UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title:	Engineering Materials
Module Code:	ENG4007-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Mechanical and Energy Systems Engineering
Subject Area:	Engineering
FHEQ Level:	FHEQ Level 4
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	**Hours**
Independent Study	125
Lectures	45
Tutorials	24
Laboratory	6

Availability	
Occurrence	**Location / Period**
BDA	University of Bradford / Semester 1 (Sep - Jan)

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

Materials

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; Tensile testing of various metals and rubber).
2. Polymers: structures, processing, properties and applications.
3. Ceramics: structures, processing, properties and applications.
4. Bonding: types of bonding and their effect on various properties.
5. 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.
6. 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).
7. Concrete: properties, microstructure, determination, admixtures, strength, moisture related movement, permeation, durability, `labcrete` and `realcrete`, concrete mix design.
8. Timber and Masonry: Timber (types, characteristics, engineering properties and application, and Masonry (types, characteristics, engineering properties and application).
9. 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	
1	Explain the properties, processing technology, production, and selection of materials in a wide range of engineering applications
2	Apply concepts of equilibrium of forces, stress, strain, tension, compression, and bending to the analysis of simple engineering frames and structures.
3	Work independently to apply appropriate problem solving methods to both descriptive and quantitative challenges.
4	Record and interpret data, and communicate effectively
5	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 tutorials and laboratory practical sessionss 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 smaller groups allowing students hands on experience and the opportunity to observe and measure materials properties and behaviour that are theorised during lectures and tutorials.

LO1 will be assessed via a classroom test and one laboratory practical report (25% and 25% respectively).
LO2 will be assessed via a closed book examination and one classroom test (40% and 10% respectively).
LO3 will be assessed within the two classroom tests and the examination.
LO4 will be assessed within the laboratory report, the classroom tests and the examination.
LO5 will be assessed within the laboratory report, the classroom tests and the examination.
The supplementary assessment is a closed book examination covering the entire syllabus and all Learning Objectives.
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 below Learning Outcomes as specified by the Accreditation of Higher Education Programmes: Third Edition (AHEP3) as published by The Engineering Council in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). These outcomes specify six key areas of learning: Science and Mathematics (SM), Engineering Analysis (EA), Design (D), Economic, Legal, Social, Ethical and Environmental Context (EL), Engineering Practice (P) and Additional General Skills (G).
SM1b, SM2b, SM3b, EA1b, EA4b, D1, EL2, EL4, P1, P2, P3, P4, G1, G2, G3b, G4, SM1m, EA1m, P2m.
Further details of these learning outcomes can be found at https://www.engc.org.uk/.

Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Laboratory Report	Engineering Materials: Materials		25%
Referral	Examination - closed book	Closed Book Examination of whole module content	3 hours	100%
Summative	Examination - closed book	Engineering Materials: Mechanics of Materials	2 hours	40%
Summative	Classroom test	Engineering Materials: Mechanics of Materials	1 hour	10%
Summative	Classroom test	Engineering Materials: Materials	2 hours	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.