

Bachelor of Mechanical Engineering  
4th year 2nd semester Examination 2017

Subject : Elements of Fracture Mechanics

F.M. 100

Time : 3 hrs

Answer any five questions

- 1 (a) Deduce the expression of theoretical cohesive strength.  
(b) What are the limitations of Griffith's criteria and why ?  
(c) What do you mean by Orwan's correction ? What is its importance ?  
(d) What is strain energy release rate ? 10+4+4+2
- 2 (a) Explain Stress intensity factor. What is meant by Geometry Factor, Y ?  
(b) What is critical stress intensity factor ? Why is it called plane strain fracture toughness ?  
(c) Briefly discuss various techniques of measuring  $K_{Ic}$ . 6+6+8
- 3 (a) What do you mean by R-curve ? What are the reasons behind R-curve behavior ?  
(b) What is crack arrest ?  
(c) Briefly discuss the toughening mechanisms. 6+4+10
4. (a) A structural component in the shape of a flat plate 12.5 mm thick is to be fabricated from an alloy having yield point 350 MPa and plane strain fracture toughness as  $33\text{MPa}\sqrt{\text{m}}$ . If  $Y=1.75$ , assume a design stress as half the yield stress and find out whether it is possible to compute critical crack length of a surface flaw.  
(b) What do you mean by  $K_{\text{effective}}$  ? What is etch pit experiment ?  
(c) An infinitely large plate is subjected to a nominal stress of 350MPa. It has a central crack 5 cm long and yield stress is 500 MPa. Calculate the stress intensity factor at the crack tip and also the radius of the plastic zone at crack tip.

8+4+8

- 5 (a) What is the effect of strain rate on ductile brittle transition temperature and why ?  
(b) Explain steps of MVC.  
(c) What are the basic mechanisms of fracture in polymers ?  
(d) What do you mean by mirror-mist-hackle zone ? What is its importance ?  
(e) Explain transgranular and intergranular fracture. 4X5

6. (a) What is Paris Law ?  
(b) How can we use for life prediction of a component, subjected to cyclic loading ?  
(c) What is meant by persistent slip band ?  
(d) What is extrusion-intrusion model ?  
(e) What is the effect of grain size on creep deformation and fracture and why ?  
(f) What is stress corrosion cracking ? 3+4+4+3+4+2