MODULE DESCRIPTOR

TITLE:	Mechanical Design and Materials Selection
CODE:	EAT342
CREDITS:	20
LEVEL:	6
FACULTY:	Engineering and Advanced Manufacturing
MODULE BOARD:	Undergraduate Engineering
PRE-REQUISITES:	EAT206
CO-REQUISITES:	None
LEARNING HOURS:	200

LEARNING OUTCOMES

Upon successful completion of this module, students will have demonstrated

Knowledge :

an understanding of

1. The practical application of the design process to a real industrial problem

2. Materials requirements in the wider engineering context and the interdependency of design, manufacture, economics and environmental considerations.

3. The essential characteristic properties of groups and sub-groups of materials and how they relate to specific areas of application.

Skills

and the ability to

4. Synthesise solutions to engineering problems using knowledge and techniques acquired throughout their undergraduate studies.

5. Make critical comparisons of various methods of materials selection and property evaluation.

CONTENT SYNOPSIS

There will be a single design exercise based upon a real engineering problem in which students will apply the design process and undertake the selection of appropriate materials from which specified components or assemblies would be made.

Students will work in groups to prepare a group report, submitted in stages, in which there will also be individual submissions to provide the opportunity for differentiation of students. In so doing the student will do the following: -

Clarify an initial design brief and write and agree a specification with the customer.

Devise a range of possible conceptual design solutions, using sketches to illustrate the ideas, and select one for further development.

Carry out the embodiment design of their chosen solution using appropriate analytical tools, awareness of financial, legal, ethical and environmental issues relating to engineering design

and manufacturing methods, consideration of the human interface in relation to the designed artefact and the needs of the range of potential user(s), the techniques of materials selection, (see below) and a solid modeller to produce an arrangement drawing.

Prepare an engineering drawing depicting the principal components.

Write a report outlining each stage of the procedure.

Materials Selection
Concept of the performance index. The performance index in terms of functional requirements, geometric parameters and material properties. Procedure for the derivation of a performance index. Function, free variables, objectives and constraints. The procedure for selecting materials. Primary constraints, performance maximising criteria multiple constraints and multiple design goals. Worked examples and case studies.

Concept of the materials selection chart. The materials selection chart as both graph and map. Location of the various classes of engineering material on selection charts. Selection charts for mechanical, electrical and thermal properties. Incorporation of cost factors in selection charts. Use of logarithmic scales on selection charts. Selection charts and performance indices used in conjunction. Worked examples and case studies on the combined use of selection charts and performance indices.

Consideration of computer-based materials property databases and selection packages. Retrieval of property data from computer databases. Comparisons of property data from a number of different computer-based sources. Use an industry standard material selection software to generate materials selection charts. Performance indices and computer-generated materials selection charts.

Nature of viscoelasticity. Damping. Creep. Stress relaxation. Models for viscoelastic behaviour. Application of creep data. Isochronous and isometric creep data. Creep modulus. Creep rupture. Computer-based information sources. Pseudoelastic design principles.

Review of brittle fracture. Strength-controlling factors (time, temperature, fabrication). Design with brittle materials. Statistics of strength - Weibull statistics.

This will be a student centred module. There will be an introductory lecture or lectures supporting various technical aspects of the design and covering techniques and theory on the selection of appropriate materials. A series of tutorials/workshops following the lectures will be provided with academics present in a consultative and advisory capacity.

TEACHING AND LEARNING METHODS:

Scheduled activities		Independent study		Placement		Total hours
Hours	Detail	Hours	Detail	Hours	Detail	
35	Lecture-tutorials	115	Group design activities and preparation for group assessments	0		150
		50	Independent private study and preparation for individual assessments			50
					Total	200

The learning on this module will be through the use of lectorials in which the theory will be delivered via a lecture to the students and supported by worked examples. The tutorial sessions will subsequently be used to encourage students to work together in their groups to develop their skills and understanding of the theoretical principles from the lectures and apply this learning to the solution of the design problem set. Feedforward will be provided on work already completed to encourage students to improve and develop their submission and to assist in the application of theory provided during the lectures. Additional tutorial support will be provided by the VLE. As means of assessing progress, students may be required to give formal presentations to staff and peers.

ASSESSMENT METHODS

							Required For KIS return to HESA							
Seq.	Element	% of module assessment weighting	Summary	Element Qualifying Mark	Overall Module Pass Mark	LO	Written exam – central timetable (% of the element)		Written exam – local timetable (% of the element)		Coursework (% of the element)		Practical (% of the element)	
							%	Type	%	Type	%	Type	%	Type
001	Assignment	100%	Written Assignment	30%	*	1-5					100	Assignment		

Assessment 001 Group coursework with individual elements, contributing 100% to the overall module mark and assessing all learning outcomes.

Working in a group of four, students will prepare a design report for the engineering artefact described in the design brief. The report will typically comprise a number of different sections, of the general form given below:

- Design specification
- Concept design
- Selection of the optimum design to take forward
- Materials selection
- Selection of appropriate proprietary items
- Design embodiment and design calculations
- Overview of the manufacturing methods and sequence required
- Solid model arrangement drawing

To help with time management all of the above will be submitted in the sequence shown, or similar, with sufficient time in between each submission to allow completion of the sections.

MyModuleResources List link:

https://moduleresources.sunderland.ac.uk/#/list?course_identifier=EAT342

Additional Support Materials

Cambridge Engineering Selector Edupack, 2013 (CES4), Granta Design, plus associated learning resources.

PROGRAMMES USING THIS MODULE AS CORE/OPTION:
BEng (Hons) Mechanical Engineering (core)

Is the programme delivered On Campus or Off campus *(please delete, as appropriate)***:**

On campus / Off campus

College(s):
SEGi University College Kota Damansara, Malaysia
SEGi College Subang Jaya, Malaysia
SEGi College Penang, Malaysia
TEG International College Singapore
International College of Business and Technology Sri Lanka
Hong Kong College of Technology – Homantin, Hong Kong

Work based learning: **No**

Professional Accreditation: Yes

Institution of Engineering and Technology (IET)

Where this module forms part of an IET accredited programme, any assessment contributing more than 30% to the module mark is subject to a qualifying mark of 30%. In order to pass the module, the qualifying mark where applicable must be reached as well as the module average pass mark.

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