Hall Ticket Number:

Code No.: 21416 S

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. II Year (Mech. Engg.) I-Semester Supplementary Examinations, May/June-2017

Mechanics of Materials

Time: 3 hours Max. Marks: 70

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 X 2=20 Marks)

1. Define Poisson's ratio and Young's modulus.
2. Determine the minimum diameter of a steel wire, which is used to raise a load of 4000 N, if the stress in the rod is not to exceed 95 MN/m^2.
3. Draw Shear force and bending moment diagrams for a cantilever of length L carrying a UDL of w per meter length over its entire length.
4. Define polar modulus and modular ratio.
5. Sketch the shear stress distribution across the square with diagonal vertical and I section.
6. Define Major and Minor principal planes and Major and Minor principal stresses.
7. Write the expression for maximum deflection and maximum slope in a cantilever beam of 'L', flexural rigidity 'EI', due to a load 'W', which is acting at a distance of 'z' from fixed end.
8. Find the torque which a shaft of 100 mm diameter can transmit safely, if the shear stress is not to exceed 100 N/mm^2.
9. Write the assumptions of Lame's theory for determining stresses in thick cylinder.
10. A steel column is of length 8 m and diameter 600 mm with both ends fixed. Determine the crippling load by Euler's formula. Take $E = 2.1 \times 10^5$ N/mm^2.

Part-B (5 × 10 = 50 Marks)

11. a) Derive the relation between the modulus of elasticity and modulus of rigidity. [5]

    b) An aluminum rod 22 mm diameter asses through a steel tube of 25 mm internal diameter and 3 mm thick. The rod and tube are fixed at a temperature 180°C. Find the stress in the rod and tube, when the temperature falls to 60°C. Take $E_s = 200$ kN/mm^2, $E_A = 70$ kN/mm^2, $\alpha_s = 12 \times 10^{-6}/°C$ and $\alpha_A = 23 \times 10^{-6}/°C$ [5]

12. a) A Simply supported beam AB, 8 m long carries point loads of 3 kN each at a distance of 2 m and 5 m from A and a uniform distributed load of 2 kN/m between the two point loads. Determine the position and magnitude of maximum bending moment. Draw S.F.D. and B.M.D. [5]

    b) A beam simply supported at ends and having cross section as shown in figure 1 is loaded with a UDL., over its entire span. If the beam is 8 m long, find the U.D.L., if the maximum permissible bending stress in tension is limited to 30 MN/m^2 and in compression to 45 MN/m^2. What are the actual maximum bending stresses set up in the section? [5]

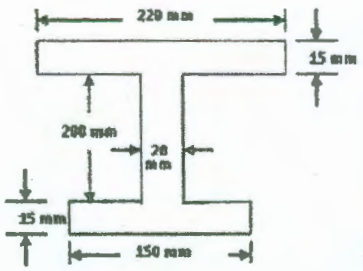

Figure 1

Contd...2

13. a) A T- section beam of flanges 200 mm × 20 mm and web 250 mm × 25 mm is subjected to a shear force of 30 kN. Find the maximum shear stress intensity. [4]

b) A rectangular element in a strained material is subjected to tensile stresses of 100 N/mm^2 and 60 N/mm^2 on mutually perpendicular planes together with a shear stress of 70 N/mm^2. Find the principal stresses, principal planes and maximum shear stress in the block analytically or otherwise. [6]

14. a) Find the end slopes and the maximum deflection of the simply supported beam shown in figure.2. Take E = 2 x 10^4 N/mm^2 & I = 1.1 x 10^9 mm^4. [6]

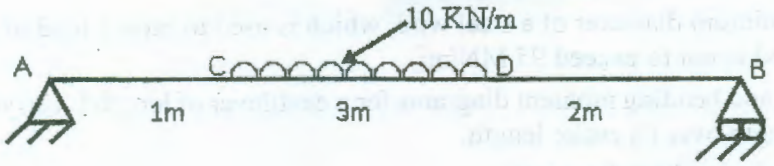

Figure 2

b) Define point of contra flexure and its importance in the analysis of beams, also state the advantages of Macaulay's method in determining the deflections of beams. [4]

15. a) A spherical shell of 175 mm external diameter and 25 mm thick wall subjected to an internal fluid pressure of 100 N/mm^2. Find the distribution of radial and hoop stresses across the wall of the shell. [6]

b) A hollow cylinder cast iron column of 150 mm external diameter and 15 mm thick, 3 m long and is hinged at one end and fixed at other end. Find the ratio of Euler's and Rankine's load. Take σc = 550 N/mm^2 and α = 1/1600. [4]

16. a) List out the assumptions made in theory of pure bending and, derive the equation of $\frac{M}{I} = \frac{f}{y}$ for pure bending. [5]

b) Rails of 15 m length were laid on the track when the temperature was 20°C. A gap of 1.8 mm was kept between two consecutive rails. At what maximum temperature the rails will remain stress free? If the temperature is raised further by 15°C, what will be the magnitude and nature of stresses induced in the rails? [5]

17. Write short notes on any *two* of the following:

a) Mohr's circle in determining stresses [5]

b) Slenderness ratio and its importance to columns [5]

c) Stresses in thin and thick cylinders. [5]

****