Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION PROFORMA

Module Title:	**Engineering Mechanics and Design**	**Level**:	5	**Credit Value**:	20

Module code:	ENG53C	**Is this a new module?** Yes	**Code of module being replaced**:	ENG52G

Cost Centre(s):	GAME	**JACS3 code**:	H310

Trimester(s) in which to be offered:	1, 2	**With effect from:**	September 18

School:	Faculty of Arts, Science and Technology	**Module Leader:**	Dr Zheng Chen

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Aeronautical & Mechanical Engineering	✓	☐
BEng (Hons) Mechanical Manufacturing	✓	☐
BEng (Hons) Applied Product Design	✓	☐
BEng (Hons) Automotive Engineering	✓	☐
BEng (Hons) Drone Technology & Operations	✓	☐
BEng (Hons) Aerospace and Modern Optics	✓	☐

Pre-requisites
None

Office use only

Initial approval: February 17

APSC approval of modification: Sept 18 Version: 1

Have any derogations received Academic Board approval? Yes ☐√ No ☐ N/A ☐

If new module, remove previous module spec from directory? Yes ☐ No ☐

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Module Aims
1. To analyse the motion of particles, the motion of rigid bodies with and without reference to the forces producing motion and the response of vibrating systems; 2. To develop understanding of the design process, the use of specifications, and the creation of design solutions by manual methods and by use of computers, including relevant theory, such as basic statics and dynamics, in the design process.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Define, formulate, and solve problems involving the rectilinear and curvilinear motion of particles and rigid bodies	KS5	
2	Analyse mechanism dynamics using concept absolute and relative motion	KS5	
3	Analyse single-degree-of-freedom vibrating systems and determine the response of undamped and damped systems	KS5	
4	Demonstrate an ability to recognise, identify, define and produce specifications for a set of engineering problems and communicate the results effectively to a client	KS1	KS3
		KS5	
5	Identify and with a minimum of guidance, analyse the data provided and select appropriate methods/techniques to produce an optimum and sustainable design	KS1	KS5
6	Appraise the social, ethic, economic, and environmental implications of the design process and awareness of the relevant legal and contractual issues.	KS3	KS5
		KS7	

Transferable skills and other attributes

1. Problem solving
2. Mathematical applications
3. Design
4. Awareness of social and environmental concerns

Derogations

A derogation from regulations has been approved for this programme 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%.

Assessment:

Assessment One: is by means of an examination covering outcomes 1, 2 and 3. It is an unseen and time-constrained.

Assessment Two: is by means of a portfolio reflecting design activities carried out throughout the module. The design activities cover learning outcomes 4, 5, and 6, and the portfolio comprises design planning, concept designs, CAD designs, detail designs, materials selections, and design analysis, etc.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1, 2, 3	Examination	50%	2 hours	
2	4, 5, 6	Portfolio	50%		2000

Learning and Teaching Strategies:

The module will be presented to students through lectures, tutorials and practically-based work utilising laboratory equipment and workshop. Approximately one half of the time will be devoted to practical investigation, design and development. The use of computer for analysis, simulation and design is involved.

In 'Engineering and Mechanism Dynamics' the emphases will be on motion and dynamics analysis, problem solving, and quantitative evaluations, and students will be given case studies to complement the work in the course.

In 'Engineering Design' students will apply knowledge and analysis methods from previous modules to the design process and choose appropriate methods for their resolutions. It will also give responsibility to individual students at this level to manage the process within broad guidelines and to plan and develop interactive group skills. Formal lectures are kept to the minimum except to introduce new concepts to allow this freedom. The use of discussion groups, seminars and tutorials will be the method of delivery envisaged. Use of computers, standards and codes of practice will be encouraged.

Syllabus outline:

Kinematics and kinetics of particles and rigid bodies: Revision of Newton's Laws. Development of equations of motion. Rectilinear motion, including constant acceleration, acceleration as a function of time, acceleration as a function of velocity, acceleration as a

function of displacement, projectiles. Plane curvilinear motion, use of rectangular, normal and tangential, and polar coordinates.

Analysis of mechanisms: Absolute motion. Relative velocity, vector representation, graphical solutions. Relative acceleration, analysis of practical mechanisms, graphical solutions. Motion relative to rotating axes, analysis of mechanisms, use of graphical solutions. Coriolis acceleration. Force and torque in various systems.

Vibration analysis: Harmonic motion. Free undamped vibration of single degree of freedom systems. Free damped vibration of singled degree of freedom systems. Force vibration of undamped and damped single degree of freedom systems.

Appreciation of design requirements: Innovation in Design. Design constraints: market, technical, manufacturing, economic and environmental constraints. Codes and standards. Ethical and legal considerations. Evaluation.

Sustainable design: Phases of design. Product life cycle. Reliability. Economics of the design. Environmental impacts of the product. Relevant legal and contractual issue.

Design solutions: Team work: From a specific design brief (a 'real' industrial problem) work as part of a small team, analyse problem, and propose various designs. Apply static and dynamic analysis. Choose one cost effective design and produce a design study with full documentation.

Computer simulation in design: Understand how computers can aid the designer in the design process. Introduction to various simulation packages such as linkage simulations, optimisation design process etc.

Stages in the development of a project: relate the design process to the requirements and stages of a student's individual project - in preparation for level 6 main individual project.

Bibliography:

Essential reading

Hibbeler, R.C. (2011) Engineering Mechanics: Dynamics, 13th Edn., Prentice-Hall.

Cross, N. (2008) Engineering Design Methods: Strategies for Product Design, 4th Edn., Wiley Blackwell.

Other indicative reading

Meriam, J.L. and Kraige, L.G. (2007) Solving Dynamics Problems in MATLAB: with Engineering Mechanics Dynamics; 6th edition, John Wiley and Sons.

Dresig H.; Holzweißig F; (2010); Dynamics of Machinery: Theory and Applications; Springer.