22303

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

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) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) 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 elastic body and plastic body.

b) Write mathematical expression 'strain energy for impact load' with meaning of each term.

c) Define shear stress and shear strain.

d) State relationship between modulus of rigidity and bulk modulus.

e) Sketch any two types of beam.

f) State the maximum shear stress in S/S rectangular beam section carrying central point load.

g) Define long column and short column.

Marks

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

a) State 'Parallel axis theorem' and write mathematical expression with meaning of each term.

b) Define 'Polar moment of inertia'. Calculate Polar moment of inertia for square lamina of side 30 cm.

c) Calculate the least moment in inertia of a symmetrical I-section having following details :

Flanges : 150 mm × 20 mm

Overall depth : 240 mm and Thickness of web : 10 mm

d) Calculate centroidal moment of inertia about X-X axis of composite lamina made up of with circular hole of 52 mm is removed from rectangular plate of 200 mm × 150 mm axis symmetrically.

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

a) Define –

(i) Normal stress

(ii) Direct stress

(iii) Bending stress

(iv) Shear stress

b) A metal rod 12 mm diameter and 2 m long when subjected to tensile force of 50 kN shows an elongation of 2 mm. Calculate the modulus of elasticity.

c) Determine load shared by each material due to axial thrust of 1000 kN on composite steel tube with 150 mm inside diameter and 6 mm thickness is filled with concrete. Take $E_{steel} = 210 \times 10^3$ N/mm^2 and $E_{concrete} = 14 \times 10^3$ N/mm^2.

d) A compound stepped bar having solid steel rod of diameter 50 mm and solid copper rod of diameter 20 mm is pulled by 180 kN. Calculate change in length of stepped bar. Take Modulus of elasticity E_s=210 kN/mm^2 and E_c = 110 kN/mm^2.

Marks

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

a) In tension test a metal rod of 18 mm diameter and 30 cm long when subjected to a tensile force 220 kN produces an elongation of 0.5 mm and reduction in diameter 0.0055 mm. Calculate Poisson's ratio.

b) A cube of 100 mm side is subjected to a uniform tensile stress of 60 N/mm^2 on all faces. Calculate the increase in volume of the cube. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio is 0.33.

c) Draw shear force and bending moment diagram for simply supported beam of 4.5 m span subjected to UDL of 18 kN/m up to its midspan from left hand support. Also determine point of maximum bending moment.

d) A circular column having diameter 360 mm is 4.5 m long. Determine Euler's crippling load, if both ends of column are fixed. Take $E = 2 \times 10^5$ N/mm^2.

e) Calculate the crippling load by Rankine's formula for square column of 450 mm side if unsupported length of the column is 6 m with both ends are hinged.

Take fc = 550 N/mm^2 and a = (1/1600)

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

a) Draw shear force and bending moment diagram for beam ABC simply supported at A and B with BC is overhang. The entire beam is supporting UDL of 22 kN/m with anticlockwise moment of 15 kNm at its free end C. Take AB = 4.8 m and BC = 2 m.

b) A simply supported beam of span 5.8 m carries UDL of 10 kN/m upto 2.2 m from right hand support and vertically downward point load of 33 kN at its midspan. Draw SFD and BMD with appropriate calculation.

c) A cantilever beam of 4.5 m span is loaded with UDL of 20 kN/m up to its midspan from its free end and clockwise moment of 10 kNm at its mid span. Draw shear force and bending moment diagram.

Marks

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

a) A simply supported beam of span 4.5 m carries central point load of 32 kN. Draw shear stress distribution along a cross section of maximum shear stress if beam having rectangular cross section of 230 mm × 450 mm.

b) Design cantilever beam for bending stress of circular cross section with span 3.2 m if maximum bending stresses in beam is limited up to 15 N/mm^2.

c) Draw shear stress distribution along of beam for symmetrical I section with flanges 120 mm × 10 mm and web 8 mm × 160 mm carrying shear force of 240 kN.

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