MODULE SPECIFICATION PROFORMA

Module Title:	**Mechanical Systems Analysis**	**Level**:	5	**Credit Value**:	20

Module code:	ENG658	**Is this a new module?**	NO	**Code of module being replaced**:	N/A

Cost Centre:	GAME	**JACS3 code**:	H143

Trimester(s) in which to be offered:	1, 2	**With effect from:**	September 16

School:	Applied Science, Computing & Engineering	**Module Leader:**	Z. 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) Industrial Engineering	☐	✓

Pre-requisites
None

Derogations
A derogation from regulations has been approved for this module which means that whilst the pass mark is 40%, each element of assessment requires a minimum mark of 30% for the module to be passed overall.

Office use only
Initial approval June 16
APSC approval of modification *Enter date of approval* Version 1
Have any derogations received SQC approval? Yes ✓ No ☐

Module Aims
To develop an in-depth understanding of mechanical systems operations. To develop analytical skills relating to engineering mechanical system vibrations. To investigate approaches for mechanical systems condition monitoring

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 in mechanical systems.	KS1	
2	Analyse mechanism dynamics using concept absolute and relative motion	KS5	
3	Analyse engineering vibrating systems from the first principles and determine the response of the systems.	KS3	
4	Select from a range of analysis methods and possible solutions to suit different practical analysis and design situations.	KS3	

Assessment:

Assessment One: is by means of a coursework which will involve the students identifying and implementing appropriate methods of analysis for given problems. From this analysis the student should be able to propose solutions (perhaps with the aid of software simulation) and predict the system response

Assessment Two: is by means of unseen exam will test for learning outcomes 1, 2 and 3 and will involve the application of mathematical methods and knowledge of mechanical principles to provide solutions to questions.

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

Learning and Teaching Strategies:

The module will be presented to students through a series of lectures, tutorials and case studies utilising laboratory equipment where appropriate. Use of computer packages, including specially developed computer aided packages from within the department, will be used to aid learning

Syllabus outline:

Motion and operation of mechanical systems: 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.

Mechanical system vibrations: Harmonic motion. Free undamped vibration of mechanical systems. Free damped vibration of mechanical systems. Force vibration of undamped and damped mechanical systems. Solutions by eigenvalues and eigenvectors, matrix iteration etc, modal shapes, orthogonality of principal modes.

Vibration control: Concept of vibration absorbers, undamped vibration absorbers, merits of damped vibration absorbers.

Mechanical systems condition monitoring: Measurements of engineering systems vibrations. Practical measurements of displacement, velocity and acceleration. Data processing. FFT analysis. Mechanical systems condition monitoring via vibration analysis. Case studies in mechanical systems condition monitoring

Bibliography:
Essential reading
Hibbeler R.C;(2013); *Engineering Mechanics: Dynamics*; 13th edition; Prentice Hall
Other indicative reading
Inman D.J.; (2008) *Engineering Vibrations*, 3rd edition; Pearson Rao S. S.; (2011) *Mechanical Vibrations*, 5th edition; Pearson Ed Asia Dresig H.; Holzweißig F; (2010); *Dynamics of Machinery: Theory and Applications*; springer