



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

MATERIAL SCIENCE AND ENGINEERING BRANCH

THIRD SEMESTER

ML 9203 – STRENGTH AND TESTING OF MATERIALS

(REGULATIONS 2008)

Time : 3 hrs

Max Marks : 100

Instructions: 1. Assume any relevant data if found necessary

Answer ALL Questions

3

Part – A (10 x 2 = 20 Marks)

1. Define factor of safety.
2. Explain the concept of double shear with sketches.
3. Find the reaction of a simply supported beam of length 'L' m subjected to a clockwise moment of 'M' kNm at its midspan.
4. What is slenderness ratio?
5. Give the maximum deflection of a cantilever beam of length 'L' m with a uniformly distributed load of w kN/m.
6. List out the factors affecting the shape and magnitude of the stress-strain curve of mild steel.
7. What is proof stress?
8. Give the formula for Vickers's hardness.
9. What is the nature of stress induced in every cross section of a shaft when it is subjected to twisting moment?
10. What is the function of springs?

Part – B (5 x 16 = 80 Marks)

11. In a tensile test, a piece of 30 mm diameter and 100 mm gauge length is stretched 0.1 mm under a pull of 30 kN. In a torsion test, the same rod is twisted 0.02 radian over a length of 175 mm by applying a torque of 500 Nm. Determine the Poisson's ratio, Young's modulus, Bulk modulus and Rigidity modulus of the material of shaft. (16)
12. (a) A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column, if it has to carry a safe load of 250 kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take Rankine's constant as $1/1600$ and maximum compressive stress as 550 N/mm^2 . (16)

(OR)

- (b) Draw the shear force and bending moment diagram indicating the salient points for the loaded beam as shown in figure. (16)

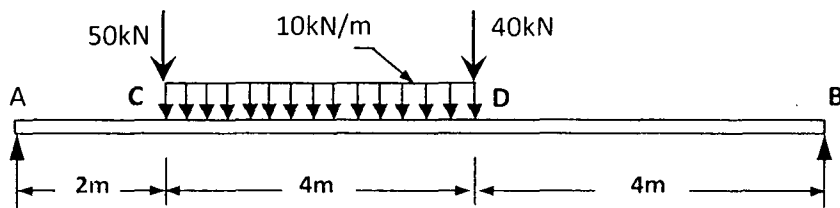


Fig.12b

13. (a) Explain in detail the effect of strain rate and temperature on flow properties. (16)

(OR)

- (b) Describe in detail the factors that affect the tensile properties of steel. (16)

14. (a) (i) Give the relationship between hardness and flow curve? (4)

- (ii) Explain in detail the different types of impacts tests with sketches. (12)

(OR)

- (b) A single overhanging beam AC of 8 m length rests on supports A and B, 6 m apart. A load of 30 kN acts at the free end C and a uniformly distributed load of 20 kN/m for a length of 3 m starting at a distance of 1 m from end A. Determine the deflection at free end C and the maximum deflection between A and B. Take Young's modulus as 200 kN/mm^2 and moment of inertia as $45 \times 10^6 \text{ mm}^4$. (16)

15. (a) (i) A solid circular shaft of 3 m length and 200 mm diameter is subjected to a torque of 100 kNm. Find the relative rotation between the end cross sections of the shaft. Assume modulus of rigidity as $1 \times 10^5 \text{ N/mm}^2$. (6)

- (ii) A solid aluminium shaft 100 m long and 50 mm diameter is to be replaced by a hollow steel shaft of same length and same outside diameter, so that the shaft could carry the same torque and same angle of twist over the same length. What must be the inner diameter of the hollow shaft? Take modulus of rigidity of steel and aluminium as $0.85 \times 10^5 \text{ N/mm}^2$ and $0.28 \times 10^5 \text{ N/mm}^2$ respectively. (10)

(OR)

- (b) A closely coiled helical spring is subjected to an axial load of 300 N having 12 coils of wire diameter of 16 mm, and made with coil of 250 mm. Determine the axial deflection, strain energy stored, maximum torsional shear stress in the wire and the maximum shear stress using Wahl's correction factor. Take modulus of rigidity as 80 GN/m^2 . (16)