

Module Title Failure Analysis Keywords Material Properties, Complex Stresses, Failure Analysis, Failure Modes, Fracture Toughness, Crack Growth, Creep, Rotating Machinery Faults, Unbalance, Misalignment, Bearing & Gear Faults, Vibration Monitoring, Wear Debris Analysis, NDT, Acoustic Emission	Reference EN4701 SCQF SCQF Level 10 SCQF Points 15 ECTS Points 7.5 Created May 2002 Approved March 2004 Amended August 2011 Version No. 2
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This Version is No Longer Current

The latest version of this module is available [here](#)

Prerequisites for Module

Engineering Analysis 1 (EN3501) or its equivalent

Corequisite Modules

None.

Precluded Modules

None.

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

Mode of Delivery

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

Assessment Plan

	Learning Outcomes Assessed
Component 1	1
Component 2	2,3,4

Component 2 is a closed book examination (70% weighting).

Component 1 is a case-study coursework assessment covering learning outcome 1 (30% weighting).

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

1. Assess the properties of materials and their modes of failure under adverse environmental conditions.
2. Apply the 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.
3. Analyse and evaluate typical operational problems in rotating machinery.
4. Identify and appraise condition monitoring and non-destructive testing techniques as applied to industrial plant.

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

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.

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.

resonance. Condition monitoring methods including vibration. Non-destructive testing methods including acoustic emission.

Indicative Student Workload

	Full	Part
<i>Contact Hours</i>	Time	Time
Assessment	9	9
Lectures	26	26
Tutorials	14	14
<i>Directed Study</i>		
Coursework Preparation	24	24
Directed Self-Study	35	35
<i>Private Study</i>		
Private Study	42	42