17311

21415

3 Hours/100 Marks

Seat No. | | | | | | | | |

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*
(2) Answer ***each*** *next main question on a* ***new*** *page.*
(3) ***Illustrate*** *your answers with neat sketches* ***wherever*** *necessary.*
(4) Figures to the ***right*** *indicate* ***full*** *marks.*
(5) ***Assume*** *suitable data, if* ***necessary****.*
(6) ***Use*** *of Non-programmable Electronic Pocket Calculator is* ***permissible****.*
(7) Mobile Phone, Pager and any other Electronic Communication devices are ***not*** *permissible in Examination Hall.*

MARKS

1. A) Solve **any six** of the following : **12**

a) State perpendicular axis theorem, giving its expression.

b) Write mathematical expression of M.I. of a triangle about horizontal axis passing through its apex.

c) Define ductility and malleability.

d) State the difference between nominal breaking stress and actual breaking stress from point of cross section of body.

e) State any four end conditions of column.

f) Justify the end condition of column, if

i) $y = 0$ but $\frac{dy}{dx} \neq 0$ ii) $y \neq 0$ and $\frac{dy}{dx} \neq 0$.

g) State the meaning of proof resilience.

h) Differentiate between gradual and sudden applied load with respect to stress produced.

B) Solve **any two** of the following : **8**

a) i) Enlist four assumptions in bending theory.

ii) State bending equation giving meaning of terms used in it.

b) Draw shear stress distribution diagram for triangular section showing maximum shear stress and stress at neutral axis.

c) Define short columns and long columns.

P.T.O.

MARKS

2. Solve **any two** of the following : **16**

a) Find the M.I. of section shown in Fig. 1 about horizontal axis passing through C.G.

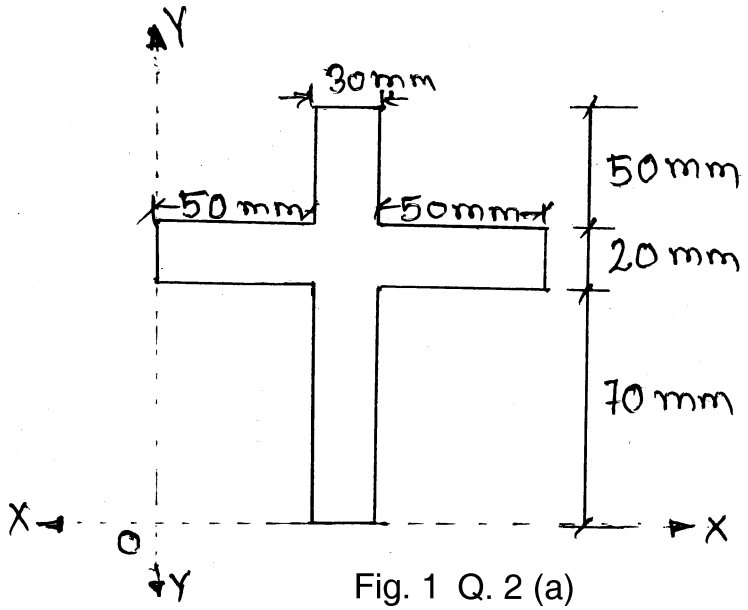

Fig. 1 Q. 2 (a)

b) Find the moment of inertia of section shown in Fig. 2 @ x – x and y – y axis.

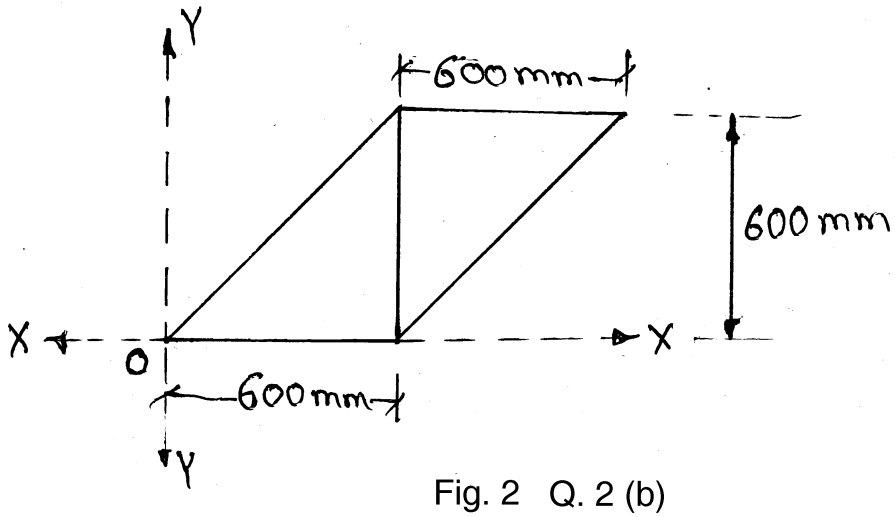

Fig. 2 Q. 2 (b)

c) i) Using parallel axis theorem, obtain the expression for moment of inertia of a rectangle b × d about the axis passing through its base and side.

ii) Draw stress-strain curve for mild steel under tensile loading showing important points on it.

MARKS

3. Solve **any two** of the following : **16**

a) A composite bar comprising of aluminium and steel is as shown in Fig. 3. Find the value of 'P' if net elongation produced in the bar is 2 mm. Take Es = 20×10^4 N/mm^2 and Eal = 7×10^4 N/mm^2.

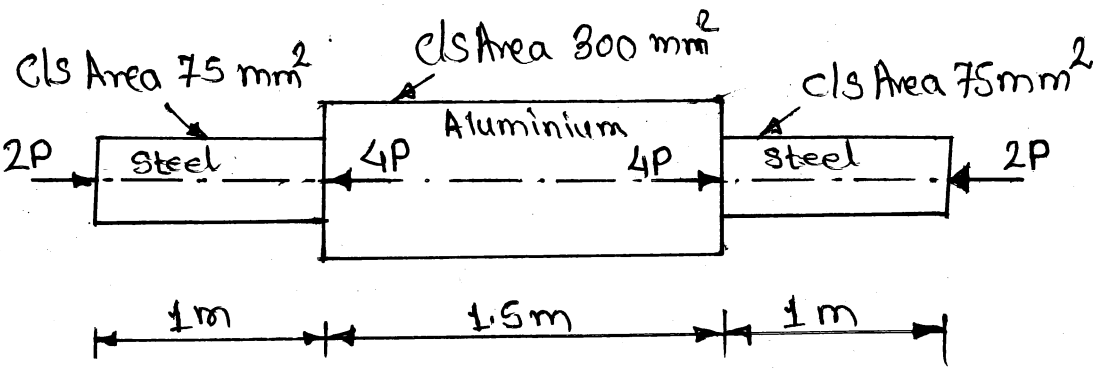

Fig. 3 Q. 3 (a)

b) A RCC column 400 mm × 400 mm is reinforced with 4 bars of 20 mm ϕ diameter. Determine the stresses induced in steel and concrete if it is subjected to an axial load of 500 kN. Take modular ratio $\frac{Es}{Ec} = 13.33$.

c) A cube of 150 mm side is subjected to a uniform tensile stress of 50 N/mm^2 on all faces. Calculate the increase in volume of the cube and bulk modulus. Take E = 2×10^5 N/mm^2 and Poisson's ratio is 0.33.

4. Solve **any two** of the following : **16**

a) A steel rod, 1 m long is fixed at the ends and subjected to a pull of 9 kN. Determine the residual stress due to an increase of 20°C. Diameter of bar = 12 mm. E = 200 kN/mm^2, $\alpha = 16 \times 10^{-6} / °C$.

b) A cube of 250 mm side is subjected to a compressive, force of 3.8 MN on each face. The change in volume is found to be 5200 mm^3. Find E and K if $\left(\frac{1}{m}\right) = 0.25$.

c) A simply supported beam of span 5 m carries a u.d.l. of 20 kN/m over 4 m length from the left support and a point load of 50 kN at 2 m from right support. Draw S.F. and B.M. diagrams.

MARKS

5. Solve **any two** of the following : **16**

   a) A simply supported beam 5 m long carries a point load of 20 kN and anticlockwise moment of 8 kN-m at a distance of 3 m from the left hand support. Draw SF and BM diagrams.

   b) i) An overhanging beam is supported at A and B, with AB = 8 m and BC = 2 m. BC is overhang. Locate the point of contraflexure if a u.d.l. of 20 kN/m is acting throughout the beam.

   ii) A cantilever beam of span 2 m is subjected to point load of 10 kN upward at free end, and clockwise moment of 20 kN-m at free end. Draw BMD only.

   c) A T section beam having flange 180 mm wide and 20 mm thick and web 150 mm long and 20 mm thick carries u.d.l. of 80 kN/m over an effective span of 8 m. Calculate the maximum bending stress.

6. Solve **any two** of the following : **16**

   a) A rectangular beam 230 mm wide has a shear force 120 kN at a section. The maximum shear stress induced is 3.13 N/mm^2. Find the depth of the beam. Calculate the minimum radius of gyration of section.

   b) Find the crippling load by Rankine's formula for a hollow circular column of 200 mm external diameter and 150 mm internal diameter. Length of the column is 5 m. If

      a) Both ends are fixed

      b) One end is fixed and other free

      c) One end is fixed and other is hinged

      d) Both ends are hinged.

      Take fc = 550 N/mm^2, $a = \left(\frac{1}{1600}\right)$.

   c) A steel rod of 25 mm diameter and 1500 mm long is subjected to a load of 30 kN applied suddenly. Calculate the strain energy stored and modulus of resilience along with change in length.
      Take $E = 2.1 \times 10^5$ N/mm^2.
