PVP 12

Code: **MEMD1T6A**

I M.Tech-I Semester-Regular Examinations-April 2013

FRACTURE MECHANICS

(MACHINE DESIGN)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. For a semi-infinite crack subjected to tearing (antiplane) mode of deformation assume that the displacement w has the form

$$w = r^{\lambda} f(\theta)$$

Based on this expression for w determine the singular stress and displacement components. 14 M

2. (a.) What are the effect of metallographic aspects on fracture of metals? Explain? 7 M

(b.) What is theoretical cohesive strength of metals? Explain? 7 M

3. A spherical vessel of radius R and thickness t contains a crack of length 2a oriented at an angle w with the meridional direction. When the vessel is subjected to an internal pressure p determine the stress intensity factors at the crack tip. 14 M

4. A cylindrical pressure vessel with internal radius R = 600 mm and thickness B = 20 mm (Fig.a)contains a longitudinal crack of length L = 100 mm and depth a = 2 mm When the vessel is subjected to internal pressure p = 1 MPa determine the stress intensity factor at the crack tip. 14 M

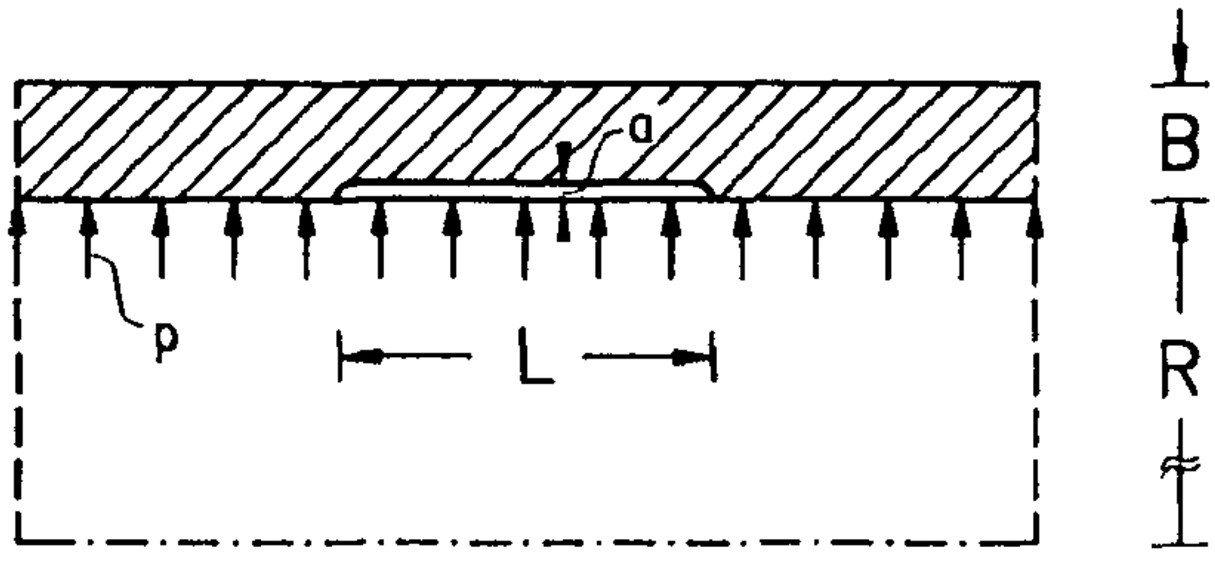

Fig.a

5. (a.) What are the Crack deformation modes? Explain them in detail? 7 M

(b.) Derive the expressions for the singular principal stresses for sliding-mode loading. 7 M

6. Determine the minimum thickness B_{min} and/or crack ligament b_{min} of a three-point bend specimen required for a valid J_{1c}, test according to the ASTM standards for a material with K_{1c}, = 100 MPa $\sqrt{m}$,σ_y = 400 MPa, E = 210 GPa and v = 0.3. Compare the results with those for a valid K_I, test.

14 M

7. What is the significance of CTOD and J in fracture mechanics? Show the equivalence between CTOD and J? 14 M

8. A plate of thickness 20 mm with a crack of length 50 mm is subjected to displacement controlled loading. The crack starts to grow at a displacement u = 10 mm and continues to propagate under constant displacement until the crack length is 100 mm, when it stops. At the beginning of crack growth the load was measured to be 2 kN and at crack arrest 1.5 kN. Calculate the elastic strain energy released during crack growth. 14 M