

Scheme – G

## Sample Question Paper

Course Name : Mechanical Engineering Group

Course Code : ME/PG/PT/AE/MH/MI/FE/FG

Semester : Third

Subject Title : Strength of Materials

Marks : 100

**17304**

Time: 3 Hours

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### Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

### Q1. (A) Attempt any SIX of the following

**12 Marks**

- a) Define plasticity and stiffness.
- b) Draw Core section for rectangular column.
- c) Write the Equation for M.I. of Hollow Shaft.
- d) Draw stress distribution on Rectangular section subjected to bending.
- e) State expression for Power transmitters by a shaft giving meaning of each term. .
- f) Define Poisons Ratio & modular of elasticity.
- g) What is principle stress and principle plain?
- h) What is meant by direct stress?

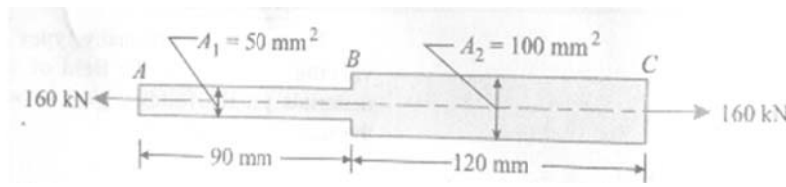
### Q1. (B) Attempt any TWO of the following

**08 Marks**

- a) A load of 5KN 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 100MPa.
- b) A cantilever beam 2 meter long carries a udl of 1.5 KN/m over a length of 1.6 m from the free end. Draw shear force and bending moment diagram for the beam.
- c) A steel wire of 5mm diameter is bend into a circular shape of 5 m radius. Determine the minimum bending stress induced in the wire. Take  $E=200\text{GPa}$ .

**Q2. Attempt any FOUR of the following****16 Marks**

- (i) Draw the sketch of stepped section showing axial load.  
(ii) State the effective length for both end hinged column.
- Write the assumptions made in the Euler's column theory.
- Draw the stress strain curve for ductile material and explain the term ultimate stress.
- An automobile component shown in fig no.1 is subjected to a tensile load of 160 kN. Determine the total elongation of the component, if its modulus of elasticity is 200GPa.  
Fig no.1.



- The principle tensile stresses at a point across two perpendicular planes are  $80 \text{ N/mm}^2$  and  $40 \text{ N/mm}^2$ . Find the normal and tangential stresses and its obliquity on a plane at  $20^\circ$  with the major principle plane.
- A gas cylinder of internal diameter 40mm is 5mm thick. If the tensile stress in the material is not to exceed 30 MPa. Find the maximum pressure which can be allowed in the cylinder.

**Q3. Attempt any FOUR of the following****16 Marks**

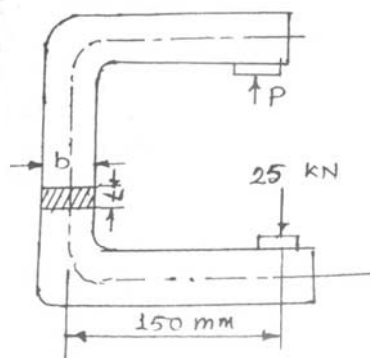
- A simply supported beam of span 'L' is subjected to udl of 'w'/unit length. Draw S.F. diagram. and B.M. diagram.
- A beam AB 10 m long has supports at its ends A and B .It carries a point load of 5KN at 3 meters from A and a point load of 5KN at 7 meters from A and a udl of 1KN per meter between the point loads. Draw S.F. Diagram and B.M. diagram for the beam.
- A cantilever beam 1.5 meter long is carrying point loads 1000N each at a distance of 0.5 meter, 1.0 meter, and 1.5 meter from the fixed end. Draw S.F. diagram and B.M. diagram for the cantilever beam.
- 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.
- A simply supported beam of 5 meter span subjected to a clockwise moment of 15 KN/m in a distance of 2 meter from the left end. Draw S.F. diagram and B.M. diagram.
- Find M.I. of a square 100 mm size about their diagonal.

**Q4. Attempt any FOUR of the following****16 Marks**

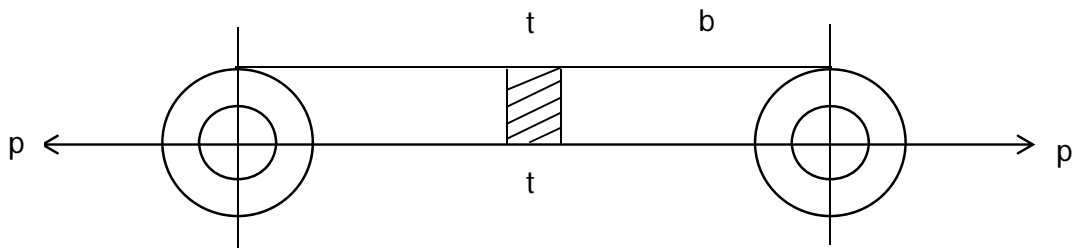
- Find M.I. about x-x axis of T-section having flange 150 mm x 50 mm and web 150 mm x 50 mm, overall depth 200 mm.
- An I-section have the following dimensions Top flange 60 mm x 20 mm. bottom flange 100 mm x 20 mm, web 100 mm x 20 mm, overall depth 140 mm .Find the M.I. about y-y axis.
- An angle section having dimensions 100 mm x 80 mm x 20 mm. Find M.I. about y-y axis, where 100 mm side is vertical.
- 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.
- What is meant by moment of resistance and neutral axis?
- Draw shear stress distribution diagram for circular section and define average shear stress.

**Q5. Attempt any FOUR of the following****16 Marks**

- 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.
- Calculate the limit of eccentricity for a circular section having diameter 50 mm.
- 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.
- A hallow circular column having external and internal diameters of 300 mm and 250 mm respectively carries a vertical load of 100 KN at the outer edge of the column. Calculate the maximum and minimum intensities of stress in the section.
- 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  $100\text{N}/\text{mm}^2$ . Find its dimensions.
- A M.S. link as shown in fig.no.3.by full lines, transmits a pull of 80 KN. Find the dimensions b and t if  $b=3t$ . Assume the permissible tensile stress as 70 MPa.

**Fig no.2.**

**Fig no.3.**



**Q6. Attempt any FOUR of the following**

**16 Marks**

- State the equation of torsion and write the notations used in it.
- 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  $T_{max} = 1.4 T_{avg}$ .
- Find power transmitted by a shaft having 60 mm diameter rotating at 120 rpm. If maximum permissible shear stress = 80 MPa.
- A steel shaft of solid circular section has to transmit 375 KW at 210 rpm. The maximum shear stress is not to exceed 50 MPa and the angle of twist must not be more than  $1^\circ$  in the length of 3m. Take  $G = 80 \text{ GPa}$ . Determine diameter of the shaft.
- A shaft of hollow 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.
- Define bending stress.
  - Define torque and state its S.I. unit.