Roll No. .....

22241

M. Tech. 3rd Sem. Mechanical Engg. (Machine Design) Examination–May, 2015

MECHANICAL BEHAVIOUR OF MATERIALS

Paper : M-821-A

Time : 3 hours ***Max. Marks : 100***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard will be entertained after the examination.

Note : Attempt any **five** questions.

1. (a) With the help of neat sketches explain the three modes of crack deformation. (10)

(b) Discuss about stress concentration factors. (10)

2. (a) Draw a unit cell for an HCP crystal. Show the perfect dislocations in the base plane. Can they decompose into partials ? If so, represent them by the special notation for dislocations. (10)

(b) How is the yield stress influenced by strengthening from grain boundaries ? (10)

3. (a) Explain the construction of S-N curves for ferrous and non-ferrous metals. (10)

(b) A steel bar is subjected to an axial load that varies from 400 KN tension to 200 kN compression. The mechanical properties of steel are σ_u =1100 N/mm², σ_0=1000 N/mm² and σ_e = 500 N/mm². Determine the bar diameter for infinite life based on a safety factor of 2.5. Use Goodman's theory. (10)

4. Explain the following factors affecting the surface of a fatigue specimen. (20)

(i) Surface roughness

(ii) Changes in surface properties

(iii) Surface residual stress

5. Explain the creep curve and Sketch the creep curve with the three steps of creep. What is Andrade's Analysis ? (20)

6. (a) Explain the Griffith's theory of brittle fracture with relevant diagram. (10)

(b) Give a brief account on high temperature fracture. (10)

7. (a) Explain the Micro mechanisms of fatigue damage. (10)

(b) What do you mean by Larson-Miller parameter ? Also determine the stress required for failure in 10^5 hours at temperatures of 650^0C and 870^0C. (10)

8. Write short note on any **four** of the following : (5×4=20)

(a) Effect of metallurgical impurities

(b) Flow and fracture under rapid loading

(c) Temper and hydrogen embrittlement

(d) Dislocation climb and jog

(e) Creep parameters and practical applications
