Materials Engineering and Design

Module Code: MAE5005-B
Academic Year: 2018-19
Credit Rating: 20
School: Department of Mechanical and Energy Systems Engineering
Subject Area: Mechanical and Automotive Engineering
FHEQ Level: FHEQ Level 5
Module Leader: Dr Christopher Wright

Pre-requisites: 
Co-requisites: 

Contact Hours

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>36</td>
</tr>
<tr>
<td>Laboratory</td>
<td>36</td>
</tr>
<tr>
<td>Directed Study</td>
<td>126.5</td>
</tr>
<tr>
<td>Examinations DO NOT USE</td>
<td>1.5</td>
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Availability Periods

<table>
<thead>
<tr>
<th>Occurrence</th>
<th>Location/Period</th>
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<tbody>
<tr>
<td>MSA</td>
<td>Management Development Institute of Singapore (MDIS) / Academic</td>
</tr>
<tr>
<td>BDA</td>
<td>University of Bradford / Academic Year (Sept - May)</td>
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Module Aims

The aim of this module is to develop core technical knowledge and understanding of the intimate relationship between mechanical engineering design (form and function), manufacturing methods and materials selection.

Outline Syllabus
1. Control of Form and Function:
Tolerances- the ISO system of Limits and Fits and tolerance stack up. Tolerance chains &
identification of functionally important dimensions. Methods of allocating assembly
tolerances to ensure correct assembly & desired function through the use of path equations
to allocate tolerance values to functionally important dimensions. The use of the ISO system
of Geometric Dimensioning and Tolerancing (GDT) to control form & position of component
features. 2. The Engineering of Material properties, The correlation between product
performance requirements & how these can be achieved through the selection of
appropriate materials & materials processing routes. Overview of plastic deformation in
metals & alloys. Introduction to crystal defects, principles of alloying, brief overview of
processes used to strengthen metals & alloys. Introduction to fracture; brittle & ductile
fracture processes. Annealing of metals, heat treatment of steels; TTT & CCT transformation
diagrams. Relationship between structure & mechanical properties in polymers. Composite
materials, fibre reinforcement, effects of fibre orientation, volume fraction & aspect ratio
Ceramic materials, related forming processes & their physical and mechanical properties.3.
CAD CAM Principles of parameter design/assembly modelling/virtual prototyping. Selection
of correct manufacturing sequence, material factors affecting cutting tool selection,
calculation of cutting speed & feed rates. CNC machining. CNC programming & cutter path
simulation.

Module Learning Outcomes

On successful completion of this module, students will be able to...

1
1.1. Select appropriate materials and manufacturing methods to achieve specific
design requirements.
1.2. Explain the role CADCAM plays in product development.

2
2.1. Create assembly models/virtual prototypes using 3D Solid modelling
software.2.2. Select appropriate tolerances for critical component features to meet a
specified functional requirement for simple assemblies.2.3. Show practical skills in
CADCAM.2.4. Show practical skills in the steps needed to manufacture successfully
a simple mechanism2.5. Describe how material microstructure and processing
route influences mechanical properties.2.6. State how Geometric Dimensioning &
Tolerancing is used to control form & position.

3
3.1. Illustrate engineering design information in a clear, concise manner using .3D
CAD models / Simulations / 2D drafting. 3.2. Use virtual prototyping tools to
problem solve design/manufacturing operation errors prior to the final physical
manufacture of engineering components.

Learning, Teaching and Assessment Strategy

Key concepts will be developed in lectures and tutorials and practised in laboratory and
individual project work. Learning outcomes LO 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 3.1 and 3.2 will
be assessed by individual project work whilst the examination will assess LO1.1, 2.5 and
2.6. Oral feedback will be given during practical/laboratory sessions. Written feedback will
be via assessments.

Mode of Assessment
<table>
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<tr>
<th>Type</th>
<th>Method</th>
<th>Description</th>
<th>Length</th>
<th>Weighting</th>
<th>Final Assess'</th>
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<tr>
<td>Summative</td>
<td>Examination</td>
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<td>1.5 hours</td>
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<td>Summative</td>
<td>Coursework</td>
<td>Individual CADCAM assignment 2000wd equiv individual practical materials selection manufacturing assignment 500 wd equiv</td>
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**Legacy Code (if applicable)**
ENG2100L

**Reading List**
To view Reading List, please go to rebus:list.