Module Proforma

Approved, 2022.02

Summary Information

Module Code	4515USST
Formal Module Title	Applied Mechanics 1
Owning School	Engineering
Career	Undergraduate
Credits	20
Academic level	FHEQ Level 4
Grading Schema	40

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Dante Matellini	Yes	N/A

Module Team Member

Contact Name	Applies to all offerings	Offerings

Partner Module Team

Contact Name	Applies to all offerings	Offerings

Teaching Responsibility

LJMU Schools involved in Delivery
LJMU Partner Taught

Partner Teaching Institution

Institution Name
University of Shanghai For Science and Technology

Learning Methods

Learning Method Type	Hours
Lecture	22
Tutorial	22

Module Offering(s)

Offering Code	Location	Start Month	Duration
SEP-PAR	PAR	September	12 Weeks

Aims and Outcomes

Aims	To introduce the essential principles of applied mechanics.

Learning Outcomes

After completing the module the student should be able to:

Code	Description
MLO1	Use the principles of equilibrium to analyse coplanar static force systems.
MLO2	Apply the concepts of stress and strain to simple engineering problems involving axial, shear, flexural and torsional loading.
MLO3	Apply the principles of kinematics and dynamics to problems of motion.
MLO4	Apply the principles of work, energy, power, impulse and momentum to the solution of engineering problems.

Module Content

Outline Syllabus
1. Statics Static force systems:

Planar force systems. Statics of a particle (addition of forces [graphical, force components], resultant force, condition for static equilibrium). Statics of rigid bodies (moment of a force, free-body diagrams, condition for static equilibrium). Application to connected bodies. Application to planar pin-jointed frameworks. Friction.

Flexurally loaded beams. Shear force and bending moment distribution in flexurally loaded beams. Development of shear force and bending moment diagrams for beams subject to concentrated and uniformly distributed loading.

2. Strength of Materials:

Concepts of stress and strain.

Axial and shear loading. Calculation of stresses and deformation (strain) in components subject to axial and shear loading. Review of load-deformation behaviour of materials (tensile test, Young's Modulus, Poisson's Ratio, yield stress, tensile strength, shear strength). Application to design and structural integrity.

Flexural loading. Calculation of bending stresses in beams (simple theory of elastic bending).

Calculation of deflection in beams (direct integration, Macaulay's methods). Shear stresses in beams resulting from bending.

Torsional loading. Calculation of shear stresses in circular section shafts (theory of pure torsion).

Stress concentration. Stress concentration factor kt. Use of charts to determine kt. Factor of safety. Design stresses.

3. Dynamics Kinematics:

Review of kinematics of rigid bodies. Linear and angular motion with uniform acceleration. Linear – angular motion relationships. Projectile motion.

Graphical representation and interpretation of kinematic data, application to linear and simple non-linear motion, the application of calculus in the analysis of linear and nonlinear motion.

Dynamics of rigid bodies. Newton's laws of motion and their application to simple mechanical systems including linear and rotational motion. Concepts of force, mass, weight and inertia, D'Alembert's principle, friction, torque and moment of inertia. Applications. Connected bodies.

4. Energy Methods:

Concept of work. Work done by uniform and non-uniform forces. Work done by a torque. Springs.

Concept of energy. Kinetic energy and the work-energy equation. Potential energy. Strain energy. Conservation of energy. Kinetic energy of rotation.

The notion of power. The power associated with a moving force and a torque. Efficiency. Applications.

Impulse and momentum: Definition of impulse and linear momentum. Temporally varying forces. Conservation of linear momentum. Impulsive forces. Angular momentum and impulse. Applications of impulse and momentum to impact and restitution: Collision of two bodies. Collision of perfectly elastic bodies. Partially elastic collisions. Inelastic collisions.

Module Overview

Additional Information
The module will provide students with an introduction to essential applied mechanics (static force systems, strength of materials, kinematics, dynamics, impulse and momentum). This module includes content which relates to the following UN Sustainable Development Goals. SDG 4 – This module will ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by providing foundational skillsets in engineering design, research and development. SDG 8 – This module aims to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all by ensuring that skillsets learned are consistent with market and societal needs to guarantee sustainable employment and economic benefit. SDG 9 – This module aims to provide student with knowledge and understanding of engineering requirements for building resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Learning Outcome Mapping
Exam	Examination	60	2	MLO1, MLO2, MLO3, MLO4

Test	VLE Test	40	0	MLO1, MLO2, MLO3, MLO4