

**MASTER OF MECHANICAL ENGINEERING EXAMINATION, 2017**

( 2nd Semester )

**DESIGN FOR FRACTURE, FATIGUE AND CREEP**

Time : Three hours

Full Marks : 100

Answer *any five* questions

1. a) Discuss the need of fracture mechanics in design.  
 b) Discuss the condition of unstable crack growth.  
 c) Why plane strain condition is required to measure  $K_{IC}$ .  
 d) Explain the dependence of fracture toughness on specimen geometry. .  
 4 + 5 + 6 + 5
2. a) Discuss the principle and method of assessing fracture toughness in ductile to brittle transition Zone.  
 b) Describe the  $J_{IC}$  measurement method and mention the shortcomings .  
 c) How J-R curve is measured experimentally ?  
 8 + 6 + 6
3. a) Explain FAD at different levels and its application in design.  
 b) Why the value of  $J_Q$  is determined?  
 c) How crack growth is measured?  
 10 + 5 + 5
4. a) Give the definition of fatigue failure.  
 b) Discuss the concept of defect tolerant approach of fatigue design.  
 c) How fatigue crack growth curve is generated?  
 d) Derive the equation for fatigue crack growth curve?  
 4 + 6 + 5 + 5
5. a) Discuss the principles of defect free design concept of fatigue design ?  
 b) Compare the aspects of cyclic stress – strain curve with a monotonic curve.  
 c) What is meant by cyclic hardening and cyclic softening?  
 5 + 10 + 5
6. a) Discuss the in detail the principles of strain – life equation for LCF, HCF and also for combined .  
 b) Discuss the effect of mean stress and notch effect in fatigue life.  
 c) Describe the sequence of operations for assessment of a flaw.  
 10 + 6 + 4
7. a) Define creep in detail.  
 b) Draw and discuss the aspects of a creep curve. Derive the creep equation for combined dependence of temperature and stress.  
 c) How creep fatigue interaction can be modelled.  
 4 + 8 + 8
8. Write short notes on any four : 4 X 5 = 20  
 a) rupture test for creep b) effect of metallurgical parameters on fatigue c) Miner's rule  
 d) S-N curve e) Statistical nature of fracture toughness. f) fatigue design based on crack growth.