MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME966 FUNDAMENTALS OF MATERIALS SCIENCE- Online

Module Registrar: Dr Andrew McLaren andrew.mclaren@strath.ac.uk	**Taught To (Course): Cohorts for whom module is optional**	
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 1 (Online Learning)**
Optional module (not available to 5th year MEng students)	**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 of basic materials science (chemistry) terms:
- Molecules, atoms, particles (protons, neutrons, and electrons), primary & secondary bonding
- Material groups: metals & alloys, ceramics & glasses, polymers (including elastomers), and composites

Mechanics of Materials:
Knowledge of concepts from mechanics of materials and material properties:
- Stress, strain, moduli (Young's, shear, and bulk), Poisson's ratio, strength, ductility (brittle/ductile), hardness, and toughness
-Uniaxial (simple) tensile testing procedures and their graphical interpretation (stress-strain plots)

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

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
					40		20	40	100

Educational Aim

This module aims to develop and build upon a fundamental knowledge of materials science that underpins the design of engineering systems. The microscopic and atomic structure of different classes of materials are studied in relation to their macroscopic behaviour and material properties. This module will review these relationships and impart the learner with an appreciation of how these structures determine a material's applications and the design of manufacturing processes.

Learning Outcomes

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

LO1 Classify material groups and their macroscopic properties in terms of their microscopic and atomic structures.
LO2 Analyse phase diagrams of metals and alloys to determine the equilibrium structure of metals and alloys
LO3 Investigate the role of processing and heat treatments in the determination of material properties.
LO4 Outline the importance of environmental factors and sustainability in the Life Cycle of materials.

Syllabus

The module will teach the following:

- Crystal structure and crystal systems
- Defects in crystal structures
- Diffusion in solid materials
- Dislocations and plastic deformation in metals
- Strengthening mechanisms in metals and alloys
- Phase diagrams and their interpretation
    - Binary isomorphous systems
    - Eutectic systems
    - The iron-carbon phase diagram
- Phase transformations
- Steels, production route, heat treatment and advanced concepts
- Non-ferrous metals and alloys
- Ceramic and glass materials
- Polymers and polymer composites
- Sustainable development and natural materials

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: Describe and apply understanding of:
C1: Metals, ceramics, glasses, polymers, polymer composites and natural materials in terms of properties and applications.
C2: The role of crystal defects in the determination of properties of metals.
C3: How metals and alloys may be strengthened.
C4: The factors that determine the strength of composite materials.
C5: The effects of anisotropy in metals, ceramics, and composites.
LO2:
C1: Be able to determine the phases present, compositions, and proportions of each phase at a given temperature and composition.
C2: Be able to describe the changes in structure that occur as temperature is varied.
LO3:
C1: Appreciate the effect of temperature and deformation history on the properties of metals and alloys.
C2: Describe heat treatments with reference to equilibrium phase transformations in metals and alloys.
C3: Appreciate the importance of non-equilibrium transformations (e.g. high cooling rates).
C4: Understand the importance of processing on the properties of ceramics, polymers, and composites.
LO4:
C1: Demonstrate understanding of sustainability in material supply and use.
C2: Demonstrate understanding of the use of natural and biomaterials.

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/ *)*

Deliver high quality feedback information that helps learners self-correct.
The assessment for this module is by a mid-semester online time constrained quiz in week 7 (to be completed in week 7) and end of semester submission of a final coursework consisting of an untimed quiz and a text based report (released in week 8 and due by week 11). For coursework, students are invited and encouraged to contact staff with draft submissions upon which specific formative feedback is given, including advice on style as well as content.

Ensure that summative assessment has a positive impact on learning.
The open book nature of the assessments encourages students to read and research widely in preparation of their written answers.

The return of marks from the mid-semester online quiz assessment in week 7 provides an opportunity to receive formative feedback on students' learning at this stage and contributes to the final mark.

Give choice in the topic, method, criteria, weighting or timing of assessments.
The online quiz and coursework have extended submission windows to allow ongoing progress and for scheduling around employment related tasks.

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

Online Examination				**Coursework**		**Practical**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
1 (online)	wk7 (Nov)	1.5hrs	30%	1	70%				
*LO1 – LO2				*LO1 – LO4					

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

Coursework / Submission deadlines (*academic weeks*):
Coursework due on Thursday week 11 at 12 noon.

Resit Assessment Procedures:
2hr examination in August diet.

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**

** "Materials Science and Engineering: An Introduction" by William D. Callister, John Wiley & Sons.

Other online textbooks will be recommended and linked through Myplace

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

Date	Time	Room No
Explorance Blue feedback Q&A Forums	Mid-semester and end of year feedback Daily monitoring of Myplace forums	N/A

Session: 2023/24

Approved:

Course Director Signature: Olga Ganilova

Date of Last Modifications: 25 August 2023

(Updated August 2023)

MODULE TIMETABLE

Module Code:	**ME966**	**Module Title:**	**FUNDAMENTALS OF MATERIALS SCIENCE**

Brief Description of Assessment:

Mid-semester online time constrained quiz (30%)
Final coursework consisting of an untimed quiz (30%) and a text based report (40%).

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.	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.	Online Test (quiz)	Course work Set	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Submit	Choose an item.

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.