Module specification

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Module Code	ENG5AG
Module Title	Mechanical Systems Design
Level	5
Credit value	20
Faculty	FAST
HECoS Code	100190
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Industrial Engineering Design (Mechanical)	Core
FdEng Industrial Engineering (Mechanical)	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	30 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	10 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**40** hrs
Placement / work based learning	0 hrs
Guided independent study	160 hrs
Module duration (total hours)	200 hrs

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Initial approval date	11/09/2019
With effect from date	11/09/2019
Date and details of revision	30/01/20 admin update of derogation 4/8/20 addition of FdEng as option

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	Oct 22 minor modification to LO wording through the revalidation and template update, core module for FdEng Industrial Engineering (Mechanical) August 2024 APSC approval to • Add 10 practical hours • Simplify MLO1 and reword MLO4 • Change ASS002 from written assignment to coursework Replace ventilation with fatigue in the syllabus 26th March APSC approval to update learning outcomes and change assessment type
Version number	4

Module aims

This module aims to develop the student's understanding of the system design process the function of system equipment elements and their applications in mechanical, pneumatic and hydraulic system designs

Module Learning Outcomes - at the end of this module, students will be able to:

1	Use technical skills to solve real world engineering problems for the likes of pneumatic and hydraulic systems.
2	Develop an overall appreciation of load bearing requirements and structure consideration design.
3	Ascertain where failure might occur, including the conditions that might produce the failure and evaluate the relevance of results
4	Model a broadly defined mechanical structural problem using simulation software and interpret the results.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment One: an example could be the design of a pneumatic or hydraulic system to meet specific criteria or the analysis of an existing system to identify faults and recommend corrective actions.

Assessment Two: investigations into a structure under certain loading conditions. The problem will include consideration of multiple loads and conditions that may include failure and will require both hand calculation and computer simulation to solve.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1	Written Assignment	50
2	2,3,4	Portfolio	50

Derogations

A derogation from regulations has been approved for this module which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Learning and Teaching Strategies

The module will be presented to students through a specified series of lectures assisted by notes given to the student at the start of each lecture. Demonstrations will also be arranged, for example to show the operation and set up of a pneumatic and hydraulic system before the students are expected to carry out their own designs. Where possible, visits to local industries will be arranged to demonstrate actual system operations. Relevant videos will also be used to aid the learning process. Practical assignment exercises will be devised to enhance the students' learning and team working skills.

Indicative Syllabus Outline

Design: The importance and challenges of geometric distancing and toleranced for customer requirements. Machine Elements: Principles, operation, and constructions of machine elements: bearings, cam, spur gears, helical gears, bevel gears, worm gears, clutches and brakes.

Mechanism Trains: Principles, operation, and constructions of parallel axis gear trains, determining tooth numbers, epicycle gear trains, Bevel-gear epicycle trains, all-wheel drive trains, applying solutions to a practical situation.

Hydraulics: Principle and operation of individual components within typical systems and examine various applications. Principle and operation of complete hydraulic systems and discuss the arrangement of the components to enable specific functions to be carried out. Analyse the operation of each component within the system. Advantages and disadvantages of hydraulic systems.

Pneumatics: Principle and operation of individual components within typical systems. Principle and operation of complete pneumatic systems. Analysis and performance of individual components and system operation.

Fatigue – Investigate and understand, failures due to fatigue

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads

Parr, A. (2011), Hydraulics and Pneumatics: *A Technician's and Engineer's Guide.* Illustrated 3rd edition, Butterworth-Heinemann Ltd.

Junvinal, R.C. (2017), *Juvinall's Fundamentals of Machine component design.* Hoboken, New Jersey: John Wiley & Sons.

Other indicative reading

Uicker, J.J. et al., (2017), *Theory of Machines and Mechanisms*. 5th ed. Oxford: Oxford University Press.

Turner, I. C. (1995), *Engineering Application of Pneumatics and Hydraulics*. Oxford: Butterworth Heinemann

Hanieh, A.A. (2012), *Fluid Power Control: Hydraulics and Pneumatics*. Cambridge International Science Publishing

Childs, P.R.N. (2004), *Mechanical Design*, 2nd ed. Oxford: Butterworth Heinemann