16030(J)   I-16

B. Tech 2nd Semester Examination

Engineering Mechanics (NS)

**BE-105**

Time : 3 Hours   Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question each from Sections A, B, C & D of the paper and all sub-parts of Question No. 9 of Section E. Use of Non-Programmable calculators is allowed.
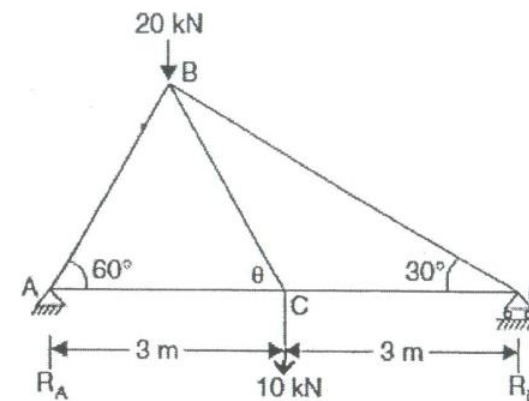
SECTION - A

1. (a) Determine the moment of Inertia of the section given below, about an axis passing through the centroid and parallel to the top most fibre of the section. Also determine the moment of inertia about the axis of symmetry. (15)
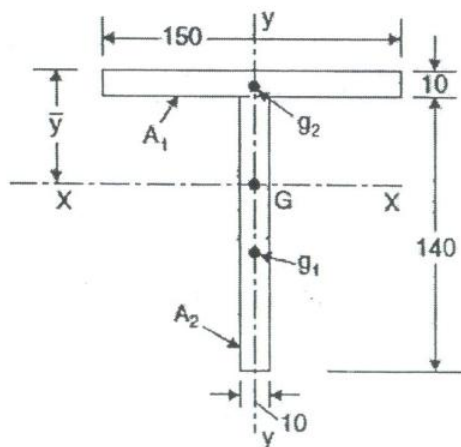
[P.T.O.]

(b) Find the centroid of a semicircular lamina of radius r.

(5)

2. (a) Determine the forces in all the members of the truss loaded as shown in the figure below and tabulate the results.   (10)

(b) Define Perfect, Deficient and Redundant frames with suitable examples.   (10)

SECTION - B

3. Explain the following terms: Young's Modulus (E), Shear Modulus (C), Bulk Modulus (K) and Poisson's ratio. Also derive the following relations:

   (i)   Young's Modulus (E) and Shear Modulus (C)

   (ii) Young's Modulus (E) and Bulk Modulus (K)

   (iii) Shear Modulus (C) and Bulk Modulus (K) and

   (iv) Young's Modulus (E), Shear Modulus (C) and Bulk Modulus (K)   (20)

4. A beam AB 20 meters long supported on two intermediate supports 12 meters apart carries a uniformly distributed load 6 kN/m together with concentrated loads of 30 kN at the left end A and 50 kN at the right end B. Draw the shear force and bending moment diagrams for the beam. (20)

SECTION - C

5. Derive the Flexure formula (bending equation) for the beam stating all the assumptions made. (20)

6. A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of beam is rectangular having a depth of 500 mm. If the maximum stress in the material of beam is 120 N/mm^2 and the moment of inertia of the section is 7×10^8 mm^4, find the length of the beam. (20)

SECTION - D

7. Two shafts of same material and same length are subjected to same torque. If the first shaft is of a solid circular section, and the second shaft is of a hollow circular section, whose internal diameter is 2/3 times the outer diameter and the maximum shear stress developed in each shaft is same, compare the weights of the two shafts. (20)

8. Define friction and its types. State and explain the Laws of friction. With neat schematic diagram explain: Angle of friction, Angle of repose and Cone of friction. (20)

SECTION - E

9. (a) State Parallel and perpendicular axis theorem for moment of inertia.

   (b) State and prove Varignon's theorem.

[P.T.O.]

(c) Differentiate between plane truss and space truss.

(d) Draw a neat stress-strain diagram for mild steel.

(e) State Hooke's law. Define Poisson's ratio.

(f) Define point of inflection for a beam.

(g) Derive the relation between shear force and bending moment.

(h) Define thermal stress and thermal strain.

(i) What do you mean by factor of safety in design?

(j) Differentiate between hollow and solid shaft.

(2×10=20)