Question Paper

Exam Date & Time: 24-Dec-2022 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATION - DECEMBER 2022
I SEMESTER B.Sc.(Applied Sciences) in Engg.
MECHANICS OF SOLIDS [ICE 111]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitably assumed.
Draw neat sketches wherever necessary.

1) A) Determine the support reactions RA and RB of the overhanging beam loaded as shown in **FIG. Q.NO.1A.** (5)

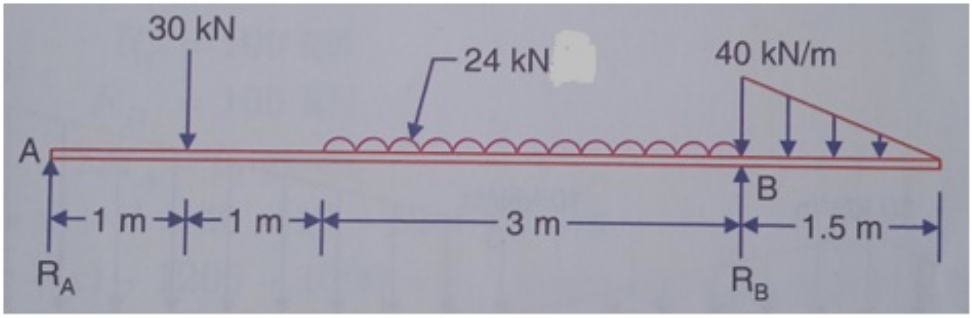

FIG. Q.NO.1A

B) A pile hammer weighing 15 kN drops from a height of 600 mm on a pile of 7.5 kN. How deep does a single blow of hammer drive the pile if the resistance of the ground to file is 140 kN? Assume the ground resistance is constant. (5)

2) A) Define the FOUR elastic constants and give any one mathematical relationship among them. (5)

B) Determine the moment of inertia about the horizontal centroidal axis of the area shown in **FIG. Q.NO. 2B.** (5)

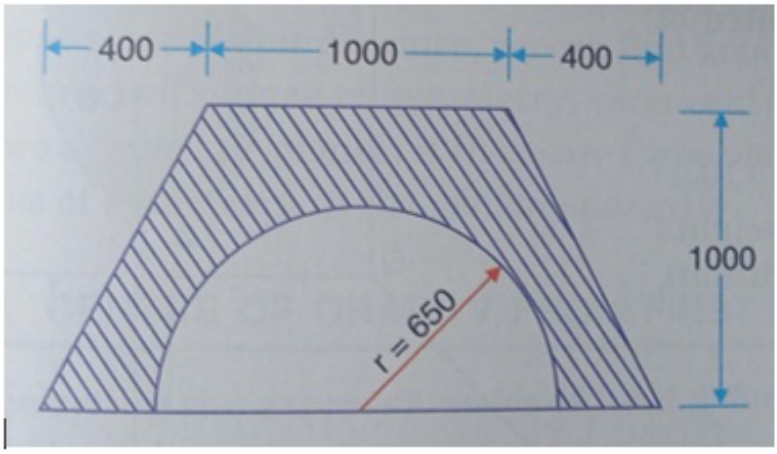

FIG. Q.NO. 2B

3) Explain with sketches (i) Cone of friction (ii) Temperature stress (iii) D'Alembert's Principle (5)

A)

B) A steel rod 28mm diameter is fixed concentrically in a brass tube of 42mm outer diameter and 30mm inner diameter. Both rod and tube are of 450mm long and is rigidly connected at their ends. When the temperature of the compound bar is raised to 70^{o}C, determine the stresses developed in both the rod and tube. Also find the magnitude and nature of forces induced in them. Take E_s = 200GPa, E_b = 90GPa, α_s = 11.2 x 10^{-6}/^{o}C and α_b = 21 x 10^{-6}/^{o}C. (5)

4) Determine the resultant completely (from the left end of lamina) of the force system shown in **FIG. Q. NO. 4A** acting on a lamina of equilateral triangular shape. (5)

A)

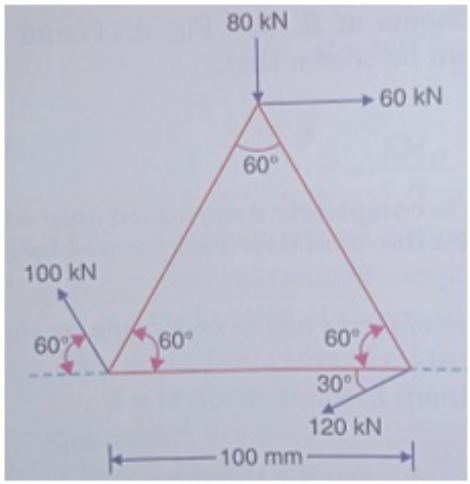

FIG. Q.NO. 4A

B) A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick is subjected to an internal pressure of 3 MPa. Calculate the change in volume of the vessel. Take E = 200 GPa and Poisson's ratio 0.3 for the vessel material. (5)

5) (5)

A) A bar of 12mm diameter is acted upon by an axial load of 20kN. The change in diameter is measured as 0.003mm. Determine (i) Poisson's ratio (ii) Modulus of Elasticity. Take Modulus of rigidity as 80GPa.

B) For the ladder AB with loads shown in FIG. Q.No.5B, determine the least value of α at which the ladder may be placed without slipping. Assume the co-efficient of friction between the floor and the ladder as 0.25 and between the wall and the ladder as 0.4. (5)

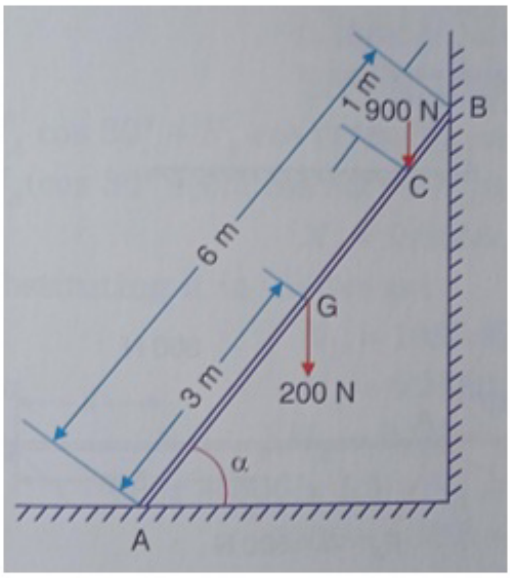

FIG. Q.NO. 5B

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