MODULE DESCRIPTION FORM

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

CL996 Materials & Microstructures

Module Registrar: Katherine Dobson	**Taught To (Course): CEE (MEng, MSc), CPE (MSc), MAE (MSc)**		
Other Lecturers Involved: Andrea Hamilton, Paul Edwards (Physics)	**Credit Weighting: 10**	**Semester: 2**	
Assumed Prerequisites: none	**Elective**	**Academic Level: 5**	**Suitable for Exchange: Y**

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

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
8	2	12	10		4	36	8	20	100

Educational Aim

This module aims to provide students with:

- an understanding of how microstructures control material performance and properties
- knowledge of microstructural characterisation techniques and how these can be used to assess material properties
- the ability to develop and apply appropriate testing and analysis protocols to characterise the causes and consequences of material microstructures

Learning Outcomes

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

LO1: Understand the principles and methods for 2D, 3D and 4D microstructural characterisation, and how these can be used to develop knowledge of material properties and performance

LO2: Apply 2D, 3D and 4D materials characterisation methods and critically assess qualitative and quantitative results to gain understanding of material behaviours and the processes of microstructural change

LO3: Can address a key theoretical or applied challenge by integrating and synthesising information; identifying the appropriate characterisation methods and designing a research programme to address the challenge.

Syllabus

The module will teach the following:

Topic 1: From micro to macro – the need for microstructural characterisation.
The what, why and the how microstructures control everything about material properties

Topic 2: 2D Characterisation methods
SEM, EPMA and other 2D methods, chemical and physical properties, non-destructive vs. destructive analysis.

Topic 3: Diffraction based techniques
XRD and compositional/structural analysis.

Topic 4: 3D Characterisation methods
X-ray tomography, 2D analysis through time, other 3D techniques.

Topic 5: Image based quantification for materials characterisation
Image analysis and quantification methods for 2D and 3D.

Topic 6: Synchrotron based materials characterisation
How synchrotrons work, applications of synchrotron science for materials characterisation.

Topic 7: In situ analysis – Understanding changes

2D, 3D and 4D Non-destructive in situ testing methods.

Topic 8: Using modelling in materials characterisation

Overview of FEM, DEM, CFD techniques and how they can be applied to microstructural characterisation.

Topic 9: Microstructural Solutions for Sustainability Challenges

Assessment of Learning Outcomes

Criteria

LO1: Understand the principles and methods for 2D, 3D and 4D microstructural characterisation, and how these can be used to develop knowledge of material properties and performance

C1: Can summarize and contrast the key microstructural characterisation methods
C2: Can identify which method(s) are appropriate for a problem
C3: Can evaluate and discuss appropriate parameters for microstructural characterisation
C4: Can explain how and when physical measurements and computational tools can be used in microstructural characterisation

LO2: Apply 2D, 3D and 4D materials characterisation methods and critically assess qualitative and quantitative results to gain understanding of material behaviours and the processes of microstructural change

C1: Can apply methods/perform analysis and construct/perform an appropriate data collection and analysis workflow
C2: Can interpret qualitative and quantitative microstructural information
C3: Can assess uncertainty arising from microstructural analysis and can communicate the implications of that uncertainty on interpretation/understanding
C4: Can use data to evaluate material properties, behaviour or processes in engineering & sustainability

LO3: Can address a key theoretical or applied challenge by integrating and synthesising information; identifying the appropriate characterisation methods and designing a research programme to address the challenge.

C1: Can apply advanced problem solving and synthesis skills to identify and define a research challenge/problem
C2: Can integrate approaches from different disciplines and evaluate their application to an unrelated challenge
C3: Can plan a research/investigation strategy to solve identified challenges in engineering & sustainability

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/http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)

Synchronous and asynchronous feedback is provided, and tutor and peer assessment and feedback are both employed. Students are asked to solve problems of different levels of complexity in lecture laboratory and assignments, engage with an assessment exercise (assessing external material) as part of the situated learning component of the course. Guided student background specific self-reflection on the individuals weekly learning is also used to help incorporate learning and enhance feed forwards into future tasks and learning.

Assessment criteria and practices are defined (available on myplace, and discussed with the students) at the beginning of the course, students' comments taken into account, and peer feedback requested on group based activities. The course requires engagement of all students in pre-class, flipped and jigsaw/peer based activities, and the learner agreement and expectations will be discussed extensively at the start of the class. Changes to assessment and feedback required any point during the course will be communicated prior to implementation

Mid-term questionnaires and responses to continual assessment questions will both be used to adjust the teaching approach as needed.

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

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
					5	100		
L/Outcomes					All			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines (*academic weeks*): Part 1 Blog - (8%, ~250-500 words/Topic) Set Week 1, all complete by Week 11 Part 2 XRD report (20%) - Set week3, submit Week 5 Part 3 image Processing (12%, 2-3 hours work) - Set week 3, submit week 7 Part 4 Peer Review panel (10%, 1 hours work) - Set week 4, Submit Week 6 Part 5 Project proposal (50%) - Set Week 1, submit Week 11
Resit Assessment Procedures: (Re-)submission of Portfolio prior to end of 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-examined during the August diet. This re-examination will consist entirely of coursework. Only those pieces of coursework failed will be included in the re-examination.

Recommended Reading

There is no pre-requisite reading material.

All recommended core reading material will be made available through the myplace page 2 weeks prior to the start of teaching.

Additional reading materials, for reading prior to teaching activities, and to guide student driven learning will be made available before and along-side the course materials.

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

Date	Time	Room No

Session:

Approved:

Course Director Signature:
Date of Last Modifications:

(Updated May 2018)

MODULE TIMETABLE

Module Code:	**CL996**	**Module Title:**	**Materials & Microstructure**

Brief Description of Assessment:
Part 1 Blog - (8%, ~250-500 words/Topic) Set Week 1, all completed by Week 11
Part 2 XRD report (20%) - Set week3, submit Week 5
Part 3 image Processing (12%, 2-3 hours work) - Set week 3, submit week 8
Part 4 Peer Review panel (10%, 1 hours work) - Set week 4, Submit Week 6
Part 5 Project proposal (50%) - Set Week 1, submit Week 11

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. 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.

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	All Assessments and criteria available	Course work Set 1 & 5 Set	Choose an item. Choose an item.	Course work Set 2 Set	Course work Set 3 (<3 hours) & 4 (1 hour max) Set	Course work Submit Part 2	Course work Submit Part 4	Choose an item. Choose an item.	Course work Submit Part 3 (may be end of Week 7 dependi ng on	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Submit Part 1 & 5	Choose an item.

									timetable, use data in live session in Wk8				