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B.E / B.Tech ( Full Time ) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2013

Materials Science & Engineering  
II Semester  
ML 9251 – Mechanical Metallurgy  
(Regulation 2008)

5

Time: 3 Hours

Max. Marks 100

Answer ALL Questions

**PART-A (10 x 2 = 20 Marks)**

1. How direction vector and burger vector arranged in Screw dislocation?
2. Why critically resolved stress of FCC metals is low?
3. Write Hall - Petch relation.
4. What is the effect of carbon and nitrogen on Lower yield point?
5. State the effect of grain size on Ductile- brittle transition temperature.
6. What is J integral?
7. Mention any two methods to improve fatigue resistance of materials.
8. Define endurance ratio. (ie. Fatigue ratio).
9. How TD( thoria –dispersed) nickel has adequate creep resistance upto  $0.7T_m$ ?
10. What is Equicohesive temperature?

**PART – B ( 5 X 16 = 80 Marks)**

11.(a) (i) Calculate the line energy of dislocations in BCC iron. The burgers vector in iron is of the  $\frac{1}{2} \langle 111 \rangle$  type. The shear modulus of iron is  $80.2 \text{GN m}^{-2}$ . (BCC iron  $a = 2.89 \text{\AA}$ ). (6)

(ii) Determine whether the dislocation dissociation reaction is feasible.

$$b_1 = b_2 + b_3$$

$$\frac{a}{2} [0 \bar{1} 1] = \frac{a}{6} [1 \bar{2} 1] + \frac{a}{6} [\bar{1} \bar{1} 2] \quad (10)$$

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12 (a)(i) Explain strain aging. (8)

(ii) Explain interaction of solute atoms with dislocations by long range order interaction. (8)

OR

(b) Explain precipitation hardening effect of strengthening crystalline materials to increases the stress required to move a dislocation. (16)

13.(a)(i) Derive the equation of Griffith's theory of brittle materials. (10)

(ii) What is the critical crack length in iron according to the Griffith –Orowan equation if  $y_p \sim 10\text{J/m}^2$  ?  $E = 205\text{ GPa}$ ,  $\sigma_c = 900\text{MPa}$ . (6)

OR

(b) (i) Illustrate briefly the modes of loading. (6)

(ii) What is  $K_{IC}$  and describe the determination of  $K_{IC}$  by plane – strain toughness testing. (10)

14.(a) What are the factors affecting fatigue? Explain any two factors briefly. (16)

OR

(b) Write short notes on  
(i) Low cycle fatigue (8)

(ii) Thermal fatigue (8)

15.(a) (i) Draw Creep curve and explain its stages. (10)

(ii) Write short notes on High temperature materials (6)

OR

(b) Describe the mechanism of creep that becomes important, as the temperature of deformation is progressively increased. (16)

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