

## MODULE DESCRIPTOR

### Module Title

Failure Analysis

Reference	EN4701	Version	5
Created	December 2022	SCQF Level	SCQF 10
Approved	March 2004	SCQF Points	15
Amended	August 2023	ECTS Points	7.5

### Aims of Module

To provide the student with the ability to relate the mechanisms of engineering failures, and methods for their detection, to the incipient and wear-out failure of engineering systems.

### Learning Outcomes for Module

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

- 1 Evaluate the properties of materials and their modes of failure under adverse environmental conditions
- 2 Critically solve problems of complex stress systems
- 3 Apply a systematic approach to the solutions of typical operational problems in rotating machinery
- 4 Select appropriate non-destructive methods as applied to defect detection in industrial plants

### Indicative Module Content

Microstructural properties of materials; analysis of microstructures; applications of microstructural analysis to failure mechanisms of materials; dielectric properties and degradation processes. Modelling of complex stress systems; failure analysis; fracture toughness and stress intensity factors; crack growth and material failure mechanisms; creep and creep stress relaxation. Operational problems in rotating machinery; unbalance; misalignment bearing and gear faults; mechanical resonance. Condition monitoring methods including vibration. Non-destructive testing methods including acoustic emission.

### Module Delivery

The module is taught using a a balanced programme of lectures, tutorials and self-study. Case studies are used to illustrate industrial applications.

**Indicative Student Workload**

	Full Time	Part Time
Contact Hours	45	45
Non-Contact Hours	105	105
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	150
<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
Description:	Closed book examination.				

**MODULE PERFORMANCE DESCRIPTOR****Explanatory Text**

The module has one component and to gain an overall pass a minimum D grade must be achieved in the component. The component weighting is as follows: C1 is worth 100%.

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

**Module Requirements**

Prerequisites for Module	Engineering Analysis 1 (EN3501) or equivalent.
Corequisites for module	None.
Precluded Modules	None.

**ADDITIONAL NOTES**

An Indicative Bibliography will normally reference the latest edition of a text. In some cases, older editions are equally useful for students and therefore, those are the editions that may be stocked.

**INDICATIVE BIBLIOGRAPHY**

- 1 DOWLING, N.E., 2013. Mechanical Behaviour of Materials. 4th ed. Upper Saddle River, NJ: Prentice Hall.
- 2 HERTZBERG, R.W., 2013. Deformation and Fracture Mechanics of Engineering Materials. 5th ed. New York, NY: Wiley.
- 3 CALLISTER, W.D., 2015. Materials Science and Engineering. 9th ed. New York, NY: Wiley.
- 4 BARRON, R., 1996. Engineering Condition Monitoring: Practice, Methods and Applications. Essex: Addison Wesley Longman.
- 5 ROYLANCE, B.J. and HUNT, T.M., 1999. The Wear Debris Analysis Handbook. Oxford: Coxmoor Publishing Co.
- 6 REEVES, C.W., 1998. The Vibration Monitoring Handbook. Oxford: Coxmoor Publishing Co.