Liverpool John Moores University

Title:	Mechanical and Thermal Systems 2
Status:	Definitive
Code:	**5104SBC** (124867)
Version Start Date:	01-08-2021
Owning School/Faculty:	Engineering
Teaching School/Faculty:	The Sino-British College

Team	Leader
Russell English	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	68
Total Learning Hours:	200	**Private Study:**	132		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	44
Tutorial	22

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Exam	60	2
Test	AS2	Test	40	

Aims

To provide the means for solving many basic engineering problems by learning the principles of mechanics for rigid and deformable solid bodies. To provide an insight into the physical behaviour of fluid flow and heat transfer by application of the theory to practical engineering examples.

Learning Outcomes

After completing the module the student should be able to:

1 Determine the stresses and strains in an elastic continuum and utilise these to assess failure by yielding and by fatigue
2 Determine the equations of motion for rigid bodies undergoing translation, rotation about fixed axes and general plane motion. Analyse the dynamical behaviour of systems with one-degree-of-freedom by applying the notions of stiffness, damping, natural frequency, rate decay.
3 Apply the governing equations for modes of heat transfer
4 Analyse flow in pipe networks and behaviour of compressible fluids

Learning Outcomes of Assessments

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

Exam	1	2	3	4
Test	1	2	3	4

Outline Syllabus

1. Continuum stress and failure analysis
Elasticity of a continuum. 2D stress/strain transformations, Mohr's Circle (stress/strain). Use of strain gauges to determine strains in loaded components. Application to thin walled cylindrical and spherical pressure vessels.
Failure Modes; Yield criteria. Application of Rankine, Tresca and Von-Mises theories. Application to brittle and ductile materials. Fatigue. S-N curves and endurance limit. Factors affecting the endurance limit and their application.

2. Dynamics and Vibration
General planar motion. Two-dimensional kinematics and dynamics of rigid bodies. Applications. 1DOF systems. Free vibration of undamped/damped systems. Harmonic motion/Damped motion. Response of one-degree-of-freedom systems to harmonic excitations.

3. Heat transfer
Modes of heat transfer:- conduction, convection and thermal radiation. Multimode/2D heat transfer. Introduction to types of heat exchangers:- plate, compact, shell and tube. Log mean temperature difference (LMTD) method of heat exchanger analysis.

4. Fluid flow and behaviour of compressible fluids
Laminar and turbulent pipe flow, friction and minor losses in pipes and pipe networks. Pumps and pump characteristic curves. Descriptive treatment of real fluid flow. 1-d compressible flow. Mach no., isentropic flow, stagnation conditions, use of tables. Flow through nozzles. Choked conditions. Critical pressure ratio.

Learning Activities

Lectures and tutorials

Notes

The module extends previous studies in mechanics by examining more applied problems, which relate to real mechanical systems. It helps to strengthen the student's knowledge for successful mechanical design. It continues the development of the fundamental ideas behind the core engineering disciplines of thermodynamics and fluid mechanics. The module is supported by tutorial work which will help develop the necessary understanding and skill required of an engineering student.