Module specification

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Refer to the module guidance notes for completion of each section of the specification.

Module code	ENG4AJ
Module title	Mechanical Engineering
Level	4
Credit value	20
Faculty	FAST
Module Leader	Wei Qi
HECoS Code	100430
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Mechatronics Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	0 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**0** hrs
Placement / work based learning	0 hrs
Guided independent study	140 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	24/09/2020
With effect from date	24/09/2020

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Date and details of revision	
Version number	1

Module aims

To be able to apply the principles of engineering mechanics to solve problems in practical situations.

To develop an understanding of the motion of particles, the motion of rigid bodies with and without reference to the forces producing motion and the response of vibrating systems.

To be able to apply the principles of fluid mechanics to solve problems in practical situations.

To be able to apply the principles of thermodynamics to solve problems in practical situations.

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

1	Conduct static force analysis on mechanical systems.
2	Define, formulate, and solve problems involving the rectilinear and curvilinear motion of particles and rigid bodies, and analyse mechanism dynamics.
3	Explain the properties of fluids, their effect on fluid flow and the importance of their effects on objects in contact with flowing fluids.
4	Explain the laws of thermodynamics, and do calculations to determine heat transfer, the state changes of a liquid and the Coefficient of Performance of a Heat pump.

Assessment

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.

Indicative Assessment Tasks:

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

Assessment 2: is by means of an hour examination covering outcomes 3 and 4. It is an unseen time-constrained (2 hours).

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

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%.

Learning and Teaching Strategies

The module will be taught with lectures, tutorials and laboratory sessions.

Indicative Syllabus Outline

Systems of Force and Moments: Type of forces; Equilibrium and free-body diagrams; Two dimensional and three-dimensional force systems; Two-dimensional and three-dimensional description of moment and moment vector; Couples; Moment of a force about a line; Equivalent systems.

Structures in Equilibrium: Trusses; The method of joints; The method of sections; Space Trusses; Frame and machines.

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.

Angular Motion: Equations for angular motion; Application to practical engineering problems; Relationship between applied torque, angular acceleration and moment of inertia; Radius of gyration; Angular acceleration of discs and flywheels; Static and dynamic balancing; Solution of problems involving out of balance forces by analytical and graphical means.

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.

Impulse-momentum theorem: Impulse. Momentum calculation of particle and particle system. The application of momentum theorem. Centroid motion.

Moments of momentum: The application of the theorem of moments of momentum of particles and particle systems. The equations motion of rigid body rotation around a fixed axis and rigid body plane motion.

Work-energy theorem.

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.

Fluid Properties: Absolute density, Relative Density, Absolute (Dynamic) viscosity and Kinematic viscosity of liquids and gases, Bulk Modulus, Surface tension.

Fluid Flow: Laminar, Transitional and Turbulent flow regimes. Boundary Layer, Continuity of Flow and Bernoulli's Equation, Flow through a Venturi-meter.

Temperature measurement: Celsius (Centigrade), Kelvin, Fahrenheit and Rankine scales and Methods of Temperature Measurement.

Pressure measurement: Absolute and gauge pressure measurement. Boyle's Law, Charles' Laws and the equation of state for an ideal gas.

Heat & Work: Thermodynamic laws, Enthalpy and Entropy, Material Phase Changes, Polytropic processes, the Carnot Cycle, Specific Heat Capacity, Heat Transfer, Vapour-cycle Refrigeration and Heat Pumps.

Indicative Bibliography:

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

Essential Reads

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

Other indicative reading

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

Bolton, W. (2006) Mechanical Science, 3rd Edn. Blackwell Publishing.

Hannah,J & Hillier,J (1999) Mechanical Engineering Science, 3rd Edn. Prentice Hall.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas. Click here to read more about the Glyndwr Graduate attributes

Core Attributes
Engaged

Key Attitudes
Curiosity

Practical Skillsets
Critical Thinking
Communication