

MODULE DESCRIPTOR

Module Title

Mechanical Engineering Design 3

Reference	EN3101	Version	5
Created	February 2024	SCQF Level	SCQF 9
Approved	July 2018	SCQF Points	30
Amended	April 2024	ECTS Points	15

Aims of Module

This module will develop an understanding of the formal design process and expand the knowledge of engineering principles and analysis introduced in the second year, with application of these principles 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 Assess the behaviour of structural elements such as struts, cylinders, plates and rotating components.
- 2 Interpret appropriate analysis methods for standard cases in stress concentration and fatigue.
- 3 Assess the behaviour of shrink fit and compound cylindrical components.
- 4 Interpret 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.
- 5 Demonstrate engineering and security risk and reliability techniques to components and systems in order to review outcomes.

Indicative Module Content

Stress analysis of components subject to combined loading such as tension, bending, torsion, pressure, roary 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. 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 etc. shrink fits; compound cylinders. Modelling of complex stress systems; failure analysis; fracture toughness and stress intensity factors; crack growth and material failure mechanisms; creep and creep stress relaxation. 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. Engineering and security risk, reliability and safety - reliability theory, analysis, design for reliability.

Module Delivery

The module is delivered in Blended Learning mode using structured online learning materials/activities and directed study, facilitated by regular online tutor support. Workplace Mentor support and work-based learning activities will allow students to contextualise this learning to their own workplace. Face-to-face engagement occurs through annual induction sessions, employer work-site visits, and modular on-campus workshops.

Indicative Student Workload

	Full Time	Part Time
Contact Hours	30	N/A
Non-Contact Hours	30	N/A
Placement/Work-Based Learning Experience [Notional] Hours	240	N/A
TOTAL	300	N/A
<i>Actual Placement hours for professional, statutory or regulatory body</i>	240	

ASSESSMENT PLAN

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

Component 1

Type:	Coursework	Weighting:	70%	Outcomes Assessed:	1, 2, 3, 4
Description:	Practical activities and online tests.				

Component 2

Type:	Coursework	Weighting:	30%	Outcomes Assessed:	5
Description:	Individual exercises.				

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

The module has 2 components and to gain an overall pass a minimum D grade must be achieved in each component. The component weighting is as follows: C1 (y-axis) is worth 70% and C2 (x-axis) is worth 30%.

		Coursework:						
		A	B	C	D	E	F	NS
Coursework:	A	A	A	B	B	E	E	
	B	B	B	B	C	E	E	
	C	B	C	C	C	E	E	
	D	C	C	D	D	E	E	
	E	E	E	E	E	E	F	
	F	F	F	F	F	F	F	
	NS	Non-submission of work by published deadline or non-attendance for examination						

Module Requirements

Prerequisites for Module	Completion of EN2108, EN2101, EN2102, EN2103 or equivalent.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

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