

M.Tech. Mechanical Engineering Design (CBCS) Semester-II
MED25(C) - Fracture Mechanics

P. Pages : 2

Time : Three Hours



GUG/S/25/14201

Max. Marks :70

- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Diagrams and Chemical equation should be given wherever necessary.
 5. Illustrate your answers wherever necessary with the help of neat sketches.
 6. Answer **any five**

1. a) Explain the CTOD and determination of it. Discuss the stable and unstable crack growth depending on CTOD. 7
b) Explain the fracture failure in terms of energy. 7
2. a) What are the three modes of loading in fracture mechanics? Explain with neat sketches. 7
b) Explain Griffith theory of fracture with the help of suitable sketch. 7
3. a) There are two specimens, one with a surface crack and other one with a edge crack. Crack length(2a) is same for both. which specimen is critical and why? 7
b) The half length of cracks in a steel is $2.5\mu\text{m}$ Taking $Y = 200\text{GN m}^{-2}$, estimate the brittle fracture strength at low temperatures , if true surface energy bis 1.5J m^{-2} The actual fracture strength is found to be 1200MN m^{-2} Estimate the difference, if any, between this and your result. 7
4. a) What is 'J-integral'? Explain the significance of J-integral. 7
b) Explain the plane stress and plane strain conditions. What are the recommended specimens for plane strain fracture toughness testing. 7
5. a) What is fatigue according to ASTM standards? Discuss the various variables that affect the S-N curve? 7
b) What are Ductile and Brittle fractures? State their characteristics in detail. 7
6. a) A sample of glass has a crack of half length $3\mu\text{m}$. The Young's modulus of the glass is 80GN m^{-2} and the specific surface energy is 1J m^{-2} Estimate its fracture strength. 7
b) Write short note on following: 7
 - i) Sources of micro and micro cracks.
 - ii) Crack arrest due to dynamic fracture

7. a) List and discuss the various NDT method of testing used in fracture mechanics. 7
- b) Describe the importance of R-curve in fracture analysis. 7
8. a) Explain the effect of plate thickness on fracture toughness. 7
- b) Write short notes on following: 7
- i) Environment assisted cracking.
- ii) Variable amplitude fatigue load.
