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P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belagavi)
Second Semester, M.Tech. - Mechanical Engineering (MMDN)
Semester End Examination; May/June - 2018
Fracture Mechanics

Time: 3 hrs   Max. Marks: 100

Note *: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
      ii) Missing data, if any, may be suitably assumed.
      iii) Use of data hand book is permitted.

UNIT - I

1 a. Explain fracture mechanics approach to design and what made this is different from traditional approach? — 10

  b. Explain different NDT methods used in fracture mechanics. — 10

2 a. Derive an expression for fracture strength of a brittle solid containing a crack using Griffith's energy balance criterion. — 10

  b. Discuss in detail the sources of micro and macro cracks in materials. — 10

UNIT - II

3 a. Explain the concept of crack tip plastic zones. Describe Irwin's plastic zone correction. — 14

  b. The fracture toughness of a material is 55 MPa$\sqrt{m}$ yield stress is 515 MPa and modules of elasticity is 70 GPa. The plate has a through thickness central crack of $2a = 15$ mm. Calculate the plastic zone at the fracture and the fracture-stress. Assume plane stress state. — 6

4 a. Explain the methods of determination of stress intensity factors. — 10

  b. Explain Dug-dale approach to determine stress components. — 10

UNIT - III

5 a. Derive an expression to find out energy release rate using :

     i) Soft Loading Method (CLM)

     ii) Rigid Loading Method (CDM) — 16

  b. Write a note on :

     i) Energy release rate

     ii) J-Integral — 4

6 a. Explain R-curve and write the significance of it. — 6

  b. Discuss the effect of thickness on fracture toughness. — 4

  c. Determine the energy release rate for a Double Cantilever Beam (DCB) specimen and also obtain an expression for K_1. — 10

UNIT - IV

7 a. Explain the principle of crack arresting methods. 10

  b. Explain in brief leak before break criteria. 10

8 a. Explain the standard test procedure and specimens for plane strain fracture toughness testing. 12

  b. Explain the modes of fracture failure with neat sketches. 8

UNIT - V

9 a. Explain the factors affecting crack propagation. 10

  b. Explain fail safe mode of fracture and damage tolerance. 10

10a. Explain in brief dynamic stress intensity. 10

  b. Discuss the various stages of crack propagation. 10

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