B.E. METALLURGICAL ENGINEERING, THIRD YEAR, SECOND SEMESTER EXAM 2017 (Old)

Subject: TESTING OF MATERIALS & QUALITY CONTROL

Time: Three Hours   **Full Marks: 100**

(Answer Question No. 1 and any four from the rest; All parts of a question should be answered chronologically)

Q 1. Answer any five from the following with justification: 4 x 5 = 20

(a) Brinell hardness of a material is load dependent

(b) Hardness testing method of Gray Cast Iron

(c) Influence of gauge length in tensile elongation

(d) Role of grain size on creep deformation resistance of a material

(e) Role of grain size on impact toughness of a material

(f) Effect of corrosive medium on fracture toughness of material

(g) Effect of strain rate on equicohesive temperature

Q 2. (a) If a true stress-true strain curve is given by $\sigma = 1250\varepsilon^{0.27}$, where stress is in MPa, what is the ultimate tensile strength of the material?

(b) Write down the equation correlating flow stress with strain rate sensitivity. Using this equation determine the change in flow stress for commercially pure aluminium for a two-order of magnitude change in strain rate at 25°C and 440°C. The values of C at these two temperatures are 70.30 MPa and 14.50 MPa; and values of m at these temperatures are 0.066 and 0.211.

(c) What is superplasticity? In what type of material microstructure superplasticity is observed?

(d) On what factor does tensile uniform elongation of a material depend? – Explain.   5+6+3+2+4 = 20

Q 3. (a) What is universal slope equation and what is its utility? How the universal slope equation is related with Coffin-Manson and Basquin relationship?

(b) "True fatigue endurance behavior is not observed in all types of materials" – Justify.

(c) Discuss the effect of mean stress on fatigue endurance behavior.

(d) What is the similarity between fatigue endurance limit and threshold stress intensity range for fatigue crack growth?   3+2+5+5+5 = 20

Q 4. Write short notes on the following:

(a) Vickers hardness testing method; (b) Non-destructive inspection by liquid dye penetration method; (c) Wood's model for fatigue crack growth.   7+6+7 = 20

Q5. (a) Discuss cumulative fatigue damage phenomenon.

(b) After giving an example justify the creep phenomenon occurring at room temperature.

(c) Arrange in increasing order of creep resistance of a material with justification –

(i) Single crystal; (ii) polycrystal; (iii) Directionally solidified crystal

(d) Discuss the effect of specimen size on fatigue performance.   6+4+5+5 = 20

Q 6. (a) Draw and explain the nature of constant load creep curve of a material.

(b) What are the ways to improve the fatigue strength of a material – discuss.

(c) Why does fatigue failure start from the surface even in case of push-pull uniaxial cyclic loading of very good surface finish.

(d) How can you prove that tensile yield strength is a material property?   6+6+4+4 = 20