

Question Paper

Exam Date & Time: 22-Feb-2023 (09:30 AM - 12:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH. EXAMINATIONS - FEBRUARY/MARCH 2023

SUBJECT: CIE 1071 / CIE-1071 - MECHANICS OF SOLIDS

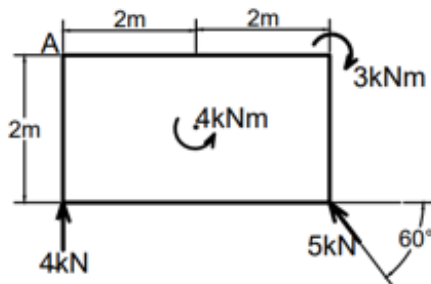
(MAKEUP)

Marks: 50

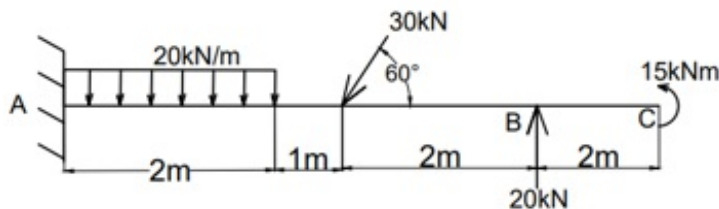
Duration: 180 mins.

Answer all the questions.

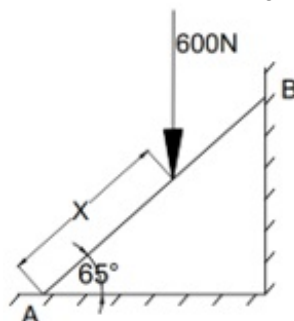
- 1A) Locate the resultant of the force system shown in figure with respect to Point A. (5)



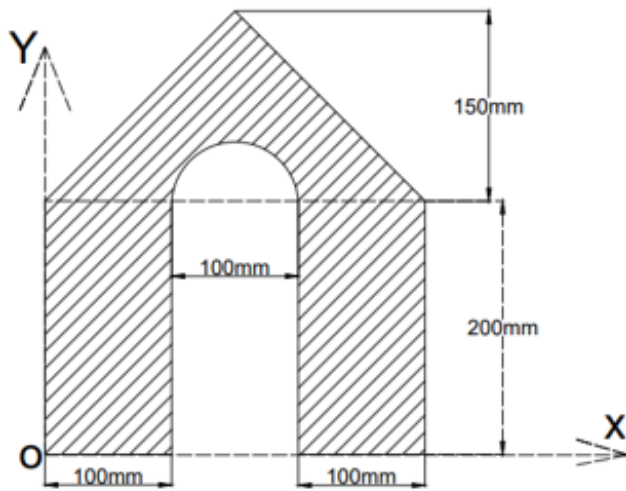
- 1B) Determine the support reactions for the cantilever beam shown in figure. (5)



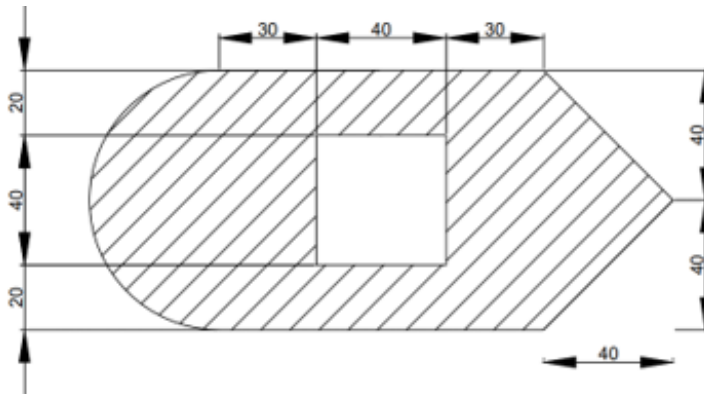
- 2A) A person of weight 600N is climbing a ladder of length 6m and weight 200N. The ladder makes an angle of 65° with horizontal floor. Determine the distance X as indicated in the figure, at which the ladder will be on the verge of sliding. The coefficient of friction for all contact surfaces is 0.4. (5)



- 2B) Locate the centroid of the hatched area shown in figure with respect to OX and OY axis. (5)



- 3A) Determine the moment of inertia of the figure shown below with respect to its horizontal centroidal axis. All dimensions are in mm. (5)



- 3B) A tensile load of 40 kN is acting on rod of 40 mm diameter and length of 4m. Determine the length of a bore of 20 mm diameter that can be made centrally in the rod, if the total extension is not to exceed by 30 percent under the same tensile load. Take $E = 2 \times 10^5 \text{ N/mm}^2$. (5)
- 4A) A specimen of steel 25 mm diameter with a gauge length of 250 mm is tested to destruction. It has an extension of 0.30 mm under a load of 95 kN and the load at elastic limit is 117 kN. The ultimate load is 145 kN. (5)
The total extension at fracture is 60 mm, diameter at neck is 20 mm and, diameter at fracture is 16mm. Find
(i) Breaking stress. (ii) True breaking stress. (iii) Percentage elongation. (iv) Percentage reduction in area. (v) Ultimate tensile stress.
- 4B) Derive the relationship between Young's modulus (E) and Bulk modulus (K). (3)
- 4C) Draw and explain shear stress and shear strain. (2)
- 5A) With the help of neat sketches, define the following terms: (2)
i) Moment of Inertia
ii) Radius of gyration.
- 5B) A reinforced concrete short column of size 300 mm \times 500 mm has 8 steel bars of 16 mm diameter inside the cross section. If the column is subjected to an axial compressive force of 800 kN, find the stresses developed in steel and concrete. Take $E_s/E_c = 18$. (5)
- 5C) Explain temperature stress and temperature strain with an example. (3)

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