22306

12223

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) State parallel axis theorem for M.I. along with diagram and write mathematical expression.

b) Enlist any two machine components each subjected to axial tensile and axial compressive stresses.

c) Define

i) Fatigue

ii) Creep

d) State the relation between B.M., S.F. and rate of loading.

e) Define section modulus with mathematical expression. State the value of section modulus for solid circular section with dia 'd'.

f) State the no tension condition at the base of a column.

g) Define eccentric loading. State two examples of it.

Marks

2. Attempt any THREE of the following: 12

a) An angle section 120 mm × 100 mm × 20 mm is placed such as its longer leg is horizontal. Calculate M.I. about centroidal horizontal axis only (i.e. I_{xx} only).

b) Draw stress-strain diagram with all important points on it for mild steel material subjected to gradually applied axial tensile load.

c) i) State the important properties required for following engineering material

1) Copper

2) Cast-iron

ii) Define

1) Poisson's ratio

2) Modulus of rigidity

d) Draw S.F. and B.M. diagram for the cantilever as shown in Figure No. 1.

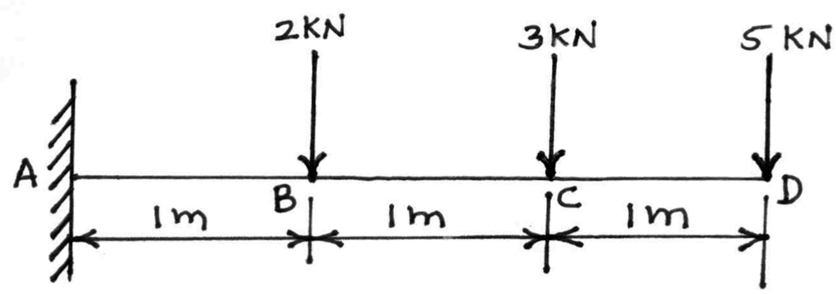

Figure No. 1.

3. Attempt any THREE of the following: 12

a) An equilateral triangle has base AB = 100 mm. Using parallel axis theorem, calculate its M.I. about AB and apex C.

b) A cube of 200 mm side is subjected to a compressive force of 3.6 MN on each face. The change in volume of the cube is observed to be 4000 mm^3. Compute the bulk modulus. If μ = 0.3, find the Young's modulus.

c) A simply supported beam of span 9.75m is carrying full span u.d.l. of 10 kN/m. Draw S.F.D and B.M.D.. Also find the magnitude and position of maximum B.M. developed.

Marks

d) A 30 mm diameter rod is bentup to form an offset link as shown in Figure No. 2. If permissible tensile stress is 90 N/mm^2, calculate maximum value of 'P'.

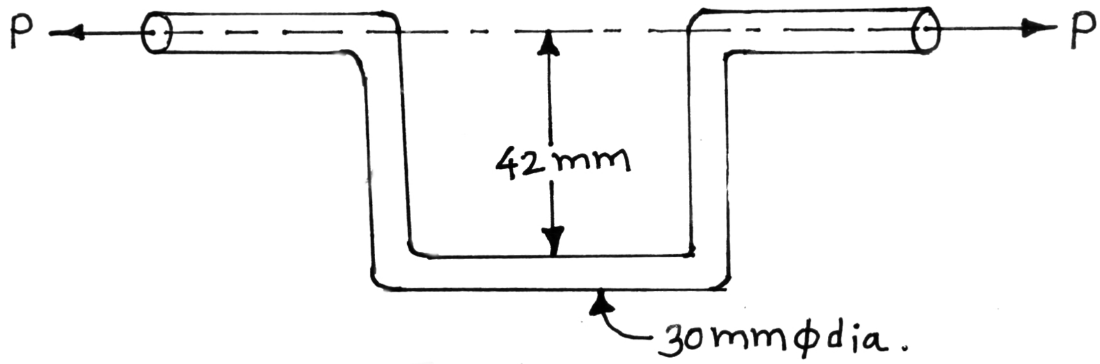

Figure No. 2.

4. Attempt any THREE of the following: 12

a) Draw the S.F.D. and B.M.D. for the simply supported beam as shown in Figure No. 3.

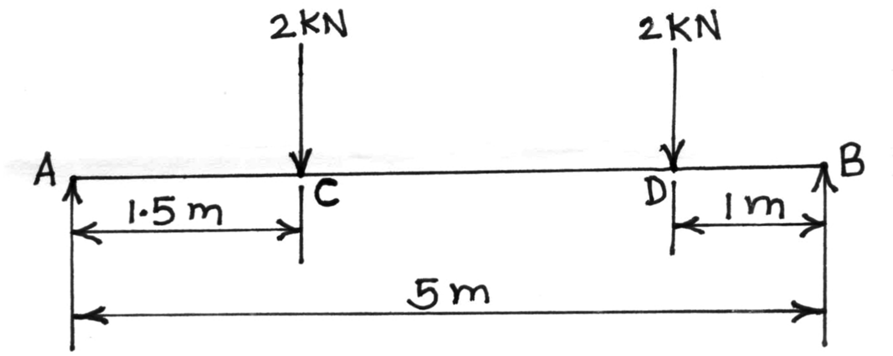

Figure No. 3.

b) A simply supported beam 150 mm wide and 300 mm deep carries a u.d.l. over a span of 4m. If the safe stresses are 30 MPa in bending and 2 MPa in shear. Find the maximum u.d.l. that can be safely supported by the beam.

c) A shaft is required to transmit 25 kW power at 180 r.p.m. The maximum torque may exceeds the mean torque by 30%. If shear stress is not to exceed 60 N/mm^2, determine the minimum diameter of the shaft.

Marks

d) A steel rod of 60 mm diameter and 3m long is subjected to pull of 90 kN applied suddenly. Calculate the maximum instantaneous stress and instantaneous elongation induced in it.

e) Compare solid shaft with hollow shaft for the following parameters.

i) Polar M.I.

ii) Polar modulus

iii) Torque transmitted

iv) Stiffness.

5. Attempt any TWO of the following: 12

a) A steel bar ABCD having 100 mm^2 cross sectional area is loaded axially as shown in Figure No. 4. Find the unknown force 'W' and deformation of bar. Take E = 200 GPa.

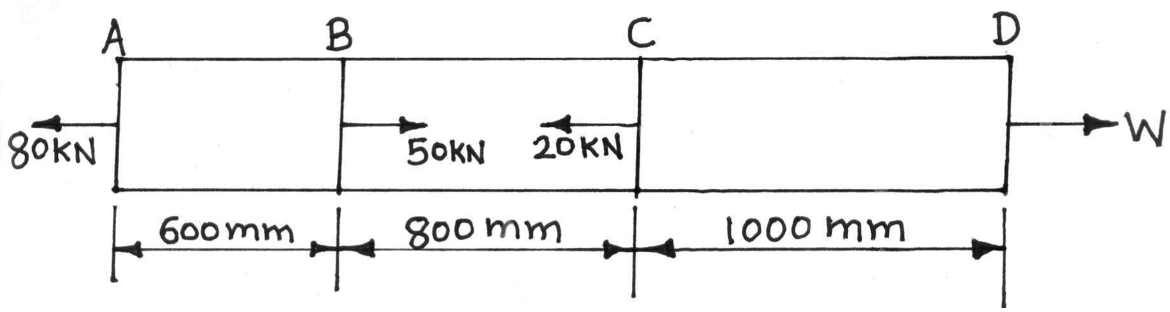

Figure No. 4.

b) A beam is loaded and supported as shown in Figure No. 5. Draw S.F. and B.M. diagrams. State only meaning of point of contra flexure.

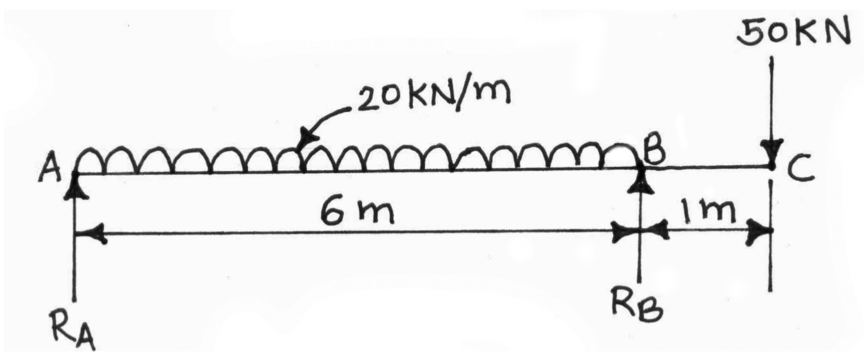

Figure No. 5.

c) A hollow rectangular beam section square in size having outer dimensions 140 mm × 140 mm with uniform thickness of material 30 mm is carrying a shear force of 130 kN. Calculate the maximum shear stress induced in the section.

Marks

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

a) A beam of square cross-section 100 mm × 100 mm is subjected to a shear force of 30 kN. Calculate the maximum shear stress as well as shear stress induced across the section at a layer 20 mm away from the neutral axis. Sketch the shear stress distribution diagram for the given beam.

b) A shaft has to transmit 105 kW at 160 r.p.m. If the shear stress is not to exceed 70 N/mm^2 and twist in the length of 3.5m must not exceed 1°; find the diameter of the shaft. Take modulus of rigidity (G) = 8×10^5 MPa.

c) A rectangular column 200 mm wide and 100 mm thick is subjected to load of 200 kN at an eccentricity of 80 mm in the plane bisecting the thickness. Dram combined stress distribution diagram.