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Question Paper Code: 44705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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. A material with identical material properties in all the directions is known as
 - (a) Homogenous
 - (b) Isotropic
 - (c) Anisotropic
 - (d) Orthotropic
2. Engineering stress-strain curve and True stress-strain curve are equal up to
 - (a) Proportional limit
 - (b) Elastic limit
 - (c) Yield point
 - (d) Tensile strength point
3. The strength of the beam mainly depends on
 - (a) Bending moment
 - (b) c.g of the section
 - (c) Section modulus
 - (d) its weight
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. _____ are called cantilever elliptical springs
- (a) Semi elliptical springs (b) Quarter elliptical springs
(c) Both (a) and (b) (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 slenderness ratio of a vertical column of a square cross-section of 2.5 cm sides and 300 cm length, is
- (a) 416 (b) 200 (c) 240 (d) 360
9. The design of a thin cylindrical shell is based on
- (a) Hoop stress (b) diameter of shell
(c) longitudinal stress (d) all the above
10. The extremities of any diameter on Mohr's circle represent
- (a) Normal stresses on plane at 45° (b) principle stresses
(c) normal and shear stresses on plane (d) Shear stresses on plane at 45°

PART - B (5 x 2 = 10 Marks)

11. Give the relationship between Bulk modulus and Young's modulus.
12. What do you mean by the point of contra flexure?
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) A compound bar of length 500 mm consists of a strip of aluminium 50 mm wide x 20 mm thick, and a strip of steel 50 mm wide x 15 mm thick rigidly joined at ends. If the bar is subjected to a load of 50 kN, find the stresses developed in each material and the extension of the bar. Take elastic modulus of a aluminum and steel as $1 \times 10^5 \text{ N/mm}^2$ and $2 \times 10^5 \text{ N/mm}^2$ respectively. (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 $2 \times 10^5 \text{ N/mm}^2$ Determine 1. Stress 2. Strain 3. the elongation of the rod. (16)
17. (a) A beam of size 150 mm wide, 250 mm deep carries a uniformly distributed load of $w \text{ kN/m}$ over entire span of 4 m. A concentrated load 1 kN is acting at a distance of 1.2 m from the left support. If the bending stress at a section 1.8 m from the left support is not to exceed 3.25 N/mm^2 find the load w . (16)

Or

- (b) A cast iron beam has I section with top flange $80 \text{ mm} \times 40 \text{ mm}$, web $120 \text{ mm} \times 20 \text{ mm}$ and bottom flange $160 \text{ mm} \times 40 \text{ mm}$. If the tensile stress is not exceed 30 N/mm^2 and compressive stress 90 N/mm^2 , what is the maximum uniformly distributed load the beam can carry over a simply supported span of 6 m if the larger flange is in tension. (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/mm^2 . Take $G = 100 \text{ kN/mm}^2$. (16)

Or

- (b) The stiffness of close coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shear stress in the wire of the spring is 125 N/mm^2 . The solid length of the spring (when the coils are touching) is 50 mm. Find the diameter of coil, diameter of wire and number of coils. $C = 4.5$. (16)
19. (a) A cantilever of length 2 m carries a uniformly distributed load of 2.5 KN/m run for a length of 1.25 m from the fixed end and a point load of 1 KN at the free end. Find the deflection at the free end if the section is rectangular 12 cm wide and 24 cm deep and $E = 1 \times 10^4 \text{ N/mm}^2$. (16)

Or

- (b) A 2 m long pin ended column of square cross section is to be made of wood. Assuming $E = 12 \text{ GPa}$ and allowable stress being limited to 12 MPa, determine the size of the column to support the following loads safely.
- (i) 95 kN and (ii) 200 kN.

Use factor of safety as 3 and Euler's crippling load for buckling. (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) A closed cylindrical vessel made of steel plates 5 mm thick with plane ends, carries fluid under pressure of 6 N/mm^2 . The diameter of the cylinder is 35 cm and length is 85 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take $E = 2.1 \times 10^5 \text{ N/mm}^2$ and $1/m = 0.286$. (16)