PVP 12

Code: **MEMD1T6A**

I M.Tech - I Semester – Regular/Supplementary Examinations
April, 2015

FRACTURE MECHANICS
(MACHINE DESIGN)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) State stress-strain relations for three-dimensional elastic Behavior. 4 M

   b) Derive bi-harmonic equation $\nabla^4\phi = 0$ for 2D using theory of elasticity approach for stress analysis. $\phi(x,y)$ is Airy's stress function. 10 M

2. a) Discuss the dislocation theories of brittle fracture. 7 M

   b) Define theoretical cohesive strength and derive an expression for theoretical cohesive strength by assuming the cohesive force curve as sine curve. 7 M

3. Discuss the applications of following fracture parameters in mechanical design.
   a) Stress Intensity factor (K) 7 M
   b) Crack Tip Opening Displacement (CTOD) 7 M

4. a) Define energy release rate (G). Determine the energy release rate for a cantilever beam. 8 M

b) Discuss the concept of R-curves. 6 M

5. a) A steel plate with a through thickness crack of length $2a = 20$mm is subjected to a stress of 400 MPa normal to the crack. If the yield strength of the steel is 1500 MPa, what is the plastic zone size and the stress intensity factor for the crack. Assume that the plate is infinitely wide. 8 M

b) Discuss the relationship between K and G. 6 M

6. a) Define J-integral. Explain the characteristics of J integral. 7 M

b) Discuss the equivalence between G and J. 7 M

7. a) Discuss the significance of CTOD. 6 M

b) Establish the relationship between CTOD, G and K_I. 8 M

8. What is critical energy release rate? Discuss the experimental determination of critical energy release rate of an interlaminar crack for mode-I with a neat sketch. 14 M