Applied Mechanics 1

Module Information

2022.01, Approved

Summary Information

Module Code	4508USST
Formal Module Title	Applied Mechanics 1
Owning School	Engineering
Career	Undergraduate
Credits	20
Academic level	FHEQ Level 4
Grading Schema	40

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	44
Tutorial	22

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
SEP-PAR	PAR	September	12 Weeks

Aims and Outcomes

Aims	To introduce the essential principles of applied mechanics

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Apply the principles of equilibrium to analyse coplanar static force systems.
MLO2	2	Apply the concepts of stress and strain to simple engineering problems involving axial, shear, flexural and torsional loading.
MLO3	3	Apply the principles of kinematics and dynamics to problems of motion
MLO4	4	Apply the principles of work, energy, power, impulse and momentum to the solution of engineering problems.

Module Content

Outline Syllabus	1 StaticsStatic force systemsPlanar 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 beamsShear 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 MaterialsConcepts of stress and strainAxial 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 DynamicsKinematics. 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).

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping

Exam	Exam	60	2	MLO1, MLO2, MLO3, MLO4
Test	In course tests	40	0	MLO1, MLO2, MLO3, MLO4

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Russell English	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings