UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Engineering Materials
Module Code	ENG4007-B
Academic Year	2024/5
Credits	20
School	School of Engineering
FHEQ Level	FHEQ Level 4

Contact Hours	
Type	Hours
Independent Study	135
Lectures	42
Tutorials	16
Laboratories	5

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1

Module Aims

Provide an introduction to materials in respect of selection, structure, processing and properties in a wide range of engineering applications.

Describe the concepts of stress, strain, equilibrium and deformation, and apply them in the analysis and understanding of simple engineering frames and structures.

Outline Syllabus

1. Metals: Cast irons (Forming, casting, cast iron types; properties and applications), ferrous and non-ferrous alloys (Heat treatment, effect of carbon on iron in terms of microstructure and mechanical properties;
2. Polymers: structures, processing, properties and applications.
3. Ceramics: structures, processing, properties and applications.
4. Biomaterials: structures, processing, properties and applications
5. Bonding: types of bonding and their effect on various properties.
6. Composites: structures, processing, properties and applications
7. Calculation of mechanical properties of metals, polymers and ceramics: Tensile and Yield Strengths, 3- and 4-Point bend (fracture) strength, Young's modulus, % Elongation and % Reduction in area.
8. Rocks, Soils and Aggregates: Rocks (cycles, types: igneous, sedimentary and metamorphic, classification; structural geology: folds and faults), and soils (characteristics and classification including Atterberg limits, formation: erosion and ground water), and Aggregates (properties, grading and determination).
9. Concrete: properties, microstructure, determination, admixtures, strength, moisture related movement, permeation, durability, `labcrete` and `realcrete`, concrete mix design.
10. Sustainability: energy intensive materials, industrial by-products, waste materials, re-use of materials. European and British Codes of Practice.

Mechanics of materials:
1. Forces: definition, resultant force, components of force, moment, equivalent force.
2. Stress and strain: elastic modulus, shear force and bending moment.
3. Structures: support reactions for statically determinate structures.
4. Tension and compression: elastic behaviour of bar in tension/compression.
5. Pin-jointed frames: external and internal forces.
6. Bending moment and shear force diagrams: statically determinate beams subject to point and distributed loads.
7. First and second moments of area: Bending stress due to bending moment.
8. Beam deflections: Macaulay`s method for integrating the expression for bending moment.

Learning Outcomes

Outcome Number	Description
01	Explain the properties, processing technology, production, and selection of materials in a wide range of engineering applications
02	Apply concepts of equilibrium of forces, stress, strain, tension, compression, and bending to the analysis of simple engineering frames and structures.
03	Work independently to apply appropriate problem solving methods to both descriptive and quantitative challenges.
04	Record and interpret data, and communicate effectively
05	Understand the impact of sustainability principles, durability and carbon footprint on the choice of materials

Learning, Teaching and Assessment Strategy

Lectures are used to introduce theoretical concepts and to contextualise module content within engineering applications. Opportunities are provided to observe and undertake examples of questions and problems, showing appropriate steps and methods and providing time for interactive learning. The concepts are then discussed, applied and practiced in online and face to face tutorials and in laboratory practical sessions to assist with deeper and better understanding. Tutorials give the opportunity for small group work, self-assessment, collaborative learning and peer feedback concurrently with tutor support. They are interactive and oral feedback is given.

Tutorials are an opportunity for formative assessment; students are provided with tutorial questions and problems that build up subject learning, culminating in questions similar to those found in summative assessments. Laboratory practical sessions are conducted in small groups and online videos provided to supplement learning, allowing students the opportunity to observe and understand the measurement of material properties and behaviour that are theorised during lectures and tutorials.

LO1 will be assessed via a MCQ test and one laboratory practical report (25% and 25% respectively, different materials covered within each mode of assessment).
LO2 will be assessed via a closed book examination (50%).
LO3 will be assessed within the MCQ test and closed book examination (25% and 50% respectively, different aspects of curriculum related to each assessment).
LO4 will be assessed within the laboratory report, the MCQ test and the examination. (100%) It underpins all parts of the module.
LO5 will be assessed within the laboratory report, the MCQ test and/or the examination. (100%) It underpins all aspects of the module.

The supplementary assessment is as original. Submission of laboratory report (with supplied data if necessary); closed book MCQ Engineering Materials Test; closed book Structural Mechanics examination. Formative assessment takes place regularly throughout the module during tutorials and laboratory sessions. Students are provided with a range of questions that initially simplify the steps to solving challenges in engineering materials before addressing more complex problems typical of those found in summative assessments.

This module satisfies the following Learning Outcomes as specified by the Accreditation of Higher Education Programmes: Fourth Edition (AHEP4) as published by the Engineering Council in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). These outcomes specify five key areas of learning which partially (C) or fully (M) meet the academic requirement for CEng registration: Science and Mathematics (1), Engineering Analysis (2-4), Design and Innovation (5-6), The Engineer and Society (7-11), and Engineering Practice (12-18): M1, C1, C2, M5, C5, M6, C6, M7, C7, M12, C12, M13, C13, M15, C15, M17, C17. Further details of these learning outcomes can be found at https://www.engc.org.uk/ahep/

Mode of Assessment

Type	Method	Description	Weighting
Summative	Laboratory Report	Engineering Materials: Materials	25%
Summative	Examination - Closed Book	Engineering Materials: Mechanics of Materials (2 Hrs)	50%
Summative	Examination - Closed Book	Engineering Materials: Materials (2 Hrs)	25%

Reading List

To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

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