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B.E. / B.Tech DEGREE ARREAR EXAMINATIONS NOV / DEC 2012

MATERIALS SCIENCE & ENGINEERING BRANCH

FOURTH SEMESTER

ML-9251 – MECHANICAL METALLURGY

(REGULATIONS 2008)

Time : 3 hrs.

Max. Mark : 100

- Instructions :
1. Read questions carefully. Write 'to the point' answers
  2. Question Nos. 1 to 11 are compulsory

Answer ALL Questions

Part – A (10 x 2 = 20 Marks)

1. Draw an engineering stress-strain curve and show significant points on it.
2. What is a slip system? Give example.
3. What are the differences between ductile and brittle fracture?
4. What are the differences between edge and screw dislocation?
5. State 'Hume-Rothery rule' for substitutional solid solution.
6. Define high cycle fatigue (HCF).
7. What is fiber strengthening?
8. Draw S-N curve for any one of the followings: i) aluminium or, ii) steel.
9. With a neat sketch demonstrate the operation of 'Frank-Read source'.
10. What is endurance limit?

Part – B (5 x 16 = 80 Marks)

11. Write short notes on any four of the followings: (4x4=16)  
(i) Burger's circuit, (ii) Screw dislocation, (iii) Dislocation loop, (iv) Double cross-slip, (v) Critical resolved shear stress (CRSS).
12. (a) (i) Discuss the structural features of fatigue in detail. (8)  
(ii) What are the effects of the followings on the fatigue behaviour?  
(A) surface roughness, (B) surface residual stress, (C) grain size and (D) temperature (8)

OR

- (b) (i) State 'Paris law' and explain it with the help of a crack growth rate ( $da/dN$ ) vs.  $\Delta K$  plot.  
(ii) Write short notes on (A) corrosion fatigue and (B) thermal fatigue. (8+4+4)

13. (a) Write brief notes on any four of the followings:

- (i) Point defects, (ii) Dislocation-climb, (iii) Stacking faults, (iv) Multiplication of dislocation,  
(v) Dislocation pile-up. (4x4)

OR

- (b) (i) With respect to annealing discuss the followings: (3x3)  
(A) Recovery, (B) Recrystallization, (C) Grain growth.  
(ii) Explain *precipitation hardening* in detail. (7)

14. (a) Write short notes on any four of the followings:

- (i) Charpy testing, (ii) Creep testing, (iii) Stress rupture testing, (iv) Fatigue testing, (v)  
Hardness testing. (4x4)

OR

- (b) (i) What are the various slip systems in (i) fcc, (ii) bcc and (iii) hcp lattices? (8)  
(ii) Derive an expression for the '*forces on dislocation*'. (8)

15. (a) (i) Write short note on (A) crack tip opening displacement and (B) mode-I fracture toughness. (8)

- (ii) Discuss *drop weight test* with respect to specimen size, test procedure, fracture surface analysis and result. (8)

OR

- (b) (i) Derive an expression for the theoretical cohesive strength of metals. (8)  
(ii) Explain Griffith theory of brittle fracture and derive the Griffith equation. (8)

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