Mechanics, Materials and Manufacture

Module Information

2022.01, Approved

Summary Information

Module Code	4265PDE
Formal Module Title	Mechanics, Materials and Manufacture
Owning School	Engineering
Career	Undergraduate
Credits	20
Academic level	FHEQ Level 4
Grading Schema	40

Teaching Responsibility

LJMU Schools involved in Delivery
Engineering

Learning Methods

Learning Method Type	Hours
Lecture	22
Tutorial	22

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
JAN-CTY	CTY	January	12 Weeks

Aims and Outcomes

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.

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Define the micro-structural characteristics of a range of engineering materials.
MLO2	2	Identify the relationships between manufacturing processes and material behaviour.
MLO3	3	Demonstrate a clear understanding of the physics of mechanical systems and mathematics by applying them in formulating solutions to common problems.

Module Content

Outline Syllabus	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 behavioural 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.
Module Overview	**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.**
Additional Information	UN Sustainable Development GoalsThis module includes content that relates to the following UN Sustainable Development Goals:SDG12 – This module supports students to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Test	Mechanical Sci Test	70	0	MLO3
Test	Materials and Manuf Test	30	0	MLO1, MLO2

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Hiren Kotadia	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings