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

Question Paper Code: 41074

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

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. What do you mean by thermal stress?
3. What do you understand by the term 'Point of contraflexure'?
4. Draw the shear stress distribution of I symmetrical section.
5. Compare closed and open coiled helical springs.
6. What is the maximum shear stress produced in a bolt of diameter 20 *mm* when it is tightened by a spanner which exerts a force of 50 *N* with a radius of action of 150 *mm*?
7. Suggest a suitable method for the evaluation of deflection of a beam carrying multiple loads.
8. What are the assumptions made in Euler's column theory?
9. What are the two stress components that exist on a thin shell subjected to internal pressure?
10. What is the use of Mohr's circle?

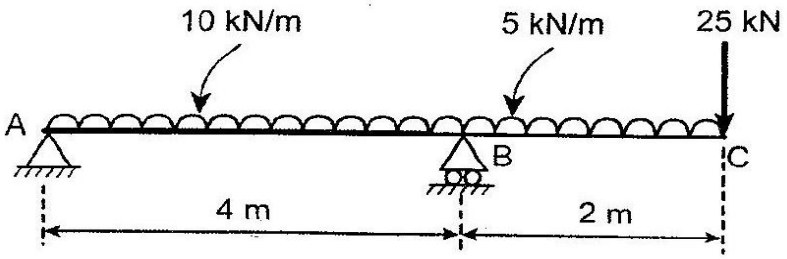
PART - B (5 x 16 = 80 Marks)

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) A steel tube of 20 *mm* internal diameter and 30 *mm* external diameter encases a copper rod of 15 *mm* diameter to which it is rigidly joined at each end. If the temperature of the assembly is raised by 80^{o} *C*, calculate the stresses produced in the tube. $E_s = 2 \times 10^5$ *N/mm*^{2}, $E_c = 1 \times 10^5$ *N/mm*^{2} and coefficient of linear expansion of steel and copper are 11×10^{-6} per ^{o}C and 18×10^{-6} per ^{o}C. (16)

12. (a) Draw the shear force and bending moment diagrams of the beam loaded as shown in below figure. Also determine the point of contraflexure if any. (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 is to have a stiffness of 1 *kN/m* of compression under a maximum load of 45 *N* and maximum shearing stress of 126 *MPa*. The solid length of the spring is to be 45 *mm*. Find the diameter of the wire and mean diameter of the coil required. Take G = 42 x 10^3 N/mm^2. (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 $EI = 6.3x10^4$ kN/m^2. (16)

Or

(b) A hollow mild steel tube 6 m long, 4 *cm* interred diameter and 6 *mm* thick is used as a column with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take $E= 2x10^5$ N/mm^2. (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 there are two mutually perpendicular stresses of 80 N/mm^2 and 40 N/mm^2 of tensile in nature. Each stress is accomplished by a shear stress of 60 N/mm^2. Determine the normal, shear and resultant stress on an oblique plane at an angle of 45 degree with the axis of the major principal stress. (16)

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