Prifysgol **Wrecsam**
Wrexham University

Module specification

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Module Code	ENG4AJ
Module Title	Mechanical Engineering
Level	4
Credit value	20
Faculty	FACE
HECoS Code	100430
Cost Code	GAME
Pre-requisite module	None

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Mechatronics Engineering	Core

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	0 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**0** hrs
Placement hours	0 hrs
Guided independent study hours	140 hrs
Module duration (Total hours)	200 hrs

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

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 1: A 3-hour examination covering outcomes 1, and 2, 3, and 4. It is an unseen time-constrained.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1, 2, 3, 4	Examination	3 hrs	100%	

Derogations

None

Learning and Teaching Strategies

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

Welsh Elements

Programme is delivered in English and Chinese, however students can submit assessments in Welsh.

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.

Administrative Information

For office use only	
Initial approval date	24/09/2020
With effect from date	24/09/2020
Date and details of revision	22/07/2025 revalidated, updated template, derogation removed
Version number	2