22303

23124

3 Hours / 70 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. Attempt any FIVE of the following: **10**

a) Define moment of inertia.

b) State Hooke's Law.

c) Define volumetric strain.

d) Define Bulk Modulus.

e) What is point of contra flexure? State its importance.

f) For a cantilever beam of span 4 m, if u.d.l. of 10 KN/m is acting on full span, calculate maximum shear force and bending moment.

g) State the effective length for a column fixed at both ends having 6 cm length. Draw figure for it.

Marks

2. Attempt any THREE of the following: **12**

a) A square has 100 mm side. Calculate M.I. about it's vertical centroidal axis and about it's polar axis. (Izz)

b) A semicircular lamina has a base diameter of 140 mm. Calculate M.I. about its horizontal and vertical centroidal axis. Also calculate the minimum radius of gyration.

c) A symmetrical I section has over all depth of 300 mm. It has flanges of size 150 mm × 10 mm and web thickness is 10 mm. Find M.I. about centroidal axis parallel to flange.

d) A mild steel flat 100 mm wide, 12 mm thick and 5 m long carries an axial load of 20 KN. Find stress, strain and change in length of bar. Take $E = 2 \times 10^5$ N/mm^2.

3. Attempt any THREE of the following: **12**

a) A force of 30 KN is required to punch a circular hole of 16 mm diameter in a metal plate of thickness 2 mm. Calculate the compressive stress developed in the punching rod and shear stress developed in the metal plate.

b) A mild steel rod 20 mm in diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. This composite bar is subjected to an axial pull of 40 KN. Find the stress developed in the rod and the tube.
Take $E_s = 200$ KN/mm^2 $E_{cu} = 100$ KN/mm^2.

c) If modulus of elasticity E = 110 GPa and
Modulus of rigidity = G = 45 GPa, find bulk Modulus and Poisson's ratio.

d) A cube of 200 mm side is subjected to a compressive force of 3500 KN on all its faces. The change in volume of the cube is 5000 mm^3. Calculate the bulk modulus and modulus of elasticity if Poission's ratio is 0.28.

Marks

4. Attempt any THREE of the following: **12**

a) A cantilever beam of span 4 m carries two point loads 10 KN and 20 KN at 1 m and 3 m from fixed end respectively draw SFD and BMD.

b) A beam having an over all depth of 300 mm is used as a cantilever for a span of 1.2 m. Calculate the intensity of u.d.l. it can carry, including self weight if the bending stress is not to exceed 8 N/mm^2, M.I. about N.A. for the beam is 4.05×10^8 mm^4.

c) A rectangular beam is 60 mm wide and 160 mm deep of span 5 m. It is simply supported and it carries a concentrated point load of 40 KN acting downwards at mid span. Find the maximum shear stress induced in the beam section.

d) A strut 2.4 m long is 40 mm in diameter. One end of strut is fixed while the other end is hinged. Calculate Euler's crippling load if $E = 2 \times 10^5$ N/mm^2. Also calculated safe load if factor of safety is 2.5.

e) A rectangular column has cross section 300 mm x 200 mm and length of 3 m. Find slenderness ratio if

(i) both ends are hinged.

(ii) both ends are fixed.

5. Attempt any TWO of the following: **12**

a) A tensile test is carried out on m.s. bar or 10 mm diameter with a gauge length of 50 mm. The bar yields under a load of 20 KN. It reaches a maximum load of 40 KN and breaks at 25 KN. The final gauge length of the specimen is 67 mm after test.

Calculate:

i) Yield stress

ii) Ultimate stress

iii) Breaking stress

iv) Actual stress if diameter of ruptured neck is 7 mm

v) Percentage reduction in area

vi) Percentage elongation

Marks

b) A beam ABCD is simply supported at A and D AB = BC = CD = 2 m. It is subjected to an u.d.l. of 10 KN/m on span AB. A point load of 20 KN is acting downwards at point C. (4 m from A). Draw SFD and BMD.

c) A beam ABC is simply supported at A and B. Span AB = 6 m and overhang BC = 2 m. It carries on u.d.l. of 15 KN/m on Span AB and a point load of 30 KN is acting at point C downwards. Draw SFD and BMD.

6. Attempt any TWO of the following: 12

a) A cantilever beam of span 4 m, carries a point load of 2 KN acting at 2 m from fixed end. An u.d.l. of 1 KN/m is acting on full span. Draw SFD and BMD.

b) A beam section is 100 mm wide and 200 mm deep. It is subjected to a shear force of 60 KN. Determine the maximum shear stress at N.A. and shear stress 50 mm above N.A. Draw shear stress distribution diagram showing these two stresses.

c) A timber beam is 100 mm wide and 200 mm deep. It is simply supported over a span of 6 m. It carries an u.d.l. of 12 KN/m on full span and a central point load of a 4 KN acting downwards. Calculate the maximum bending stress developed in the beam and draw bend stress distribution diagram.