

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

Additional Tutors:

Pre-requisites:

Co-requisites:

Contact Hours

Type	Hours
Lectures	36
Laboratory	36
Directed Study	126.5
Examinations DO NOT USE	1.5

Availability Periods

Occurrence	Location/Period
MSA	Management Development Institute of Singapore (MDIS) / Academic
BDA	University of Bradford / Academic Year (Sept - May)

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 CAD/CAM 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 CAD/CAM. 2.4. Show practical skills in the steps needed to manufacture successfully a simple mechanism. 2.5. 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 LO 1.1, 2.5 and 2.6. Oral feedback will be given during practical/laboratory sessions. Written feedback will be via assessments.

Mode of Assessment

Type	Method	Description	Length	Weighting	Final Assess'
Summative	Examination - closed book	Examination - closed book	1.5 hours	40%	Yes
Summative	Coursework	Individual CAD/CAM assignment 2000wd equiv individual practical materials selection manufacturing assignment 500 wd equiv	0 hours	60%	No

Legacy Code (if applicable)

ENG2100L

Reading List

To view Reading List, please go to [rebus:list](#).