B.E. / B.Tech. (Full Time) DEGREE ARREAR EXAMINATIONS NOV / DEC 2012

MATERIALS SCIENCE & ENGINEERING BRANCH

SIXTH SEMESTER

ML-9352 – CREEP & FATIGUE BEHEVIOUR OF MATERIALS

(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. Define anelasticity.
2. What is creep?
3. Define high cycle fatigue (HCF).
4. What is endurance limit?
5. Define stress ratio.
6. State Basquin's equation.
7. What are fatigue striations?
8. Define stress intensity factor, K.
9. Name four creep resistant alloys.
10. What is equi-cohesive temperature (ECT)?

Part – B (5 x 16 = 80 Marks)

11. (i) Draw a *creep curve* and explain the various stages of it. (8)

(ii) Discuss the various mechanisms of creep deformation with respect to various stress and temperature levels. (8)

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. ΔK plot.

(ii) Write short notes on (A) *corrosion fatigue* and (B) *thermal fatigue*. (8+4+4)

13. (a) Write brief notes on <u>*any four*</u> of the followings: (4x4)

(i) Dislocation pile-up, (ii) Dislocation-climb, (iii) Double cross slip, (iv) Multiplication of dislocation, (v) Critical resolved shear stress.

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)

14. (a) Write short notes on <u>*any four*</u> of the following: (4x4)

(i) Charpy testing, (ii) High temperature alloys, (iii) Fractography, (iv) Fatigue testing, (v) Superplasticity.

OR

(a) Write short notes on <u>*any four*</u> of the followings: (4x4)

(i) Low cycle fatigue, (ii) S-N curves, (iii) Goodman diagram, (iv) Stress cycles, (v) High temperature fatigue.

15. (a) (i) Discuss in detail the '*structural changes during creep*'. (8)

(ii) Draw a 'deformation-mechanism map' in a stress vs. temperature plot and indicate the dominant creep deformation mechanisms. (8)

OR

(b) With respect to creep failure, Explain

(i) how the engineering creep data are presented? (3)

(ii) how a creep damaged surface can be analysed? (5)

(ii) typical microstructural features of the creep damaged surface. (8)

****** ****** ******