Ex/ME/(M1)PE/B/T/423B/2022

B. E. Mechanical Engineering Examination, 2022

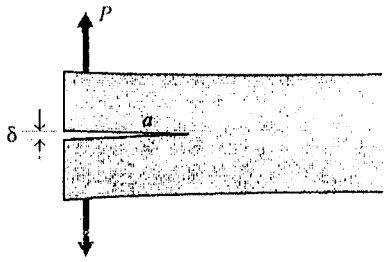
(4th Year, 2nd Semester)

Design for Fracture, Fatigue and Creep

Time : Four hours | Full Marks : 70

Answer any ***five*** questions | 14 x 5 =70

1. a) Derive the expression of failure stress from the concept of atomic theory.
   b) Explain Grifith's condition for crack growth and derive the expression for energy release rate for the following member using compliance.



   c) What is Critical energy release rate G_c?

5+5+4

2. a) Prove that "Value of energy release rate is similar either in Load control or in displacement control".
   b) Show two standard fracture specimen ?
   c) How effect of plasiticity on Stress Intensity Factor at small scale Yielding (SSY) level can be addressed ?

6+4+4

3. a) Explain Failure Assessment Diagram (FAD) for different option.
   b) Explain the procedure for determination of fracture toughness.
   c) What are the parameters on which fracture toughness depends on ?

6+4+4

4. a) What are the fracture parameters used for ductile material.
   b) Describe the design principle using CTOD.
   c) Explain J-R curve in relation crack initiation to unstable crack growth.

3+6+5

5. a) How S-N curve can be used to design for Infinite life and finite life.
   b) Explain the Modified Goodman's failure line and its significance in design.
   c) Explain Haigh diagram.

5+5+4

6. a) Derive the strain-life design equation applicable for both LCF anf HCF.
   b) Explain the non-linear cumulative damage rule by Manson and Halford and show that it can capture effect of load sequence on life .

7+7

7. a) Explain creep curve and the different material important creep properties.
   b) Explain the significance of Larson Miller parameters used in creep.
   c) Describe different material models total strain vs time in creep.

6+4+4