Liverpool John Moores University

Title:	Mechanics, Materials and Manufacture
Status:	Definitive
Code:	**4165PDE** (121747)
Version Start Date:	01-08-2021
Owning School/Faculty:	Engineering
Teaching School/Faculty:	Engineering

Team	Leader
Martin Sharp	Y

Academic Level:	FHEQ4	**Credit Value:**	20	**Total Delivered Hours:**	44
Total Learning Hours:	200	**Private Study:**	156		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	22
Tutorial	22

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Test	ICT1	Mechanical Sci Test	70	
Test	ICT2	Materials and Manuf Test	30	

Aims

This module will cover the subjects of basic mechanics, mathematical theory, materials science and manufacturing technologies through a series of case studies and design-led lectures, seminars and workshops.

Learning Outcomes

After completing the module the student should be able to:

1 Define the micro-structural characteristics of a range of engineering materials.
2 Identify the relationships between manufacturing processes and material behaviour.
3 Demonstrate a clear understanding of the physics of mechanical systems and mathematics by applying them in formulating solutions to common problems.

Learning Outcomes of Assessments

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

Mechanical Sci Test	3	
Materials and Manuf Test	1	2

Outline Syllabus

Module introduction
Module guide; aims; learning outcomes; assessment and marking schemes. Outline syllabus; module timetable and student feedback. Availability and license agreement of the student version of SolidWorks.

Material science:
Recognition of micro-structural characteristics and composition of metals, ceramics, polymers and composites: Grain structure, lattice structure, slip planes and their effect on properties of parent material. Alloying elements and their effects. Crystallinity, polymerization, co-polymerisation; additives, cross-linking.

Manufacturing:
Mechanical processing and the effect on structure and properties illustrated by a range of processes e.g. mechanical working of metals, powder processing of metals and ceramics, extrusion and forming of polymer sheet, welding, use of adhesives; effect of processing on structure and properties e.g. residual stresses, work hardening. Liquid processing: metal casting and injection moulding/extrusion of polymers; effect of processing on structure and properties e.g. grain structure, porosity. Treatment processes: heat treatments e.g. quench and precipitation hardening processes, glass transitions; surface treatments/surface engineering, polymer treatments, composites/powder produced materials, matrix/reinforcement relationships. Materials testing to determine the properties of commonly used engineering materials, such as mechanical strength, hardness, toughness, fatigue and creep resistance, corrosion and reactivity, wear resistance, optical and thermal properties and formability.
Causes of failure: failure of material categories (metals, ceramics, polymers and composites) e.g. creep, fatigue, S-N curves; modification factors due to geometric, surface and environmental factors. Impact, overstressing, corrosion, temperature, thermal cycling, residual stresses, stress relaxation, degradation (composition change), radiation, electrical breakdown, or combinations of these. Protective systems and design against corrosion.

Basic mechanics:
Engineering designers, no matter from what background, need to acquire a fundamental appreciation of the mechanical and electrical principles that underpin the design and operation of a large range of products, engineering equipment and systems. This section will develop students' understanding of the key mechanical concepts that relate to all aspects of engineering design. In particular, students will study elements of engineering statics including the analysis of beams, columns and shafts. They will then be introduced to elements of engineering dynamics, including the behavioral analysis of mechanical systems subject to uniform acceleration, the effects of energy transfer in systems.

Applied mathematical theory:
Engineering units. Algebraic functions. Fundamentals and notation of calculus (Gradient, rate of change, area beneath a function). Plotting and interpreting data in graphical formats. Trigonometry and geometry. Scalars and vectors.

Learning Activities

This module will be delivered through an integrated series of lectures, tutorials, practical sessions, guided design activities and case studies. The learning activities are to be student focused and develop the students design knowledge through experiential learning.

Notes

This module is delivered using a variety methods including lectures, seminars, tutorials and practical sessions. The module will be delivered from a engineering and product design perspective.