SE/ Sem III Civil & Prod. Production Engg 19/12/17

Sub:- MOS

Q.P. Code: 25760

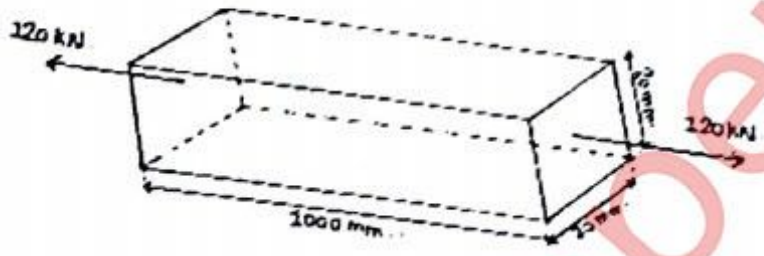
03+20+20+20+10 = 73

TIME- 3 Hrs **Total Marks-80**

N.B. : 1. Question No **1** is **compulsory**
2. Attempt any **Three** questions from the remaining five questions.
3. Assume any **suitable data** if necessary with justification.
4. Figures to the right indicates full marks

Q.1 Attempt any **Four** questions. **[20]**

a) A steel bar of length 1 m is subjected to a 120 KN tensile axial force. The cross- section of the bar is 20 mm x 20 mm. the increase in the length is found to be 0.5 mm and decrease in thickness is 0.003 mm. **Find Young's Modulus, Poisson's Ratio and Bulk Modulus.**

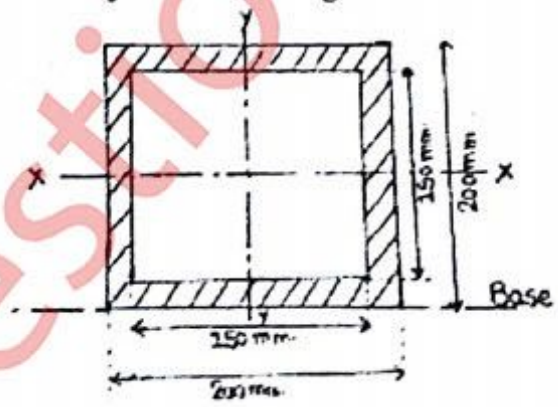


b) **Derive the expression** for Strain Energy stored in a bar due to gradually applied load.

c) **Derive the expression** for the flexural formula.

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

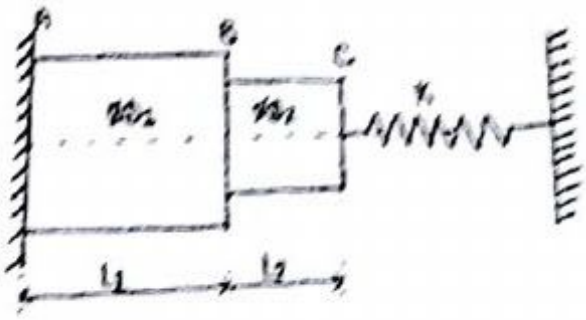
d) **Calculate M.I. and Radius of Gyrationof** the given section about base axis.



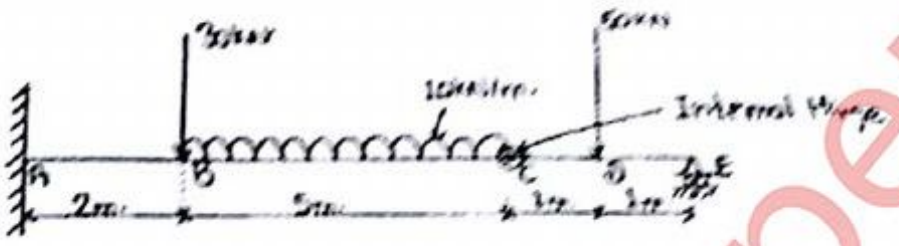
e) **Draw the shear force and bending moment diagram** for a simply supported beam of length L, subjected to UDL over the length.

Q.2 a) Figure shows a stepped shaft ABC with solid circular cross-section is held between a rigid support and a spring support. The diameter and length of the left component is denoted by D1 and L1 respectively and that of right hand component are D2 and L2 respectively. Let E denotes the modulus of elasticity of the shaft. When the temperature increases by 30^0C, **Determine change in length of each bar and total compression in spring. Also determine temperature stress**

generated. Take D1 = 75 mm, D2= 50 mm, L1 = 300 mm, L2 = 225 mm, E = 6 GPa, α= 160*10^{-6} /°C, K = 50 MN/m **[10]**

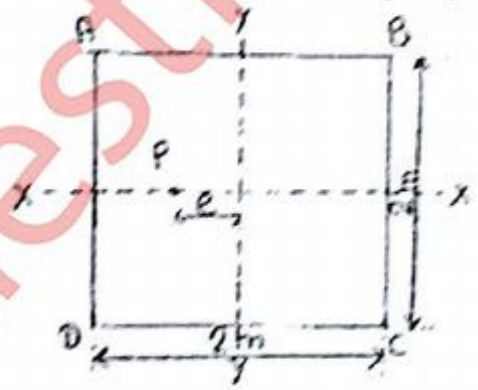


Q.2 b) **Draw the Shear Force and Bending Moment Diagram** for the beam having fixed support and roller support at end A and E respectively and internal hinge at point C. **[10]**



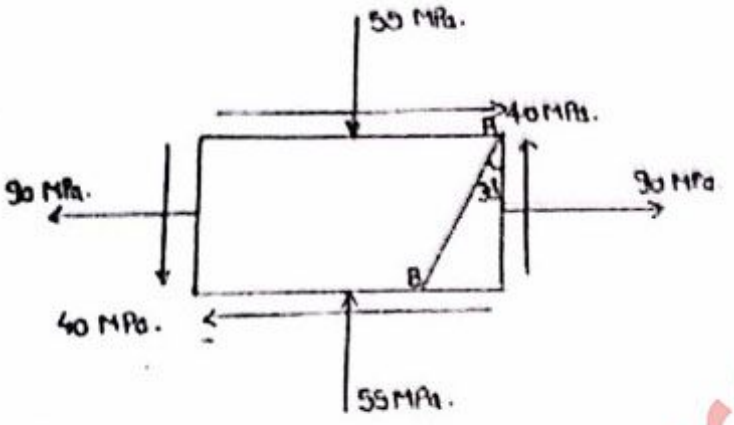
Q.3 a) An I section beam with top flange 100mm * 30mm, bottom flange 120mm * 30mm, web 120mm * 30mm, is simply supported having span of 8 m carries a uniformly distributed load over the span. If the maximum permissible bending stress in tension is 30 MN/ m^2 and in compression is 45 MN/ m^2. **Find the UDL intensity and bending stress. Assume sagging bending moment.** **[10]**

Q.3 b) A concrete block having square cross section as shown in figure. The block weighs 90 KN and a vertical downward load of 20 KN at a point P on the X-X axis, but eccentric about Y-Y axis. **Calculate the distance of the point load At P from the axis Y-Y if the stress under the block along edge AD is twice the stress under the block along edge BC.** **[10]**

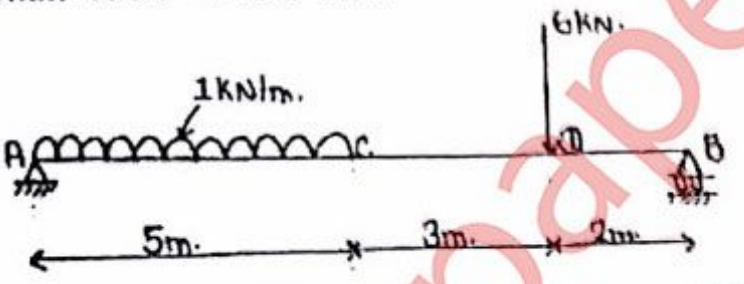


Q.4 a) A hollow shaft with diameter ratio 3/5 is required to transmit 450 KW at 120 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m must not exceed 1°. Calculate the minimum external diameter of the shaft satisfying these conditions. Take the modulus of rigidity G = 8 x 10^4 N/mm^2. **[10]**

b) A strained material is subjected to stress system as shown in figure. **Determine the principal planes and principal stresses. Also determine the maximum shear stress and plane on which it acts. Also find normal and shear stress** on plane AB inclined at 30° to plane carrying 90MPa. [10]

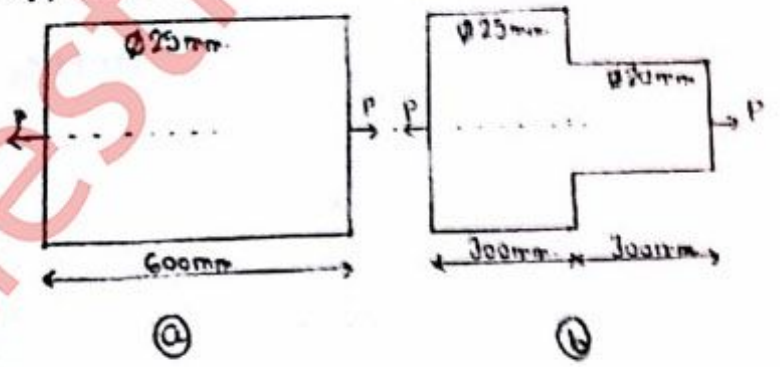


Q.5 a) For the beam shown in figure below, find slope at point A and deflection at point C and D. Take $E = 2 \times 10^5 N/mm^2$ and $I = 1 \times 10^8 mm^4$. [10]



Q.5 b) A beam of T section has a flange 100 mm x 15 mm& a web 150mm x 15 mm. Draw shear force distribution diagram for a section where shearing force is 60 KN. **Find the ratio between maximum shear stress and mean shear stress.** [10]

Q.6 a) Compare the strain energy stored in the two bars of the same material shown in figure a) and b) below, if gradually applied load is same in both bars. **Find the ratio of strain energy in bar a) and b).** [10]



b) **Compare the crippling loads given by Euler's and Rankine's formulae** for tubular steel strut 2.5 m having outer and inner diameters 40 mm and 30 mm respectively, loaded through pin joints at each end. Take yield stress at 320 N/mm^2 andRankine's constant $\alpha = 1/7500$ and $E = 2 \times 10^5 N/mm^2$. [10]