Reg. No. : | | | | | | | | | | |

Question Paper Code: 44705

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

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. When a solid shaft is subjected to torsion, the shear stress induced in the shaft at its center is

   (a) Zero (b) minimum (c) maximum (d) average

6. The ratio of strength of solid to hollow shafts, both having outside diameter D and hollow having inside diameter D/2, in torsion, is

(a) 1/16 (b) 1/4 (c) 1/2 (d) 15/16

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 defelction at a section in a loaded beam can be found out by which of the following methods

(a) Double integration method (b) Moment area method
(c) Macaulay's method (d) any of the above

9. Pressure Vessels are made up of

(a) non ferrous materials (b) sheet metal
(c) cast iron (d) All of the above

10. The extremeties of any diameter on Mohr's circle represent

(a) Normal stresses on plane at 45^o (b) principle stresses
(c) normal and shear stresses on plane (d) Shear stresses on plane at 45^o

PART - B (5 x 2 = 10 Marks)

11. What is Hooke's Law?

12. Write the equation for the simple bending theory.

13. Distinguish between closed coil helical spring and open coil helical spring.

14. Define crippling load.

15. Define principal planes and principal stresses.

PART - C (5 x 16 = 80 Marks)

16. (a) The ultimate stress for a hollow steel column which carries an axial load of 2Mn is 500 N/mm^2. If the external diameter of the column is 250mm, determine the internal diameter .Take the factor of safety as 4.0. (16)

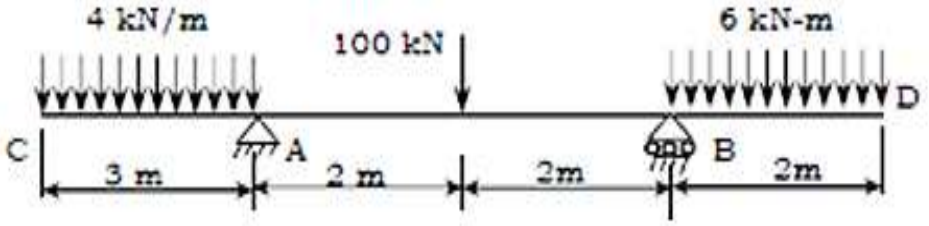
Or

(b) A rod of 250 cm long and diameter 3.0cm is subjected to an axial pull of 30 KN. If the modulus of elasticity of the material of the rod is 2x 10^5 N/mm^2 Determine 1. Stress 2. Strain 3. the elongation of the rod. (16)

17. (a) A simply supported beam of span 8 *m* long is subjected to two concentrated loads of 24*kN* and 48*kN* at 2*m* and 6*m* from left support respectively. In addition it carries a UDL of 36*kN/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) It is required to design a closed coiled helical spring which shall deflect 1mm under an axial load of 100 N at a shear stress of 90 Mpa. The spring is to be made of round wire having shear modulus of 0.8 x 10^5 Mpa. The mean diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire. (16)

Or

(b) A close coiled helical spring is to have a stiffness of 1.5*N/mm* of compression under a maximum load of 60*N*. The maximum shearing stress produced in the wire of the spring is 125*N/mm*^{2}. The solid length of the spring is 50*mm*. Find the diameter of coil, diameter of wire and number of coils. C=4.5x10^4*N/mm*^{2} . (16)

19. (a) Derive the equation of the deflection curve for a cantilever beam AB supporting a load P at the free end (figure 2). Also, determine the deflection B and angle of rotation Bat the free end. (16)

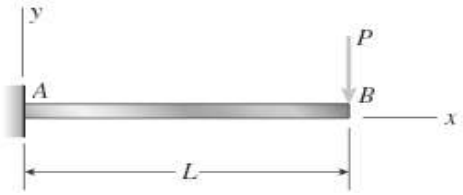


Figure 2

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 80kN/mm^2. Compare this load with that given by Rankine formula. Using Rankine Constants α = 1/1600 and 567 N/mm^2. (16)

20. (a) A cylindrical steel pressure vessel 400 mm in diameter with a wall thickness of 20 mm, is subjected to an internal pressure of 4.5 MN/m^2. (a) Calculate the tangential and longitudinal stresses in the steel. (b) To what value may the internal pressure be increased if the stress in the steel is limited to 120 MN/m^2? (c) If the internal pressure were increased until the vessel burst, sketch the type of fracture that would occur. (16)

Or

(b) A cylindrical pressure vessel is fabricated from steel plating that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa, and the circumferential stress is limited to 60 MPa. (16)