B.E. METALLURGICAL ENGINEERING, SECOND YEAR, SECOND SEMESTER EXAM 2017
SUBJECT: MECHANICAL TESTING OF MATERIALS

Time: Three Hours   Full Marks: 100

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

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

(a) Whether gauge length of tension test specimen has any influence on uniform elongation?

(b) For a particular steel sample whether tensile yield strength would depend on the specimen cross sectional area?

(c) Whether grain size of a steel sample has any role on impact toughness?

(d) Which hardness testing method would you select for measuring the hardness of Grey Cast Iron?

(e) Between fine and coarse grain size what will be your recommendation for good creep resistance of a material?

(f) Why does fatigue failure start from the surface of a specimen under push-pull condition?

Q 2. (a) Give instruction to a machinist-cum-operator in steps for doing tensile test out of round bar of 16 mm diameter and tabulate the required tensile properties. Consider that the machinist-cum-operator will follow the steps that you mention.

(b) What is impact transition temperature? How would you determine the impact transition temperature of a metal?   12 + 8

Q 3. (a) What is the condition for tensile instability? Derive the condition.   2 + 6

(b) Which property of a material dictates the uniform elongation in tensile test and how? Derive the relationship showing the equality between tensile uniform elongation and the property that controls it.   2 + 6

(c) What is the necessity for true strain in case of uniaxial deformation?   4

Q 4. (a) What is meant by strain rate sensitivity of a material? – discuss.   4

(b How would you experimentally determine the strain rate sensitivity of a material?   6

(c) What is Zener-Hollomon parameter? What is the importance of this parameter?   3

(d) Draw a schematic constant load creep curve and explain the nature of the curve.   7

Q 5. (a) What is Coffin-Manson relationship? How would you extract the data required for Coffin- Manson plot?   2 + 5

(b) Schematically draw and explain the effect of stress ratio on S-N curve.   4

(c) A steel bar is subjected to a fluctuating axial loa that varies between +300 kN and -100 kN. The mechanical properties of the steel are: σ_u = 1000 MPa; σ_o =900 MPa; and σ_e = 425 MPa. Determine the bar diameter to give infinite fatigue life based on a safety factor of 2.0.   5

(d) Explain the effect of specimen size on rotating bending fatigue life.   4

Q 6. Write short notes on the following:

(a) Drop weight test; (b) Vickers Hardness Testing method; (c) Equicohesive temperature; (d) Resilience.
                                                                                                                          5+6+5+4

Q7. (a) What is Larsen-Miller parameter and what is the utility of this parameter? Derive the Larsen-Miller parameter.
                                                                                                                          2+2+5

(b) Prove that in case of tensile tests the condition of tensile instability can be expressed as: $\frac{d\sigma}{de} = \frac{\sigma}{1+e}$ 6

(c) Write a short note on "Goodman Diagram".   5