Question Paper

Exam Date & Time: 02-Dec-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

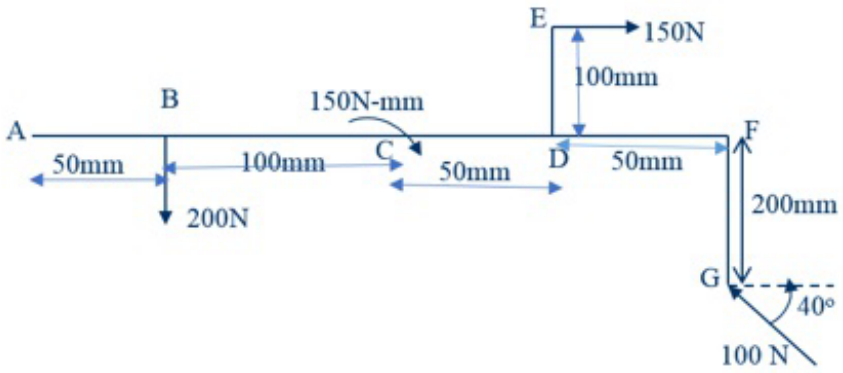
INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATION - NOVEMBER/DECEMBER 2023
I SEMESTER B.Sc. (APPLIED SCIENCES) IN ENGG.
MECHANICS OF SOLIDS [ICE 111]

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

Answer all the questions.

Missing data, if any, may be suitably assumed

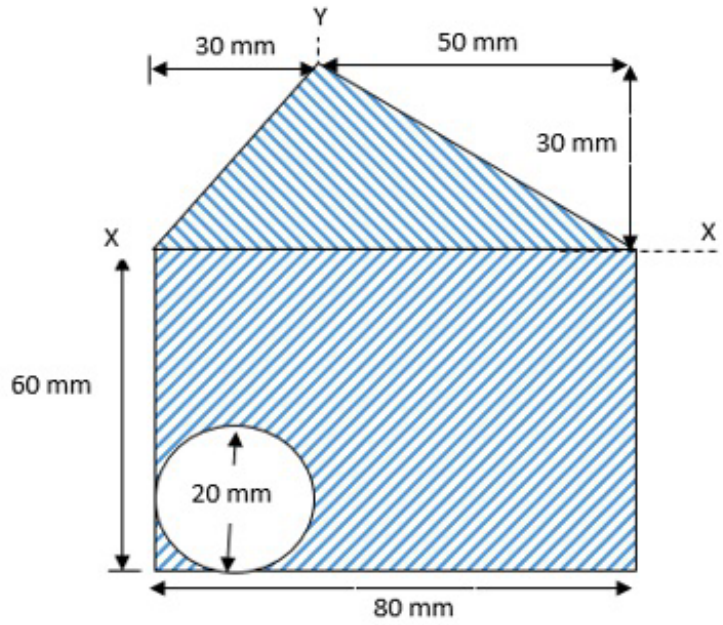
1) A) Find the resultant completely with respect to 'A' of the non-concurrent system of forces shown in the figure. (5)



B) Explain with figure (i) Force-Couple System (ii) Principle of Transmissibility. (5)

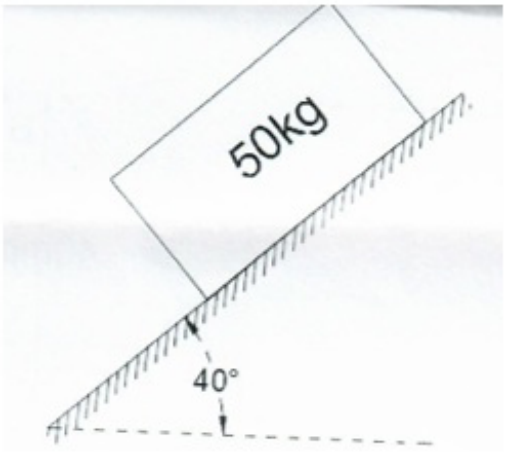
2) A) A 1.5m long steel bar having circular cross section is subjected to an axial tensile load of 100kN. Determine the required minimum diameter such that (i) the stress does not exceed 80MPa and (ii) the extension is not more than 0.8mm. Assume Young's modulus as 200GPa. (5)

B) Locate the centroid of the shaded area shown figure with respect to the axes shown. (5)



3) A) A ladder of length 5m has a weight of 200N. The foot of the ladder rests on the floor and the top of it leans against the vertical wall. Both the wall and floor are smooth. The ladder is inclined at 60^o with the floor. A weight of 300N is suspended at the top of the ladder. Find the value of the horizontal force to be applied at the foot of the ladder to keep it in equilibrium. (5)

B) A block of mass 50kg starts sliding from rest on a 40^o inclined plane as shown in figure. What is the velocity of the Block when it moves a distance of 2.5m down the plane? Also find the time taken by the block to cover the said distance. Take coefficient of kinetic friction as 0.2. Use Work Energy principle. (5)



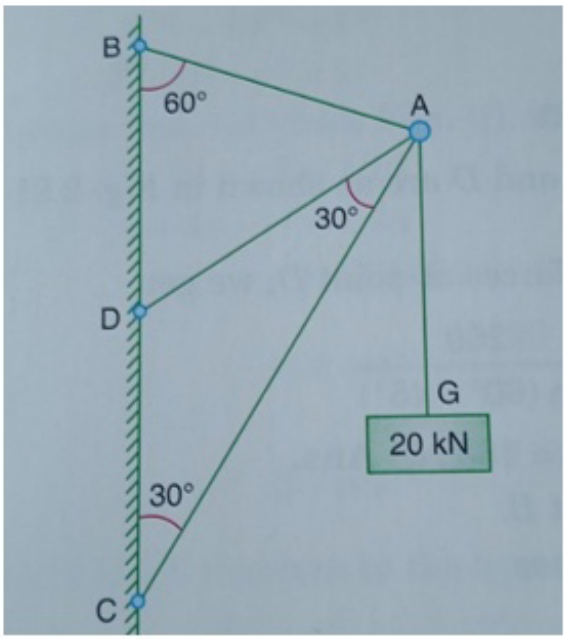
4) A) Explain (i) Radius of Gyration (ii) Modular Ratio (iii) Angle of repose (iv) Fixed Beam (5)

B) A steel rod of 20mm diameter passes centrally through a copper tube of 40mm external diameter and 30mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. If the temperature of the (5)

assembly is raised by 80^{o}C, calculate the stresses developed in copper and steel. Take E_{St} = 200GPa and E_{CU} = 100GPa and co-efficient of thermal expansion of copper and steel as 12x10^{-6}/^{o}C and 18x10^{-6}/^{o}C.

5) The frictionless pulley A supported by two bars AB and AC. Flexible cable DA supports a load of 20kN at G as shown in the fig. Determine the forces in the bars AB and AC. Neglect the size of the pulley. (5)

A)



B) A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick plates 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)

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