

II B.Tech I Semester Supplementary Examinations, November 2005
MECHANICS OF SOLIDS
 (Common to Mechanical Engineering, Mechatronics, Metallurgy & Material
 Technology, Production Engineering and Aeronautical Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Derive the expression for the elongation of a uniformly tapering rod subjected to an axial pull. [8]
 (b) Prove that the deformation of bar under its own weight is equal to half the deformation, if the body is subjected to direct load equal to weight of body. [8]
2. Two parallel walls 6m apart are stayed together by a 25 mm diameter steel rod at 80°C passing through washers and nuts at ends. If the rod cools down to 22°C, calculate the pull induced in the rod, if [16]
 (a) the walls do not yield and
 (b) the total yield at ends is 1.5 mm
 $E_{\text{steel}} = 2 \times 10^5 \text{ N/mm}^2$, $\alpha_{\text{steel}} = 11 \times 10^{-6} \text{ per}^\circ\text{C}$.
3. Draw the shear force and bending moment diagrams of a beam loaded as shown in Figure 1. [16]

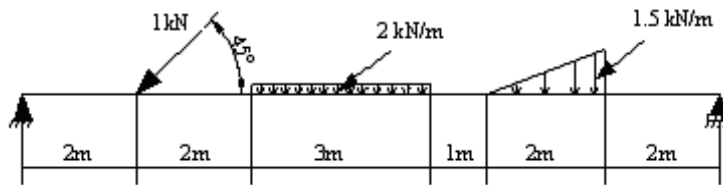


Figure 1:

4. (a) State the assumptions involved in the theory of simple bending. [6]
 (b) Derive the Bending equation from first principle. [10]
5. (a) A beam of length L is supported at each end with a couple applied at an intermediate point. Deduce an expression for the deflection and hence calculate the deflection at the point of application of the moment. [8]
 (b) A beam of length L carries a uniformly distributed load w/unit length and rests on three supports, two at the ends and one in the middle. Find how much the middle support be lower than the end ones in order that the pressures on the three supports shall be equal. [8]

6. (a) Explain horizontal and hoop stresses as applied to thin cylinders. [8]
(b) What thickness of metal would be required for cast-iron water pipe 90 cm in diameter under a head of 100m? Assume the permissible tensile stress for cast iron as 20 MN/m^2 . [8]
7. (a) Derive an expression for the maximum shear stress induced in the wire and stiffness of spring in case of close coiled helical springs. [12]
(b) What are the functions of springs ? [4]
8. (a) A hollow cylindrical cast iron column is 4m long with both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 250kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. [12]

Take $\sigma_c = 550 \text{ MPa}$ and Rankine's constant = $1/1600$

- (b) What is equivalent length of a column ? Give the ratios of equivalent length and actual length of columns with various end conditions. [4]
