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## B.Tech. DEGREE EXAMINATION, JULY 2009

Fourth Semester

### ME0204 – MECHANICS OF SOLIDS

*(For the candidates admitted from the year 2007-2008 onwards)*

Time: Three hours Max.Marks:100

### PART – A (10 × 2 = 20 Marks)

Answer **ALL** Questions

1. Define: Hooke's law.
2. Define: Yield stress.
3. What are the types of beam? Explain.
4. What are the assumptions made in the theory of pure bending?
5. Write the expression connecting torque transmitted maximum diameter and maximum shear stress.
6. Define: Stiffness and Spring.
7. State Mohr's II theorem.
8. Write an expression for the deflection under load for a cantilever of length '*l*' carrying a point load W at the free end.
9. Write an expression for hoop stress in thin cylinder.
10. What is crippling load?

### PART – B (5 × 16 = 80 Marks)

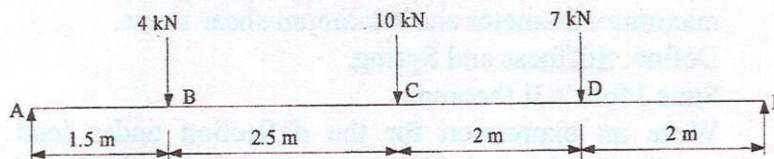
Answer **ANY FIVE** Questions

11.i. Determine the changes in length breadth and thickness of a steel for which is *5 metre* long, *40 mm* wide and *30 mm* thick and is subjected to an axial pull of *35 kN* in the direction of its length. Take $E = 2\times10^5\ N/mm^2$ and Poisson's ration $\mu = 0.32$

ii. A load of $300\ kN$ is applied on a short concrete column $250\ mm \times 250\ mm$. The column is reinforced by steel bars of total area $5600\ mm^2$. If the modulus of elasticity for steel is 15 times that of concrete, find the stresses in concrete and steel.

12. A rectangular block of material is subjected to a tensile stress of $100\ N/mm^2$ on one plan and a compressive stress of $50\ N/mm^2$ on a plane at right angles together with a shear stresses of $60\ N/mm^2$ on the faces. Find
(a) the direction of the principal plane
(b) the magnitude of principal stresses
(c) the maximum shear stress and its direction

13.i. Draw the shear force and bending moment diagrams for the simply supported beam shown in *figure*.




ii. A composite beam consists of a wooden joist $10\ cm$ wide, $20\ cm$ deep strengthened by two steel plates $8\ mm$ thick and $18\ cm$ deep placed symmetrically one on either side of the joist. If the stresses in wood and steel are not to exceed in wood and steel are not to exceed $7.5\ MPa$ and $140\ MPa$, find the moment of resistance of the section of the beam. Take the modulus ratio as 20.

14. A solid circular shaft and a hollow circular shaft whose inside diameter is ¾ of the outside diameter are of the same material of equal lengths and are required to transmit a given torque. Compare the weights of these two shafts if the maximum shear stresses developed in the two shafts are equal.

15. A closely coiled helical spring of round steel wire $10\ mm$ in diameter having 10 complete turns with a mean diameter of $12\ cm$ is subjected to an axial load of $200\ N$. Determine
(a) the deflection of the spring
(b) maximum shear stress in the wire
(c) stiffness of the spring
Take $G = 8\times10^4\ N/mm^2$.

16. A beam of length $6\ m$ is simply supported at its ends and carries a point load of $40\ kN$ at a distance of $4\ m$ from the left support. Find the deflection under the load and maximum deflection. Also calculate the point at which maximum deflection takes plane. Given moment of inertia of beam. $I = 7.33 \times 10^7\ mm^4$ and $E = 2\times10^5\ N/mm^2$.

17.i. A cylindrical shell $1\ m$ diameter and $3\ m$ length is subjected to an internal pressure of $2\ MPa$. Calculate the minimum thickness, if the stress is not exceeding $50\ MPa$. Find the change in diameter and volume of the shell. Poisson's ratio $= 0.3$, $E = 200\ kN/mm^2$.

ii. Compare the crippling loads given by the Euler's and Rankine Gordal formulae for a pin ended axially loaded tubular steel strut $2.5\ m$ long having outer and inner diameters of 40 mm and 35 mm respectively. Take the yield stress as $320\ N/mm^2$ and Rankine constant as $1/7500$. $E$ for steel is $2\times10^5\ N/mm^2$.

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