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.

1. Attempt any FIVE of the following. [10]
   (a) Define moment of Inertia. State MI of triangular section about its base.
   (b) If polar moment of inertia of circular section is 2000 mm$^4$ then calculate the diameter of the section.
   (c) Define ductility and plasticity.
   (d) For a certain material, the modulus of elasticity is 200 N/mm$^2$. If Poisson’s ratio is 0.35, calculate Bulk modulus.
   (e) Define effective length in column with its application.
   (f) Give the expression for maximum bending stress with meaning of each term.
   (g) Along with expression, define slenderness ratio.

2. Attempt any THREE of the following: [12]
   (a) Determine moment of Inertia about the centroidal axes X-X and Y-Y of an Unsymmetrical I section with following details.
      Top flange  - 100 mm × 20 mm
      Bottom flange  - 160 mm × 20 mm
      Web  - 80 mm × 20 mm
   (b) For a circular lamina of diameter 100 mm, calculate the moment of inertia and radius of gyration about any tangent.
   (c) Find the least M.I. of a symmetrical I-section having following details:
      Flanges : 100 mm × 20mm  Overall depth : 280 mm
      Thickness of web : 10 mm
   (d) Define ‘radius of gyration’ and state its application. Calculate radius of gyration for circular lamina of diameter 500 mm.

3. Attempt any THREE of the following: [12]
   (a) Sketch the standard stress-strain curve for mild steel and tor steel bar under axial tension and show important points on it.
(b) A steel rod 15 m long is at a temperature of 15°C. Find the free expansion of the length when the temperature is raised to 65°C. Find the temperature stresses when the expansion of the rod is fully prevented. Take, \( \alpha = 12 \times 10^{-6} \text{ per } ^\circ\text{C} \). \( E = 2 \times 10^5 \text{ N/mm}^2 \).

(c) A steel rod is subjected to an axial pull of 25 kN. Find minimum diameter if the stress is not exceed 100 N/mm². The length of rod is 2000 mm and take \( E = 2.1 \times 10^5 \text{ N/mm}^2 \).

(d) State any four assumptions made in theory of pure bending.

4. Attempt any THREE of the following:

(a) A cube of 200 mm side is subjected to a compressive force of 3600 kN on all its faces. The change in the volume of cube is found to be 5000 mm³. Calculate the Bulk modulus. If \( \mu = 0.28 \), find the Young’s modulus.

(b) For a given material, Young’s modulus is 110 GN/m² and shear modulus is 42 GN/m². Find the Bulk modulus and lateral contraction of a round bar of 37.5 mm diameter and 2.4 m length when stretched by 2.5 mm when subjected to an axial load.

(c) Draw SFD and BMD of a beam as shown in figure. Also find the point of contra flexure.

(d) State the flexural formula, giving meaning of the symbols used in it.

5. Attempt any TWO of the following:

(a) Draw shear force and bending moment diagrams for the cantilever beam loaded as shown in figure 1. Indicate all important values.

(b) Draw shear force and bending moment for simply supported beam as shown in Fig.
(c) A metal rod 20 mm diameter and 2 m long when subjected to tensile force of 60 kN shows an elongation of 2 mm and reduction in diameter 0.006 mm. Calculate the modulus of elasticity and modulus of rigidity.

6. Attempt any TWO of the following: [12]
   (a) (i) A simply supported beam of span `L' carries central point load `W'.
   Draw SED and BMD
   (ii) Define shear force and bending moment. Write unit of each. Also state relation between them.
   (b) A simply supported beam of span 6 m carries two point loads 18 kN with 2 m spacing and symmetrical to span. Design square beam for bending if maximum bending stresses in beam is 10 N/mm².
   (c) A simply supported beam carries a udl of intensity 2.5 kN/m over entire span of 5m. The cross section of beam is a T-section having the dimensions given below: flange: 125 mm x 25 mm web: 175 mm x 25 mm, overall depth = 200 mm Calculate the maximum shear stress for the section of the beam. Construct shear distribution diagram.

S.Y. Diploma Sem-III: Paper Discussion Schedule

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<td>Mechanical Group &amp; Civil Group</td>
<td>6 Nov. 2019</td>
<td>Wednesday</td>
<td>8 a.m. to 9 a.m.</td>
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<td>6 Nov. 2019</td>
<td>Wednesday</td>
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