12425

15116

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.*
(8) Use of Steam tables, logarithmic, Mollier's chart is ***permitted****.*

Marks

1. Attempt **any ten** of the following : **20**

a) Define stress and strain.

b) State Hook's law.

c) Define modulus of elasticity, state its unit.

d) State principle of superposition.

e) Define working stress.

f) Explain how thermal stresses are developed.

g) A 10 m long rod heated through 50°C. Find the free expansion of the rod.

Take $\alpha = 12\times10^{-6}/°C$.

h) If a bar 10 mm diameter is free to deform is heated through 80°C. Find the stress due to temperature in the bar. Take $\alpha = 12\times10^{-6}/°C$ and $E = 2\times10^{5}$ N/mm^2.

i) Draw stress strain curve for mild steel specimen subjected to tensile test. Show yield point on the curve.

j) Define shear stress and bending moment.

k) Define point of contraflexure.

l) State the relation between bending moment and shear force.

m) Draw S.F. and B.M. diagram for simply supported beam carrying point load of W at mid span.

n) Draw S.F. and B.M. diagram for cantilever of span l and carrying udl of W/unit length over entire span.

P.T.O.

Marks

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

a) A mild steel specimen was tested in tension using UTM and the following observations were recorded. Diameter of specimen = 12 mm, initial gauge length = 60 mm, load at yield point = 48 kN, ultimate load = 58 kN, final gauge length = 72 mm, breaking load = 32 kN. Calculate yield stress, ultimate stress, breaking stress and percentage elongation.

b) A mild steel bar of square cross section 10 mm ×10 mm is subjected to a forces as shown in Figure No. 1. Find the value of P and change in length of each part along with total change in length. Take E = 200 kN/mm^2.

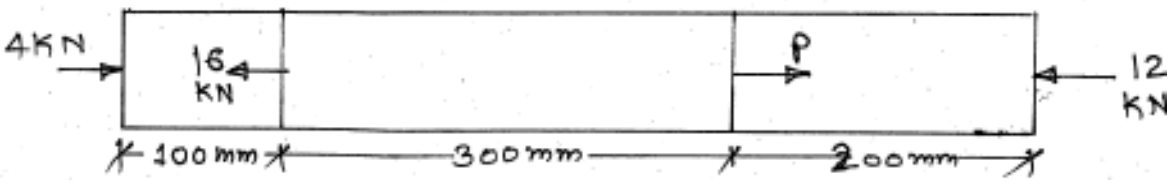

Figure No. 1 (Q. 2 (b))

c) i) A metal rod 24 mm diameter and 2 m long is subjected to an axial pull of 40kN. If the elongation of the rod is 0.5 mm. Find the stress induced and value of Young's modulus.

ii) A load of 6 kN is to be raised with the help of steel cable. If stress is not to exceed 110 N/mm^2, find the minimum diameter of steel cable.

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

a) A circular bar of 500 mm length has a cross section as given below. First 100 mm has a diameter 12 mm, second 200 mm has a diameter 20 mm, and the last 200 mm has a diameter of 30 mm. Determine total elongation of the bar along with elongation of each part of the bar if bar is subjected to axial pull of 50 kN. Take E = 2×10^5 N/mm^2.

b) A composite bar consisting of steel rod 30 mm in diameter is enclosed in a copper tube of external diameter 60 mm and internal diameter 30 mm. It is subjected to an axial compressive load of 110 kN. Calculate the stresses developed in steel and copper. Also calculate load shared by each material. Take E_S = 210 kN/mm^2 and E_C = 105 kN/mm^2.

c) i) A RCC column 450 mm diameter is reinforced with 6 bars of 16 mm diameter. Find the safe load that the column can carry, if the permissible stresses in concrete and steel are 5 N/mm^2 and 100 N/mm^2 respectively. Modular ratio m = 18.

ii) A rod 300 mm long and 20 mm in diameter is heated through 100°C and at the same time pulled by a force P. If the total elongation is 2mm, what is the magnitude of P.

Take E = 2×10^5 N/mm^2 and $\alpha = 12\times10^{-6}$ /°C.

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

a) A rod is subjected to an initial compressive stress 50 N/mm^2 and held in rigid supports at temperation of 50°C. Find the temperature at which the rod will become stress free. What stress will be developed at the temperature of 10°C ? Take $\alpha = 12\times10^{-6}$ /°C and E = 200 kN/mm^2.

Marks

b) A steel rod 20 mm diameter and 200 mm long passes centrally through a brass tube whose external diameter is 30 mm and internal diameter is 20 mm. The composite bar is heated through 120 °C. Calculate the magnitude and nature of stresses induced in each metal. Take $E_S = 2\times10^5$ N/mm^2 and $E_b = 1\times10^5$ N/mm^2, $\alpha_S = 12\times10^{-6}$ / °C and $\alpha_b = 20\times10^{-6}$ / °C.

c) A steel rod, 1 m long is subjected to a pull of 9 kN and then fixed at the ends. Determine the residual stress due to change of temperature (rise and fall) through 20 °C. Diameter of bar = 12 mm, E = 200 kN/mm^2, $\alpha = 16\times10^{-6}$ / °C.

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

a) Draw S.F. and B.M. diagram for the beam loaded as shown in Figure No. 2.

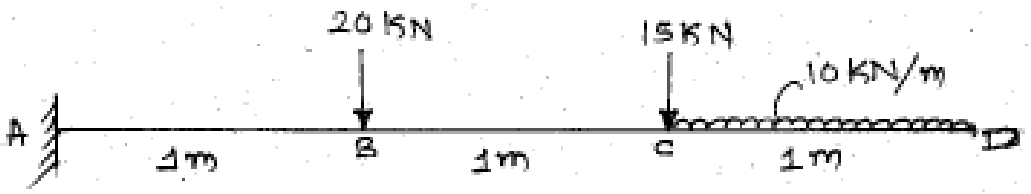

Figure No. 2 (Q. 5 (a))

b) A simply supported beam of span 6 m carries udl of 2kN per metre run over the entire span and two point loads of 4 kN and 5 kN at 2 m and 4 m from the left hand support. Draw S.F. and B.M. diagram.

c) An overhanging beam ABC is supported at A &B, 6 m apart with an overhang BC 2 m long, carries an u.d.l. of 15 kN/m over AB and point load of 30 kN at C. Draw S.F. and B.M. diagram. Locate point of contraflexure.

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

a) A cantilever beam ABCD of span 3 m is subjected to a u.d.l. of 10 kN/m over entire span. End A is fixed and AB = BC = CD = 1m. It also carries point loads of 40 kN, 50 kN and 30 kN at B, C and D respectively. Draw S.F. and B.M. diagram.

b) A simply supported beam of span 7m is subjected to udl 20 kN/m over a length of 5 m from left end and a point load of 20 kN at a distance of 5 m from right end. Draw S.F. and B.M. diagram. Calculate the maximum value of bending moment.

c) Draw SF and BM diagrams for the overhanging beam loaded as shown in Figure No. 3. Also locate points of contraflexure.

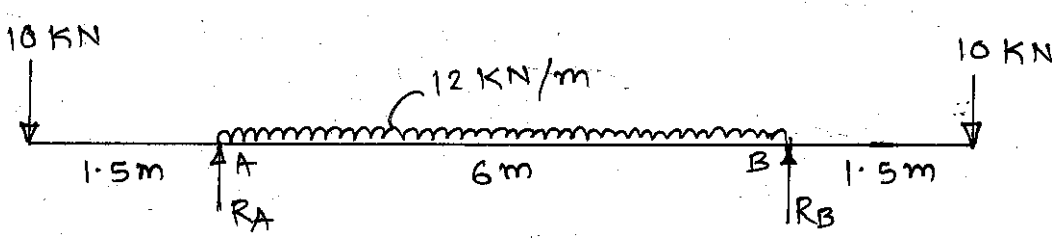

Figure No. 3 (Q. 6 (c))