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**B.E.(FULL-TIME) DEGREE ARREAR EXAMINATIONS, NOV/DEC 2013
MATERIALS SCIENCE AND ENGINEERING**

**FOURTH SEMESTER
(REGULATIONS 2008)**

8

ML 9251 - MECHANICAL METALLURGY

Time : 3 Hours

Answer ALL Questions

Max. Marks : 100

PART - A (10 X 2 = 20 Marks)

1. Define burger vector. Mention its direction with respect to pure screw and pure edge dislocation lines.
2. Distinguish dislocation climb and dislocation glides.
3. Mention the significance of equi-cohesive temperature in grain boundary strengthening.
4. What do you understand by Bauschinger effect?
5. What is cup and cone fracture?
6. Define Plane-strain fracture toughness.
7. Differentiate HCF and LCF tests.
8. Write down Basquin's strain-life equation
9. Distinguish creep and stress rupture tests.
10. What is activation energy? Mention its role in creep.

PART - B (5 X 16 = 80 Marks)

11. (i) Describe solid solution strengthening and explain the mechanism of interaction of solute atoms with dislocation. (12)

(ii) Write a brief note on yield point phenomenon (4)

12. a) i) Determine whether the dislocation dissociation reaction is feasible

$$a/2 [0 \bar{1} 1] = a/6 [1 \bar{2} 1] + a/6 [\bar{1} \bar{1} 2] \quad (6)$$

ii) Describe the characteristics of Edge and Screw dislocations. (10)

(OR)

b) Write a brief note on i) The stress field associated with screw dislocation (10)

ii) Dislocation pile-up (6)

13. a) i) Explain the Griffith's criteria for the crack propagation and also obtain Griffith equation for plane-strain condition. (12)

ii) Discuss Orowan's modification in Griffith equation for brittle fracture in metals. (4)

(OR)

b) Obtain an expression for Crack opening displacement (COD) for a crack length $2a$ in an infinite thin plate subjected to uniform tension σ .

14. (a) (i) Discuss briefly the factors influencing the endurance limit. (6)

(ii) Derive an expression for calculating the number of cycles from the smallest crack that can be detectable to grow upto the critical crack length. (10)

(OR)

14. (b) (i) Explain the method of evaluating the fatigue limit and the significance of S-N curve. (10)

(ii) Write a brief note on factors affecting fatigue limit. (6)

15. a) Discuss the method of evaluating the creep strength and explain the behavior of metals at constant loads and the data extrapolation method.

(OR)

b) What do you understand by Deformation mechanism map? Explain the mechanisms of creep deformation.