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Question Paper Code: 41745

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Mechanical Engineering

14UME405 - STRENGTH OF MATERIALS

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The ratio between the change in volume and original volume of the body is called _____ strain
(a) tensile (b) compressive (c) shear (d) volumetric
2. When a bar is subjected to change of temperature and its deformation is prevented, which of the following stresses is induced?
(a) thermal (b) shear (c) tensile (d) compressive
3. Which of the following are the statically determinate beams?
(a) Cantilever (b) SSB
(c) Overhanging beams (d) All of the above
4. In a cantilever with uniformly distributed load the shearing force varies following a
(a) Linear law (b) Parabolic law (c) Either (a) or (b) (d) None of these
5. The shafts are designed on the basis of _____
(a) Strength (b) Rigidity (c) Either (a) or (b) (d) Both (a) & (b)

6. What type of stress is induced in the helical spring wire when it is subjected to compressive load
(a) compressive (b) shear (c) tensile (d) none of these
7. The amount of deflection of a beam subjected to some type of loading depends upon
(a) cross-section (b) bending moment
(c) either (a) or (b) (d) both (a) and (b)
8. The slope and deflection at a section in a loaded beam can be found out by
(a) double integration (b) moment area
(c) macaulay's (d) any of the above
9. Which of the following are usually considered as thin cylinders
(a) Boilers (b) Tanks
(c) Steam pipes (d) All of the above
10. Vessels used for storing fluid under pressure are called
(a) cylinders (b) spheres (c) shells (d) none of these

PART - B (5 x 2 = 10 Marks)

11. Mention the relationship between the modulus of elasticity, modulus of rigidity, modulus of elasticity and bulk modulus.
12. Sketch the bending moment diagram of a cantilever beam subjected to UDL over the entire span.
13. Why hollow circular shafts are preferred when compared to solid circular shafts?
14. What is the relation between slope, deflection and radius of curvature of a beam?
15. Define Hoop Stress and longitudinal stress.

PART - C (5 x 16 = 80 Marks)

16. (a) A solid circular bar of diameter 20 mm when subjected to an axial tensile load of 40 kN, The reduction in diameter of the rod was observed as 6.4×10^{-3} mm. The bulk modulus of the material of the bar 67 GPa. Determining the following:
- (i) Young's modulus
(ii) Poisson's ratio

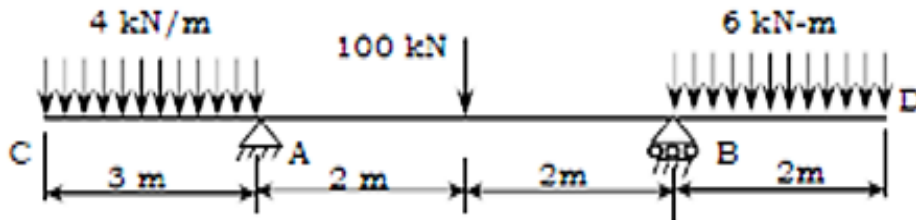
- (iii) Modulus of rigidity
- (iv) Change in length per meter
- (v) Change in volume of the bar per metre length. (16)

Or

- (b) A steel tube of 20mm internal diameter and 30mm external diameter encases a copper rod of 15mm diameter to which it is rigidly joined at each end. If the temperature of the assembly is raised by 80 °C. Calculate the stresses produced in the tube. $E_s=2 \times 10^5 \text{ N/mm}^2$, $E_c=1 \times 10^5 \text{ N/mm}^2$, Co-efficient of linear expansion of steel and copper are 11×10^{-6} per °C and 18×10^{-6} per °C. (16)
17. (a) A simply supported beam of span 8 m long is subjected to two concentrated loads of 24kN and 48kN at 2m and 6m from left support respectively. In addition it carries a UDL of 36kN/m over the entire span. Draw the shear force and bending moment diagrams. Mark the salient points. (16)

Or

- (b) Analyze the given structure and draw the shear force and bending moment diagram. (16)



18. (a) A solid circular shaft transmits 75 kW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in a shaft length of 2m and shear stress is not to exceed 50 N/mm². Take $G = 100 \text{ kN/mm}^2$. (16)

Or

- (b) A close coiled helical spring is to have a stiffness of 1.5N/mm of compression under a maximum load of 60N. The maximum shearing stress produced in the wire of the spring is 125N/mm². The solid length of the spring is 50mm. Find the diameter of coil, diameter of wire and number of coils. $C=4.5 \times 10^4 \text{ N/mm}^2$. (16)

19. (a) A cantilever beam with a span of 3 m carries a point load of 35 kN at a distance of 2 m from the fixed end. Determine the slope and deflection at the free end and at the point where the load is applied. Take $I = 11924\text{ cm}^4$ and $E = 200\text{ GN/m}^2$. (16)

Or

- (b) Find the Euler critical load for a hollow cylindrical cast iron column 150 mm external diameter, 20 mm wall thickness if it is 6 m long with hinged at both ends. Assume young's modulus of cast iron as 80 kN/mm^2 . Compare this load with that given by Rankine formula. Using Rankine Constants $\alpha = 1/1600$ and 567 N/mm^2 . (16)
20. (a) A cylindrical shell 3 m long, 1 m internal diameter and 10 mm thick is subjected to an internal pressure of 1.5 N/mm^2 . Calculate the changes in length, diameter and volume of the cylinder. $E = 200\text{ kN/mm}^2$, Poisson's ratio = 0.3 . (16)

Or

- (b) An elemental cube is subjected to tensile stresses of 30 kN/mm^2 and 10 kN/mm^2 acting on two mutually perpendicular planes and a shear stress of 10 N/mm^2 on these planes. Draw the Mohr's circle for stresses, determine the magnitude and directions of principal stresses and also the greatest shear stress. (16)
