MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME947 MATERIALS FOR HIGH TEMPERATURE APPLICATIONS

Module Registrar: Dr Andrew McLaren **andrew.mclaren@strath.ac.uk**	**Taught To (Course):Cohorts for whom class is optional**		
Other Lecturers Involved:	**Credit Weighting:10**	**Semester:1 (Distance Learning)**	
Assumed Prerequisites: None	**Optional class**	**Academic Level: 5**	**Suitable for Exchange: N**

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

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
					24			76	100

Educational Aim

This module aims to give students a thorough introduction to the materials science and metallurgy that underpins the design of power plant and high temperature applications. This will build on basic concepts to give an appreciation for the theory of alloy design and strengthening mechanisms, including an understanding of the importance of fracture and creep.

Learning Outcomes

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

LO1 Describe and understand the structure of metals and alloys
LO2 Understand the techniques used to strengthen metals and alloys
LO3 Appreciate the importance of fracture, thermal fatigue and creep as limiting factors in the design of materials for high temperature applications

Syllabus

The module will teach the following:

- The structure of metals and alloys, building on atomic bonding and crystallography, including an appreciation of crystal defects
- Definitions of material properties used in engineering
- The importance of the motion of dislocation defects as the major mechanism of plastic deformation, and an understanding of their effect on the strength of the material
- The important strengthening mechanisms available in metals and allows, namely: Solid solution strengthening, work hardening, particle strengthening and grain size control.
- The use of equilibrium phase diagrams to predict the structure of alloys
- The importance of diffusion and phase transformations and the concept of non-equilibrium conditions
- The factors that limit the design of high temperature components from a materials point of view

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 understand the structure of metals and alloys
C1 ability to explain why metals form simple crystal structures
C2 ability to describe the main defects that exist in metallic crystals
C3 an appreciation that real materials are polycrystalline

LO2 Understand the techniques used to strengthen metals and alloys
C1 be able to describe the main strengthening mechanisms (Solid solution strengthening, work hardening, particle strengthening and grain size control)

C2 appreciate the reason why the mechanisms are effective with reference to the effect on dislocation motion
C3 be able to describe which alloy systems can utilise each type of strengthening mechanism

LO3 Appreciate the importance of fracture, thermal fatigue and creep as limiting factors in the design of materials for high temperature applications
C1 be able to describe the microstructural mechanisms of each of these failure phenomena
C2 appreciate the importance of alloy selection and design for different components in power plant, with reference to the service conditions (pressure, temperature, environment) that they experience

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/)

Deliver high quality feedback information that helps learners self-correct.
The assessment is by online open book examination. 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 exam encourages students to read and research widely in preparation of their written answers.

Give choice in the topic, method, criteria, weighting or timing of assessments.
The online exam has a one month submission window, allowing students to schedule their coursework around employment related tasks.

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

Examination				**Coursework**		**Practical**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
1 DL	Dec	4weeks	100%						
*All				*		*		*	

* ***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*):N/A

Resit Assessment Procedures:
Resit online exam, submission **prior** to the August resit diet.

As soon as a student knows that they require a resit assessment for this class they should contact the class registrar to confirm these resit requirements and deadlines for this class.

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 by an online exam submission. 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 Callister.

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

Date	Time	Room No
		Check timetable webpages for details

Session: 2019/20: Detailed individual feedback is given to each student if requested.

Approved:

Course Director Signature: *E Henderson*

Date of Last Modifications: 27/08/2019

(Updated July 2019)

MODULE TIMETABLE

Module Code:	**ME947**	**Module Title:**	**Materials for High Temperature Applications**

Brief Description of Assessment:

Online exam submitted in December.

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.	Exam question paper released	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Class Test (Online exam submission)

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.