Liverpool John Moores University

Title:	Applied Mechanics 1
Status:	Definitive
Code:	**4114ENG** (120015)
Version Start Date:	01-08-2016
Owning School/Faculty:	Maritime and Mechanical Engineering
Teaching School/Faculty:	Maritime and Mechanical Engineering

Team	Leader
Russell English	Y
Michael Nieves	

Academic Level:	FHEQ4	**Credit Value:**	20	**Total Delivered Hours:**	74
Total Learning Hours:	200	**Private Study:**	126		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	48
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS2	Examination	70	2
Test	AS1	Coursework - Virtual learning environment based tests	30	

Aims

To introduce the essential principles of applied mechanics

Learning Outcomes

After completing the module the student should be able to:

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

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Exam	1	2	3	4
VLE Based Test	1	2	3	4

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.

Learning Activities

Lectures and tutorials

Notes

The module will provide students with an introduction to essential applied mechanics (static force systems, strength of materials, kinematics, dynamics, impulse and momentum).