

Liverpool John Moores University

Title: Materials
Status: Definitive
Code: **4105MAN** (121954)
Version Start Date: 01-08-2021

Owning School/Faculty: Engineering
Teaching School/Faculty: Engineering

| Team | Leader |
|-----------|--------|
| James Ren | Y |
| Lisa Li | |

Academic Level: FHEQ4 **Credit Value:** 20 **Total Delivered Hours:** 46
Total Learning Hours: 200 **Private Study:** 154

Delivery Options

Course typically offered: Semester 1

| Component | Contact Hours |
|-----------|---------------|
| Lecture | 33 |
| Tutorial | 11 |

Grading Basis: 40 %

Assessment Details

| Category | Short Description | Description | Weighting (%) | Exam Duration |
|----------|-------------------|-------------------------------|---------------|---------------|
| Exam | AS2 | Examination | 60 | 2 |
| Test | AS1 | Test with a V.L.E. Based Test | 40 | |

Aims

The module will introduce the essential principles of material science.

Learning Outcomes

After completing the module the student should be able to:

- 1 Review the range of available materials, their applications, processing methods and demonstrate knowledge of the basic structures of different groups of materials.
- 2 Understand the properties of engineering materials and factors affecting materials properties and selection.
- 3 Apply different materials testing and analysis data methods for design and product development
- 4 Review the range of metal casting processes and know the techniques for preventing defects.
- 5 Demonstrate knowledge of primary metal forming and removal processes including appropriate selection.
- 6 Understand polymer and composite processing methods and their applications

Learning Outcomes of Assessments

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

| | | | | | | |
|----------------|---|---|---|---|---|---|
| Examination | 1 | 2 | 3 | 4 | 5 | 6 |
| VLE Based Test | 1 | 2 | 3 | 4 | 5 | 6 |

Outline Syllabus

Materials

Materials Structures and Applications

Structure of atoms, Bohr theory. primary and secondary bondings and their relationships with material properties.

Classification of engineering materials: metals, ceramics, polymers and composites and typical applications.

Ideal crystalline solids: basic crystallography;

Microstructure of metals and ceramics: grains, grain size, defects and their influence on mechanical and physical properties.

Structure of polymers: molecule chains, curing, thermoplastic and thermosets

Properties, testing and selection

Materials properties and design: stiffness. strength and toughness; stress strain curves, Young's modulus, yield strength, toughness, fracture toughness.

Factors affect the behaviour and properties of materials.

Destructive and non-destructive tests; tensile, hardness, ductile and brittle failure.

Analysis and interpretation of materials testing data.

Material selection: Introduction to computer-based techniques for material selection.

Manufacturing

Metal materials and processing

Classification of materials processing methods: forming, shaping, and processing.

Casting processes: Fluid flow and solidification; casting mould design; prevention of casting defects.

Metal cutting processes: Milling, turning and grinding theory, preparation of data and tool selection.

Overview of cold working process of metals.

Processing of plastics and composites

Fundamentals of moulding processes of plastics and composites.

Injection moulding, compression moulding, blow moulding, vacuum forming

Rapid prototyping and 3D printing methods

Mould design

Learning Activities

Lectures, tutorial and practicals

Notes

This module covers the essential elements of materials science and manufacturing technology required by engineers studying mechanical, marine, design disciplines. The students will develop a good understanding on the structures, properties and processing methods of different groups of materials and be able to apply basic techniques for materials testing and selection.