USN | | | | | | | | | | | **20MMD14**

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Fracture Mechanics

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of SIF tables are permitted.

Module-1

1 a. Illustrate the importance of fracture mechanics from the design point of view. **(10 Marks)**
   b. Derive the expression for fracture strength of a brittle solid using Griffith energy balance. **(10 Marks)**

OR

2 a. List the important methods used to find cracks in structural components and explain ultrasonic testing. **(08 Marks)**
   b. What is stress intensity factor? Explain with neat sketches three different modes of fracture. **(08 Marks)**
   c. Write a note on Airy's stress function. **(04 Marks)**

Module-2

3 a. Explain: i) LEFM   ii) EPFM. **(04 Marks)**
   b. Determine the expression for effective crack length by Irwin's approach. **(06 Marks)**
   c. With the help of sketch show the plastic zone shape and size according to von-mises condition for plane stress and plain strain. **(10 Marks)**

OR

4 a. What are the constraints on fracture specimen dimensions and fatigue loading? **(04 Marks)**
   b. Explain procedure followed in K_{1c} Test technique. **(06 Marks)**
   c. Neatly sketch the Compact Tension (CT) and Single Edge Notch Bend (SENB) specimen shape and dimensions. **(10 Marks)**

Module-3

5 a. Explain the Griffith's energy criterion for crack growth and derive the expression for energy release rate for double cantilever beam. **(10 Marks)**
   b. What is J-integral? And show that it is path independent. **(10 Marks)**

OR

6 a. Explain: i) Rigidity modulus   ii) Tearing modulus. **(04 Marks)**
   b. What is CTOD? With neat sketch describe it. **(06 Marks)**
   c. Discuss the various parameters affecting the CTOD. **(10 Marks)**

Module-4

7 a. Discuss the influence of crack size on crack growth rate with suitable sketch. **(06 Marks)**
   b. Illustrate the concept of crack branching interms of G, R and crack length (a) with neat sketch. **(14 Marks)**

OR

8 a. Explain the principle of crack arrest with the help of sketch considering G, R and crack length (a). (06 Marks)
   b. Explain crack arrest in bolted joints with the help of neat sketch. (08 Marks)
   c. Explain dynamic fracture toughness. (06 Marks)

Module-5

9 a. Explain Paris law for fatigue crack growth. (04 Marks)
   b. List the factors which affect the fatigue crack propagation and explain any two of them. (10 Marks)
   c. Explain the effect of variable amplitude service loading on crack propagation. (06 Marks)

OR

10 a. Explain: i) Fail safe design ii) Safe-life design. (08 Marks)
   b. Illustrate and explain the regimes of crack growth rate with the help of sigmoidal curve. (12 Marks)

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