S.Y. Diploma : Sem. III
[ME/MH/MI/PG/PT/AE/FE/PS]

Strength of Materials

Time: 3 Hrs.] Prelim Question Paper **[Marks : 100**

1. (a) Attempt any **SIX** of the following : **[12]**

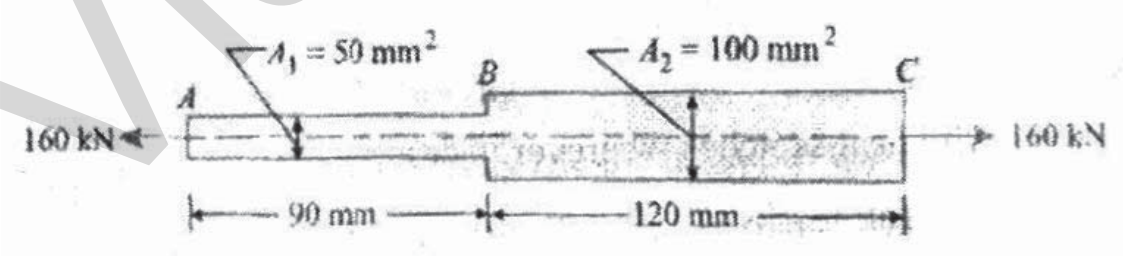
(i) Draw Core section for rectangular column.
(ii) Draw stress distribution on Rectangular section subjected to bending.
(iii) Define Poisons Ratio & modular of elasticity.
(iv) Define creep. Give one example
(v) State any four assumptions in the theory of simple bending.
(vi) Give the relationship between E, G and K.

(b) Attempt any **TWO** of the following :

(i) A load of 5 KN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa.
(ii) Calculate polar M.I. of a square section having 200 m as side.
(iii) A mild steel flat 150 mm wide by 20 mm thick, 6 m long, carries an axial pull of 300 kN, if the modulus of elasticity of steel is 200 kN/mm^2 and Poisson's ratio = 0.25. Calculate the change in length, width, thickness volume of the flat.

2. Attempt any **FOUR** of the following : **[16]**

(a) Draw the stress strain curve for ductile material and explain the term ultimate stress.
(b) An automobile component shown in figure is subjected to a tensile load of 160 KN. Determine the total elongation of the component, if its modulus of elasticity is 200 GPa.



(c) A steel rod 4 m long and 20 mm diameter is subjected to an axial tensile load of 45 kN. Find the change in length and diameter of the rod.

$E_S = 2 \times 10^5$ N/mm^2. Poisson's Ratio = $\frac{1}{4}$.

(d) A rod 300 mm long and 20 mm in diameter is heated through 100° C and at the same time pulled by a force 'P'. If the total extension is 0.4 mm. What is the magnitude of 'P'?
Take E = 2×10^5 N/mm^2 and $\propto = 12 \times 10^{-6}$/ °C.

(e) A cylindrical shell is 8 m long, 1 m internal diameter and 15 mm metal thickness. Calculate circumferential strain and longitudinal strain, if cylindrical shell is subjected to internal pressure of 1.5 N/mm^2.
Take E = 2×10^5 N/mm^2 and μ = 0.25.

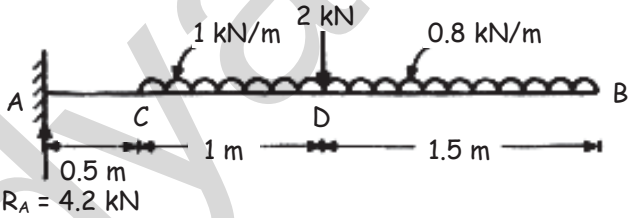
(f) A steel bar of 30 mm diameter is heated to 70°C and then clamped at ends. It is then allowed to cool down to 20°C. Calculate temperature stresses developed and reactions at the clamps, length of bar = 10 m, $\alpha = 12 \times 10^{-6}$/°C; E = 2×10^5 N/mm^2.

3. Attempt any **FOUR** of the following : **[16]**

(a) A beam AB 10 m long has supports at its ends A and B. It carries a point load of 5 KN at 3 meters from A and a point load of 5KN at 7 meters from A and a udl of 1KN per meter between the point loads. Draw S.F. Diagram and B.M. diagram for the beam.

(b) A simply supported right side overhanging beam supported at 4 meter and right side 1 meter overhang. A Loaded by udl 10 KN/m over entire span. Draw S.F. diagram and B.M. diagram.

(c) Draw S.F. and B.M. diagram for the beam as shown in Figure.



(d) A cantilever beam 4 m long carries a udl of 2kN/m over 2 m from free end and a point load of 4kN at free end. Draw S.F. and B.M. diagrams.

(e) A simply supported beam of span 4 m carries two point loads of 5kN and 7 kN at 1.5 m and 3.5 m from the left hand support respectively. Draw SFD and BMD showing important values.

4. Attempt any **FOUR** of the following : **[16]**

(a) Find M.I. about x-x axis of T-section having flange 150 mm × 50 mm and web 150 mm × 50 mm, overall depth 200 mm.

(b) An I-section have the following dimensions Top flange 60 mm × 20 mm. bottom flange 100 mm × 20 mm, web 100 mm × 20 mm, overall depth 140 mm. Find the M.I. about y-y axis.

(c) An isosceles triangular section ABC has a base width 80 mm and height 60 mm. Determine the M.I. of the section about c.g. of the section and the base BC.

(d) Calculate moment of inertia of a hollow rectangle about an axis passing through base 200 mm size, it has the following details.
   (i) internal dimension = 160 mm $\times$ 260 mm
   (ii) external dimension = 200 mm $\times$ 300 mm

(e) A symmetrical I–section has the following dimensions. Calculate Polar M.I. of the section. Flanges = 100 mm $\times$ 10 mm, Web = 10 mm $\times$ 100 mm.

(f) Find I_{yy} for an unequal angle section having vertical leg of 125 $\times$ 10 mm and horizontal leg of 75 $\times$ 10 mm.

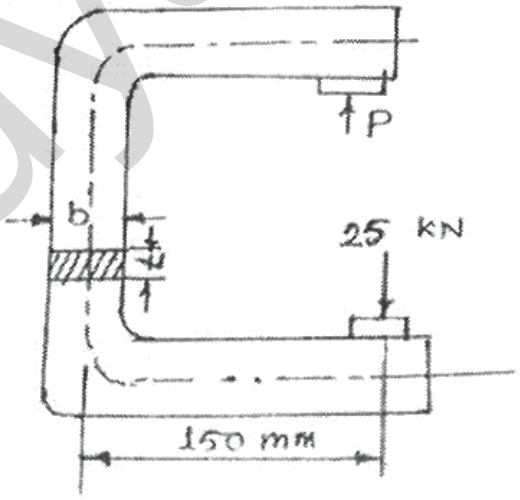
5. Attempt any **FOUR** of the following : **[16]**

(a) A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 6 m. If the beam is subjected to central point load 12 KN, Find maximum bending stress induced in the beam section.

(b) Calculate the limit of eccentricity for a circular section having diameter 50 mm.

(c) A rectangular strut is 150 mm and 120 mm thick. It carries a load of 180 KN at an eccentricity of 10 mm in a plane bisecting the thickness. Find the maximum and minimum intensities of stress in the section.

(d) A c-clamp as shown in fig. no 2 carries a load P = 25 KN. The cross section of the clamp at x-x is rectangular, having width equal to twice the thickness. Assuming that the c-clamp is made of steel casing with allowable stress of 100N/mm^2. Find its dimensions.



(e) Determine the maximum bending stress developed in a beam of rectangular cross-section 50 mm $\times$ 150 mm when a bending moment of 600 N.m is applied about X–X axis.

6. Attempt any **FOUR** of the following : **[16]**

(a) State the equation of torsion and write the notations used in it.

(b) A solid circular shaft of 120 mm diameter is transmitting power of 120 KW at 150 rpm. Find the intensity of the shear stress induced in the shaft. Take Tmax = 1.4 Tavg.

(c) Find power transmitted by a shaft having 60 mm diameter rotating at 120 rpm. If maximum permissible shear stress = 80 MPa.

(d) A shaft of hallow circular cross section has outer diameter 120 mm, inner 90 mm. It is subjected to a torsional moment of 18 KN/m. For this shaft compute shear stress at the outer surface.

(e) Find the torque that can be applied to a shaft of 100 mm in diameter, if the Permissible angle of twist is 2.75 in a length of 6m.
Take G = 30 KN/mm^2

(f) A solid circular shaft of 120 mm diameter is transmitting power of 100 KW at 150 rpm. Find the intensity of the shear stress induced in the shaft.
Take $T_{max} = 1.4\ T_{avg}$

❑ ❑ ❑ ❑ ❑