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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; June - 2027
Fracture Mechanics

*Time: 3 hrs*   *Max. Marks: 100*

Note: i) Answer **FIVE** full questions, Selecting **ONE** full question from each unit.
   ii) Assume suitable missing data if any.

UNIT - I

1 a.	Discuss in detail the sources of micro and macro cracks in material.	10
b.	Derive Airy stress function from equilibrium equation.	10
2 a.	A 3 mm thick tension panel 10 cm wide containing an edge crack of 1 mm yielded at a load of 150 kN. However, at a load of 120 kN, another panel of the same material cracked into two pieces when the crack was 5 mm long. With this information, calculate the yield stress and this information calculate the yield stress and fracture toughness of the material.	10
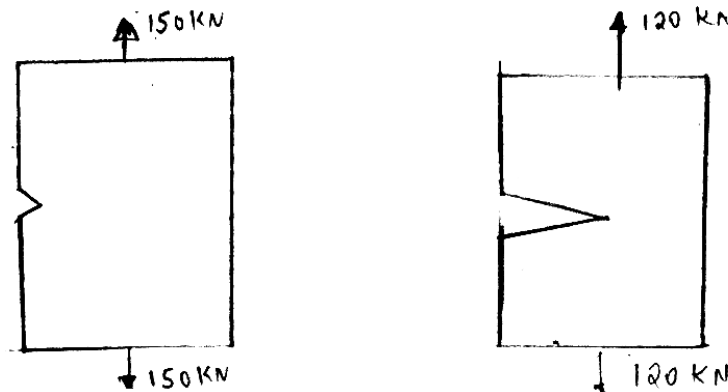
b.	Explain different NDT methods used in detecting the crack.	6
c.	State Griffith's energy balance criterion. Clearly bring out the limitations of this theory.	4

UNIT - II

3 a.	Discuss the effect of thickness on fracture toughness.	6
b.	Explain the concept of crack tip plastic zone. Describe Irwin's plastic zone correction factor.	10
c.	With a neat sketch, explain any one the fracture toughness test as per ASTM Standards.	4
4 a.	With a neat sketch, explain the three basic modes of fracture.	10
b.	Derive an expression for cohesive strength of a solid.	10

UNIT - III

5a.	Define CTOD, explain in brief.	5
b.	Explain with neat sketch of experimental determination of CTOD.	8
c.	List the various factors that influence the fatigue crack growth.	7

6 a.	What is J-integral? Show that the J-integral is path dependent.	10
b.	Derive the relation for non-linear energy release rate for linear elastic mode-1 loading.	10

UNIT -IV

7 a.	What is crack arrest? How it will be implemented in practice. Illustrate with two examples.	10
b.	Explain the concept of leak before break criterion.	10
8 a.	Explain the significance of R-curve and condition under which crack growth occurs.	10
b.	Explain different types of crack branching.	6
c.	Explain the significance of K-R curve.	4

UNIT -V

9 a.	Explain any three fatigue design laws.	10
b.	Explain the factors affecting the crack propagation.	10
10 a.	With neat sketch, explain cyclic crack growth under overload.	10
b.	Explain the mechanism of crack formation.	10

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