanical properties, particularly, strength, toughness, fatigue and creep.
C3: Students know how to troubleshoot problems in the use of different manufacturing techniques.

**LO2: Identify changes in microstructure and properties when such manufacturing techniques are applied and the impact it will have on inspection and in-service performance.**
C1: Be able to identify the optimum processing/manufacturing technique based on the design/performance in-service requirements of the product
C2: Be able to clearly articulate a materials manufacturing solution such that its constrains can be understood by a design team

**LO3: Appreciate the importance of advanced manufacturing techniques in providing a step change in economics of production and sustainability.**
C1: Know how to approach costing the impact of a new processing technology for a particular application.
C2: Be able to apply basic life cycle analysis impact of a proposed new manufacturing technology.
C3: Appreciate the relative engineering constrain of emerging technologies, including cost and environmental considerations.

**LO4: Predict the implications of applying disruptive technologies into the supply chain.**
C1: Be able to demonstrate an understanding of new supply chain requirements for an emerging technology

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/professionalservices/staff/policies/academic/*http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/ *)*

Assessment is given in multiple forms
Assessment: 1. 2hr exam (60%), 2. Life Cycle Analysis Group Project Report (40%)

Written feedback will be given on the group project within 3 weeks

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

| **Examination** | | | | **Coursework** | | **Practical** | | **Project** | |
|---|---|---|---|---|---|---|---|---|---|
| Number | Month(s) | Duration | ***Weighting*** | Number | ***Weighting*** | Number | ***Weighting*** | Number | ***Weighting*** |
| 1 | Dec | 1 hr | 60% | | | | | 1 | 40% |
| Dec. L01, L02, L03, L04 | | | | * | | * | | *L03, L04 | |
| | | | | | | | | | |

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

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|---|
| **Coursework / Submission deadlines (*academic weeks*):**<br>Project set in week 2 – submitted in week 8 |
| **Resit Assessment Procedures:**<br>1 hr examination in August |

**PLEASE NOTE:**
**Students must gain a summative mark of 50% 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 an exam. No marks from any previous attempts will be transferred to a new resit attempt.**

**Recommended Reading**

*****Purchase recommended **Highly recommended reading *For reference**

Michael Z. Hauschild, Ralph K. Rosenbaum, Stig Irving Olsen (2018), Life Cycle Assessment : Theory and Practice (Ebook)

Nieh, T., Wadsworth, J., & Sherby, O. (1997). *Superplasticity in* Metals *and Ceramics* (Cambridge Solid State Science Series). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511525230

**Additional Student Feedback**
*(Please specify details of when additional feedback will be provided)*

| Date | Time | Room No |
|---|---|---|
| | | Check timetable webpages for details |

Session: 2023/24

**Approved:**

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| **Course Director Signature: Olga Ganilova** |
| **Date of Last Modifications: 25/08/23** |

(Updated August 2023)

# MODULE TIMETABLE

| **Module Code:** | **ME978** | **Module Title:** | **Advanced Materials Processing and Manufacturing** |
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**Brief Description of Assessment:**

Group Project – covering Life cycle analysis of a manufacturing process
December Examination

## Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment. Dropdowns may be left blank. Add extra notes below the dropdowns where relevant.

**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. Choose an item. | Choose an item. Choose an item. | Project Set | Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. | Project Submission | Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Exam |

| **Semester Two** | C&D Wk | WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 | WK10 | WK11 | Exam Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. |