London South Bank University

Manufacturing Systems and Materials Technologies

ENG_6_450

School of Engineering

2018/2019

Level six

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1. MODULE DETAILS

Module Title:	Manufacturing System & Materials Technology 3
Module Level:	six
Module Reference Number:	ENG_6_450
Credit Value:	20
Contact Hours:	52
Student-managed learning hours (self-study):	160
Pre-requisite Learning (If applicable):	Solid Mechanics and FEA
Co-requisite Modules (If applicable):	N/A
Course(s):	BEng Mechanical Engineering MEng Mechanical Engineering
Year and Semester	2018 /2019 , Semester 2
Module Coordinator:	Prof. Yuqing Bao
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Teaching Team & Contact Details (If applicable):	Prof. Yuqing Bao, baoy@lsbu.ac.uk Dr Geoff Goss, gossga@lsbu.ac.uk Dr Naveed Hussein, n.hussain@lsbu.ac.uk
Subject Area:	Mechanical Engineering and Design
Summary of Assessment Method:	End of unit examination contributing 70% of the overall assessment; Coursework assignments contributing 30% to the overall assessment

2. SHORT DESCRIPTION

This module provides an advanced study on stress analysis including elasticity theory, inelastic deformations, fracture of materials and their application to practical engineering problems. The module also introduces the core concepts of manufacturing systems and computer integrated manufacturing in the contemporary product realisation process. Students will develop an understanding of the scope of materials/manufacturing technologies, the integrative role of materials selection in engineering and design and an appreciation of technological change, innovation and sustainable in manufacturing.

3. AIMS OF THE MODULE

- To provide students with the concepts, methods and applications of contemporary manufacturing systems and integrated manufacturing and its related aspects
- To equip the students with knowledge of techniques for use and management of manufacturing systems
- To provide an understanding of the theories of elasticity. plasticity, time and temperature dependent deformation
- To examine the principles and applications of fatigue, creep and fracture mechanics.

- To understand tribology and its control in practical applications.
- To enable students to understand the principles and methodology of materials selection and process selection.
- To provide an understanding of how materials technologies can be designed and controlled to meet the requirements of high-performance products and materials.

4. LEARNING OUTCOMES

The expected learning outcomes are that the student will be able to develop:

4.1 Knowledge and Understanding of:

- Classification of elasticity theory, plasticity and the principles of linear fracture mechanics and apply these theories to analysis the behaviour of engineering materials including three-dimensional elastic deformation, time and temperature dependent deformation (creep) and cyclic loading induced deformation (fatigue). (SM1p, SM2p, SM3p)
- Categorizing how materials/manufacturing technologies are designed to meet the requirements of high-performance products and materials including the role and application of industrial robots (EA1p, EA2p; EA4p)
- Examining the commercial context of manufacturing including operations management and manufacturing process planning (ET2p, ET3p)

4.2 Intellectual Skills

- Extrapolating engineering data from practical tests (e.g. creep and fatigue) for quantitative prediction of materials' behaviour. (EA2p, EA3p, D3p)
- Developing numerical and analytical skills to solve practical engineering problems (e.g. creep, fatigue problems) (EA2p, EA3p, D3p)

4.3 Practical and transferable Skills

- Prioritising quality issues, their relevant industrial standards and their application to continuous improvement, including inspection technologies and methods (EP1p, EP6p, EP7p).
- Deducing how to improve design for manufacture by modelling, monitoring, interpreting and applying analysis results (D2p, D3p).

5. ASSESSMENT OF THE MODULE

There are **two elements** of assessment in this module:

1. An end of module closed-book examination contributing 70% of the overall assessment. A minimum mark of 30% is required in this element
2. Coursework contributing 30% to the overall assessment. A minimum mark of 30% is required in this element. The coursework consists of a single assignment based on the manufacturing

systems lecture series. The brief for this assignment including the marking scheme will be issued separately in due course.

Overall requirements to pass this module:

As well as obtaining a minimum of 30% in each of the above elements, you must achieve a minimum aggregate, after weighting, of 40% to pass this module.

6. FEEDBACK

Feedbacks to students' assignments submitted will normally be given to students 15 working days after the submission of an assignment

7. INTRODUCTION TO STUDYING THE MODULE

7.1 Overview of the Main Content

Stress Analysis and Materials Technology

- Theories of elastic failure.
- Fatigue, fatigue failure and strength of materials, fatigue testing and the statistical interpretation of data, fatigue life assessment.
- Time-dependent deformation of materials. Temperature dependence and creep fracture, Prediction of creep strain and design in high temperature application.
- Selection of materials for engineering applications. Principles. Methodology
- Stress concentration. Fracture mechanics.
- Transverse shear. Shear centre.
- Design of beams and shafts, Discontinuity functions models
- Torsion of noncircular shafts
- Elasticity theory, constitutive equations. Three-dimensional stress

Manufacturing systems:

- Manufacturing and operations strategies
- Manufacturing automation
- Manufacturing process planning
- Quality control & inspection
- Material handling, storage and retrieval
- Robotics applications in manufacturing
- Elements of the manufacturing operations management
- Maintenance and reliability of the systems

7.2 Overview of Types of Classes

The module will be delivered over one semester and objectives will be accomplished by a series of lectures, tutorials, assigned text readings, , case studies, reviews of contemporary relevant literature. Moodle sites, handouts and audio-visual aids may supplement some lectures. Principles will be covered in formal lectures, while student will be expected to address the depth of the subject areas through the coursework assignments and associated studies.

7.3 Importance of Student Self-Managed Learning Time

Students are expected to spend 10-12 hours per week in private study. This will involve reading lecture notes and consulting the books in the recommended reading list. Students will be given numerical problems to solve in their own time on a weekly basis.

7.4 Employability

This module teaches problem solving skills, analytical skills and personal time management skills which will enhance students' employability.

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

The lectures will be organised on a weekly basis to cover the topics (subject to change):

Materials technologies
Theories of failures.
Fatigue: fatigue life assessment, fatigue testing and the statistical interpretation of data.
Creep: time-dependent deformation of materials, temperature dependence and creep fracture, materials in high temperature applications.
Selection of materials: Principles. Methodology and case studies.

Stress Analysis
Stress concentration. Fracture mechanics.
Transverse shear. Shear centre.
Design of beams and shafts.
Deflection of beams. Discontinuity functions models
Torsion of noncircular shafts

Manufacturing systems
Overview of manufacturing systems.
Key manufacturing processes: principles and technologies
Concepts and applications of process planning
Computer Integrated Manufacturing and automated production
Quality control and total quality management
Inspection Principles and technologies
Concepts and techniques of designing and managing operations in engineering

9. STUDENT EVALUATION

To help us to improve the module, students are strongly encouraged to complete a Module Evaluation Questionaire on-line before the end of the module. Feedback comments from the 2017-8 module have been considered in replanning this module for 2018-9and changes made accordingly.

10. LEARNING RESOURCES

Students are recommended to make full use of the LSBU learning and information facilities, including LRC and the module Moodle site on which lecture notes etc. will be updated on weekly basis.

10.1 Book lists

Core materials:

- Groover, M P, Principles of Modern Manufacturing, 5th ED, SI version ISBN: 978-1-118-47420-4
- Rees, D W A, Mechanics of Solids and Structures, McGraw-Hill.
- Gere, J. M.; Goodno, B.J.; Mechanics of Materials, Cengage learning, ISBN-13: 978-1-111-57774-2
- Ashby, M, Materials Selection in Mechanical Design. 3rd ED. 2005

Optional reading:

- Thompson, R , Manufacturing Processes for Design Professionals, ISBN: 9780500513750 2007.
- Timings R and Wilkinson S, Manufacturing Technology, Vol 2, Longman, 2000
- Reig, A.J, Introduction to Robots in CIM systems. ISBN-13: 9780130602435
- Kalpakjian,S, *Manufacturing Engineering and Technology*, 5th Ed, Pearson, Prentice Hall Schmid
- Heizer, J, *Production and Operations Management – strategies and tactics*, Render B Prentice Hall Publishers
- Benham, P.P., Crawford, R.J., Armstrong, C.G., Mechanics of Engineering Materials, 2nd edition, Longmans, 1996.
- DeGarmco,E P et al Materials and Processes in Manufacturing, 9th Ed. ISBN 0471-03306-5
- Dowling, Norman E. Mechanical Behavior of Materials: Engineering Methods for Deformation, Fracture, and Fatigue, 3rd ED, Pearson Education, Inc., 2007

10.2 Lecture notes and Moodle site

A Moodle site has been set up for this module. Weekly Lecture notes, tutorials sheets and assignments will be posted on the site. Please check the site regularly for updates