PVP 17

Code: **17MEMD2T5A**

I M.Tech - II Semester – Regular/Supplementary Examinations
July 2019

FRACTURE MECHANICS
(MACHINE DESIGN)

Duration: 3 hours Max. Marks: 60

Answer the following questions.

Note: Any missing data can be assumed suitably

1. a) Explain the equivalence of energy approach and stress intensity approach in the theory of fracture mechanics. 8 M

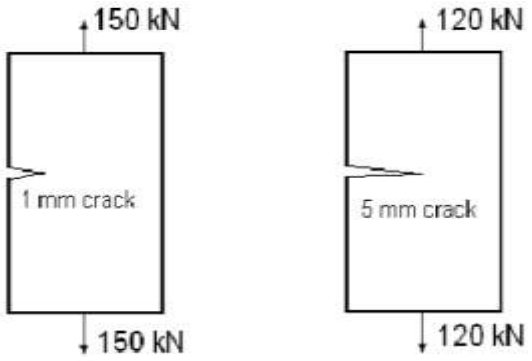
   b) Explain the fracture behavior of any metal by taking suitable example. 7 M

OR

2. a) If the fracture stress of a large sheet of maraging steel, which contains a central crack of length 40 mm, is 480 MPa, calculate the fracture stress of a similar sheet containing a crack of length 100 mm. 5 M

   b) A rectangular perspex plate 600 mm by 300 mm by 6 mm thick is scribed into two equal squares by a knife, leaving a uniform cut of depth 0.3 mm. What is the bending moment required to break the plate if the perspex has a work to fracture of 500 J/m^2? Note that E = 2.5 GPa for Perspex. 10 M

3. A 3 mm thick tension panel 10 cm wide containing an edge crack of 1 mm yielded at a load of 150 kN (as shown in figure below). However, at a load of 120 kN, another panel of same material cracked into two pieces when the crack was 5 mm long. With this information, calculate the yield stress and fracture toughness of the material. Take SIF for the edge crack is $K_I = 1.12\sigma\sqrt{\pi a}$ 15 M



OR

4. a) Explain the test procedure to determine the fracture toughness (K_{IC}) by using 3-point bend specimen. 8 M

b) Explain the effect of plate thickness on fracture toughness. 7 M

5. A circumferentially cracked rotor shaft is transmitting a power of 2 MW. Inspection records indicate current crack depth of 2 mm and the crack growth for this configuration is 1 mm over 5000 hr. What is the expected life of the rotor shaft. Assume the following; Mode III K_{IC} = 10 MPa$\sqrt{m}$, Speed = 420.2 rpm; Diameter of the shaft = 100 mm 15 M

OR

6. Explain the following terms.
a) CTOD b) J-Integral c) R-curves 15 M

7. a) Describe the stress-life approach with relevant equations. 7 M

b) What is LCF. Does the no. of cycles defines the LCF or HCF? Illustrate this using S-N curves. 8 M

OR

8. a) How do you estimate the fatigue in terms of cracked Specimens? 7 M

b) Describe Paris law. In which regions Paris law is applicable? Illustrate it with neat sketch. 8 M