Definitive Module Document (DMD)

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Module Code:3ACM0003

Title of Module
Full Title: Mechanics and Properties of Materials
Short Title: Mech & Prop of Matls

MODULE

3ACM0003 (A 05/6)

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Version: 1

Credit Points: 15

Level / ECTS Level: 3

First Offered: 22/9/1997 00-00-00

6. Home Department:
AAD

7. Departments(s) contributing to teaching:

9. Module Aims:

* extend the student's knowledge of the analysis of structural components subjected to complex stress/strain fields.

* enable students to select materials and their processing in a design situation, by matching properties of specific materials with engineering requirements.

* provide an understanding of the possible modes of failure of engineering materials during service.

10a. Learning Outcomes: Knowledge and Understanding:

* identify the types, properties and manufacture of composite materials

* recognise modes of failure in engineering materials

* identify the response of components to complex stresses.

10b. Learning Outcomes: Skills and Attributes:

* examine existing designs and actual components in engineering situations, using methods such as finite element analysis, photoelasticity, non-destructive testing and fractography.

* limit the occurrence of failure in materials by appropriate modelling, design and materials selection.

* apply analytical methods to structural components subjected to complex stress/strain fields.

11. Module Content
11a Module Content:

1.Plate theory- bending of thin plates subjected to pressure loading.

2.Elasticity & Plasticity

3.Composite Materials

4.Viscoelasticity- creep and relaxation

5.Fracture and Fatigue

6.Corrosion

7.Non-Destructive Testing

11b. Further details on how the learning outcomes of the module will be achieved:
1.Plate theory- bending of thin plates subjected to pressure loading.

2.Elasticity & Plasticity

Equilibrium and compatibility conditions for a continuum. Plane stress and plane strain. Stress analysis using photoelastic techniques. Use of strain gauges, computer reduction of laboratory data. Finite Elements- Introduction to basic elements in FE systems and appreciation of their characteristics. Simple problems. Stress concentrations- use of FE systems to evaluate simple stress concentrations; comparison with data sheets and photoelasticity results. Yield criteria for ductile materials. Plastic bending and torsion; residual stresses.

3.Composite Materials

Particle- and fibre-reinforced materials. Theories of strengthening and the micromechanics of fibre-reinforced materials. Types of material, their manufacture and applications. Strength of bonded joints. sandwich panels.

4.Viscoelasticity- creep and relaxationDefinition, stages and theories of creep deformation. Linear and non-linear models for creep behaviour. Relaxation. Steady-state creep laws. Mechanism of creep fracture. Testing and presentation of data. Alloys and ceramics for creep resistance.

5.Fracture and Fatigue

Characteristics and mechanisms of fracture. Ductile and brittle modes of fracture, shear and cleavage modes. Griffith theory, the importance of critical defect size, fracture mechanics. Importance of temperature on mode of fracture, materials for low temperature service. Fatigue S-N data, effects of mean stress, surface finish and environment. Fatigue life prediction, cumulative damage concept. Damage tolerance, prediction of crack propagation under realistic loading.

6.Corrosion

Dry corrosion- mechanisms, oxidation laws, limitation. Aqueous corrosion- mechanisms, localised acceleration. Corrosion prevention- Materials selection, design, cathodic protection, coatings.

7.Non-Destructive Testing

Defects arising during manufacture and service, their causes and prevention. Methods of detecting defects, their uses and limitations.

12. Language of Delivery:
English

13. Language of Assessment:
English

14. Assessment Details (Academic):
Coursework: 40

Exam: 60

Other: Typically, assessment will consist of-·

Group assignment on materials failure (12%)·

Report from one of two laboratory sessions (8%)·

FE analysis from a laboratory session(10%)·

Structural analysis assignment (10%)·

End of course examination (60%)

Passes in both (i) coursework and (ii) overall performance are required

Assessment Notes:

15. Locations(s):

UH HATFIELD

16. Pre and Co-Requisite:
Pre-Requisite

Co-Req

Prohibited

17. Subject Board of Examiner/s:
AERO/CIVIL/MECH ENG L2/3

18. Comments