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

Question Paper Code: 41745

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

Fourth Semester

Mechanical Engineering

01UME405 – STRENGTH OF MATERIALS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

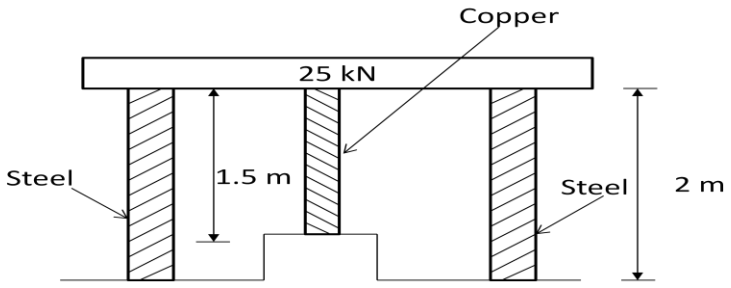
1. Define proof resilience and modulus of resilience.
2. Define bulk modulus.
3. What do you understand by the term ‘Point of contraflexure’?
4. State the theory of simple bending.
5. Compare closed and open coiled helical springs.
6. What kind of stress introduced when an axial load acts on a closed and open coiled spring?
7. Suggest a suitable method for the evaluation of deflection of a beam carrying multiple loads.
8. Differentiate between short column and long column.
9. What are the two stress components that exist on a thin shell subjected to internal pressure?
10. Define principal plane.

PART - B (5 x 16 = 80 Marks)

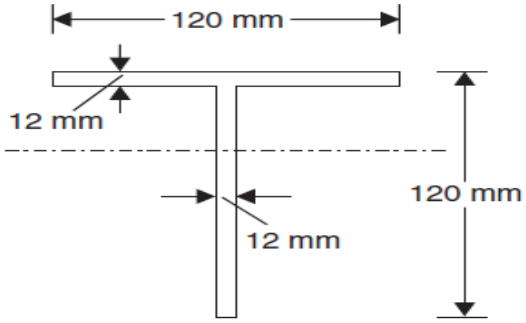
11. (a) An aluminium cylinder of diameter 60 *mm* located inside a steel cylinder of internal diameter 60 *mm* and wall thickness 15 *mm*. The assembly is subjected to a compressive force of 200 *kN*. What are the forces carried and stresses developed in steel and aluminium? Take Modulus of elasticity for steel as 200 *GPa* and aluminium as 70 *GPa*. (16)

Or

(b) Two steel roads and one copper rod, each of 20 *mm* diameters, together support a load of 25 *kN* as shown in figure below. Find the stresses in the rods.
Take E for steel = 210 kN/mm^2
And E for copper = 110 kN/mm^2. (16)



12. (a) A beam has cross-section as shown in figure, if the shear force acting on this is *25kN*, draw the shear stress distribution diagram across the depth. (16)



Or

(b) State the necessary assumptions made in the theory of sample bending. Derive an expression for bending equation. (16)

13. (a) Find the diameter of a solid shaft to transmit 120 *kW* at 180 *rpm*, such that the shear stress is limited to 70 N/mm^2. The maximum torque is likely to exceed the mean torque by 40%. Also find the permissible length of the shaft, if the twist is not to exceed 1 degree over the entire length. Take rigidity modulus as 0.8×10^5 N/mm^2.

(16)

Or

(b) A close-coiled helical spring has a ratio of wire coil diameter to diameter as 10. The spring deflects *3cm* under an axial load of *500N* and the maximum shear stress is not to exceed *300MPa*. Find the diameter and the length of the spring wire required. Shearing modulus of wire material = *80GPa*. (16)

14. (a) A cantilever of length 4 *m* carries a u.d.l of 12 *kN/m* for a length of 2.5 *m* from fixed end and a point load of 10 *kN* at free end. Determine the maximum slope and deflection using moment area method. Take $EI = 6.3 \times 10^4$ kN/m^2. (16)

Or

(b) Determine the slope and deflection of a simply supported beam carrying UDL of '*w*' over entire length of span '*L*' by Double Integration method. (16)

15. (a) A cylindrical shell of 1 *m* diameter and 3 *m* long closed at both ends is subjected to internal pressure of 2 *MPa*. Calculate the minimum thickness if the stress should not exceed 50 *MPa*. Find the changes in diameter, length and volume of the cylinder. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0.3. (16)

Or

(b) At a point within a body subjected to two mutually perpendicular directions, the stresses are 180 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Each of the above stresses is accompanied by a shear stress of 50 N/mm^2. Determine

(i) major and minor principal stresses and its direction

(ii) maximum shear stress (16)