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MODULE DESCRIPTOR

Module Title

Mechanical Engineering Design 3

Reference	EN3109	Version	3
Created	April 2023	SCQF Level	SCQF 9
Approved	March 2021	SCQF Points	30
Amended	August 2023	ECTS Points	15

Aims of Module

This module will further develop students' understanding of the formal design process with applications to the design of components and systems and machine elements.

Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Discuss the behaviour of structural elements such as struts, cylinders, plates and rotating components.
- 2 Demonstrate appropriate analysis methods for standard cases in stress concentration and fatigue.
- 3 Review design problems in shaft support bearing and spring systems and connections between component parts using current codes of practice.
- 4 Assess the natural frequencies and mode shapes of linear and rotational vibrational systems having two, three, and more degrees of freedom.
- 5 Explain relevant analysis and failure criteria to the solution of complex stress systems and determine the fracture toughness, crack growth and creep behaviour of engineering materials.

Indicative Module Content

Stress analysis of components subject to combined loading such as tension, bending, torsion, pressure, rotary and thermal actions. Elastic theories of failure such as Rankine (principal stress theory), Tresca (Max. shear stress theory), Von-Mises (max shear strain energy theory) applied to different components. Design of structural compression members: review of Euler Buckling theory, slenderness ratio, limitations, end fixings, equivalent lengths, and other analysis techniques. National and international codes of practice design approaches, including BS and Eurocodes. Principles of fatigue analysis using Soderberg and other models of fatigue diagrams incorporating competent modification factors such as surface finish, stress concentrations, reliability, size effect, non-zero mean effects, compound cylinders. Design of bearing: General overview of bearing types, parameters involved in design and selection of ball and roller bearings, lubrications and seals, assembling and securing bearing on shafts. Design and select appropriate springs for specified applications. Design of connection systems: BS5950 design requirements. Dynamics of engineering systems of two degrees of freedom; vibrational analysis of engineering components; basic numerical methods for dynamic analysis

Module Delivery

The module will be delivered by means of lectures, tutorials and workshops and student centred learning.

Indicative Student Workload

	Full Time	Part Time
Contact Hours	100	N/A
Non-Contact Hours	200	N/A
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	300	N/A
<i>Actual Placement hours for professional, statutory or regulatory body</i>		

ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

Component 1

Type:	Examination	Weighting:	100%	Outcomes Assessed:	1, 2, 3, 4, 5
Description:	Closed book examination.				

MODULE PERFORMANCE DESCRIPTOR**Explanatory Text**

Component 1 comprises 100% of the module grade. To pass the module, a grade D is required.

Module Grade	Minimum Requirements to achieve Module Grade:
A	A
B	B
C	C
D	D
E	E
F	F
NS	Non-submission of work by published deadline or non-attendance for examination

Module Requirements

Prerequisites for Module	Completion of EN2705 or equivalent.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

- 1 SHIGLEY J. E., 2020. Mechanical Engineering Design 8th Edition: McGraw-Hill.
- 2 ULRICH, K. T. and EPPINGER, S.D., 2016. Product Design and Development. 6th ed. New York: McGraw-Hill.
- 3 DIETER, G, E. and SHHMIDT, L, C; 2009. Engineering Design. 4th ed. New York: McGraw-Hill.
- 4 COLLINS, J A; BUSBY H; STABB G., 2010. Mechanical Design of Machine Elements and Machines. 2nd ed. Wiley
- 5 HERTZBERG, R.W., 1996. Deformation and Fracture Mechanics of Engineering Materials. 4th ed. New
- 6 CASE, J., CHILVER, L. AND ROSS, C.T.F., 1999. Strength of Materials and Structures. 4th ed. London: Arnold. York: Wiley.
- 7 O'Connor P.D.T., 2003. Practical Reliability Engineering. Chichester &NY: J Wiley & Sons
- 8 British Standard BS 8888:2011 - Technical product documentation and specification