Module Registrar: Dr A J McLaren  
andrew.mclaren@strath.ac.uk

Taught To (Course):  MSc Power Plant Technologies/Systems

Other Lecturers Involved: Dr A M Galloway  
Guest lecturers

Credit Weighting: 10  
Semester: 2 (Dist Learn)

Assumed Prerequisites: None  
Optional class  
Academic Level: 5

Module Format and Delivery (hours):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Laboratory</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
<th>Total</th>
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<td>0</td>
<td>0</td>
<td>0</td>
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Educational Aim

This module aims to give students a thorough introduction to the materials science and metallurgy that underpins the design of power plant. 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 power plant

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 power plant 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 power plant  
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.

### 12 Principles of Assessment and Feedback

(On Learning & Teaching web pages: [www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/](www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/))

1. 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.

2. 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.

3. Give choice in the topic, method, criteria, weighting or timing of assessments.
   Students are generally part time, working full time for their company. The online exam has a one month submission window, allowing students to schedule their coursework around employment related tasks.

4. Involve students in decision-making about assessment policy and practice.
   The timing of the exam is negotiated with the student body when they attend for the intensive module week.

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

<table>
<thead>
<tr>
<th>L/Outcomes</th>
<th>Examinations</th>
<th>Courseworks</th>
<th>Projects</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Duration</td>
<td>Weighing</td>
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<tr>
<td>1</td>
<td>4 weeks</td>
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**Courseswork / Submissions deadlines:**
N/A

**Resit Assessment Procedures:**
2hr examination in August diet.

Please Note:
Students need to 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 examination.

**Recommended Reading**

****Purchase essential  ***Purchase recommended  **Highly recommended reading
*Simply for reference (DO NOT purchase)*

(Textbook is provided free of charge on a loan basis to each student)

**Additional Student Feedback**

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

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Session 2014/15: This section is not applicable to this module: students are part time and off site, only attending during the intensive week. Detailed individual feedback is given to each student if requested.

**Approved:**

Course Director Signature: P Strachan

Date of Last Modifications: 02 September 2014
MODULE TIMETABLE

Note: This section is not applicable as this module is delivered intensively over one week, outside normal semester system.

<table>
<thead>
<tr>
<th>Module Code:</th>
<th>ME920</th>
<th>Module Title:</th>
<th>Materials for Power Plant</th>
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Brief Description of Assessment:

Assessment Timing:

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

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<th>WK2</th>
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<th>WK4</th>
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<th>WK7</th>
<th>WK8</th>
<th>WK9</th>
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<th>WK11</th>
<th>WK12</th>
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<th>WK10</th>
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