

Total Pages—5

(Set-R₂)

B.Tech-6th

Testing of Materials

Full Marks : 70

Time : 3 hours

**Q. No. 1 is compulsory and answer five
from Q. Nos. 2 to 8**

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2 × 10
- (a) Explain the difference between true elastic limit and proportional limit.
 - (b) Derive the relation between true strain and engineering strain.
 - (c) Draw schematic tensile curves for “pure AL” and “Plain Carbon Steel” on the same diagram. (N.B. : Identify the differences between 2 curves)
 - (d) For the same material tensile test is done on a (i) screw driven machine and (ii) Hydraulic

(Turn Over)

(2)

machine. Machine cross-head movement is used to determine the sample elongation. Explain the differences expected between 2 curves.

- (e) Write down the stress states during (i) tensile test and (ii) torsion test.
- (f) Name the different hardness scales. Which scales are load dependent-identify ?
- (g) Schematically draw brittle and ductile fracture in a uniaxial tensile sample.
- (h) Draw a schematic curve showing fatigue crack growth. Identify the different stages of growth.
- (i) Schematically draw creep curves for (i) constant load test and (ii) constant stress state.
- (j) The axle of a car needs to be checked for surface cracks, internal cracks. What NDT methods will you use ?

(3)

2. (a) Derive the relation between total strain rate, plastic strain rate and elastic modulus of a tensile testing machine. Given that V is the cross-head velocity, A is the cross-section of specimen, L is the gauge length, E is the elastic modulus of specimen. 5
- (b) Using above relation explain why elastic modulus of specimen cannot be measured using cross-head displacement. 5
3. (a) Explain why Vickers hardness is independent of load while Brinell hardness is not. 5
- (b) At very low loads (< 100 gmf) VHN is found to be load dependent. Explain why it is so. 5
4. (a) A steel plate with a through thickness crack of $2a = 25$ mm is subjected to a stress of 350 MPa normal to the crack. If the y.s. of steel is 1000 MPa, what is the plastic zone size and stress intensity factor for the crack. Assume that the plate is infinitely wide. 5

(4)

- (b) Schematically show the different crack deformation modes during fracture mechanics testing. 5
5. (a) Draw the flow diagram for a pulse-echo UT system. 5
- (b) Can you use UT system to identify surface and sub-surface defects? Answer with proper explanation. 5
6. (a) Derive the condition for necking during tensile testing (uniaxial). 5
- (b) Discuss effect of sample size on total elongation measured. 5
7. (a) Draw a S-N curve and identify the following (i) LCF region (ii) HCF region and (iii) fatigue limit. 5
- (b) Discuss the different methods to improve fatigue life of a material. 5

(5)

8. Draw the flow-charts for the following NDT processes : $2\frac{1}{2} \times 4$

- (a) Magnetic powder inspection
 - (b) Radiographic testing
 - (c) Dye penetration and
 - (d) Visual testing.
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