Question Paper

Exam Date & Time: 02-Feb-2023 (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 - S2]

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

Answer all the questions.

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

1) A) Explain with sketch and relationship (i) the principle of compound bar (ii) Temperature stresses. (5)

B) A small block starts from rest at a point A and slides down the incline as shown in **FIG.Q.NO.1B.** What distance along the horizontal plane will it travel before coming to rest? Take the co-efficient of friction between the block and the planes as 0.3. Assume that the initial velocity with which it starts to move along BC is of the same magnitude as that gained in sliding from A to B. (5)

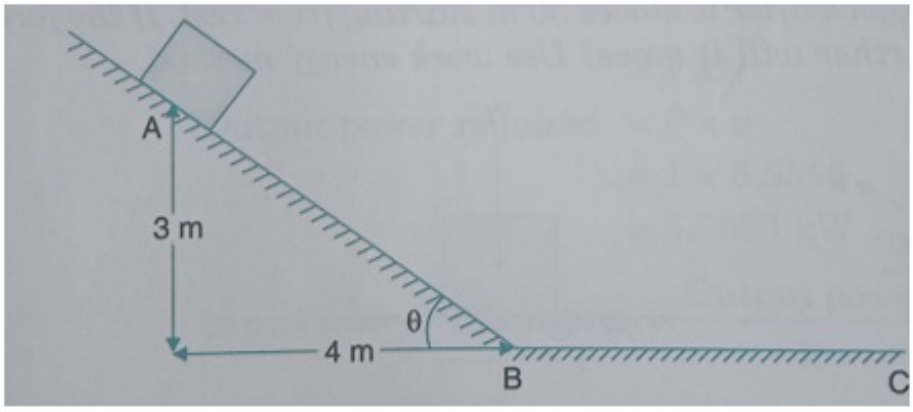

FIG. Q.NO.1B

2) A) Derive from first principles the moment of inertia for a right-angled triangle about its base and then demonstrate the application of parallel axes theorem to determine MI about its horizontal centroidal axis. (5)

B) A system of connected flexible cables shown in **FIG.Q.NO.2B** is (5)

supporting two vertical forces 200N and 250N at points B and D. Determine the forces in various segments of the cable.

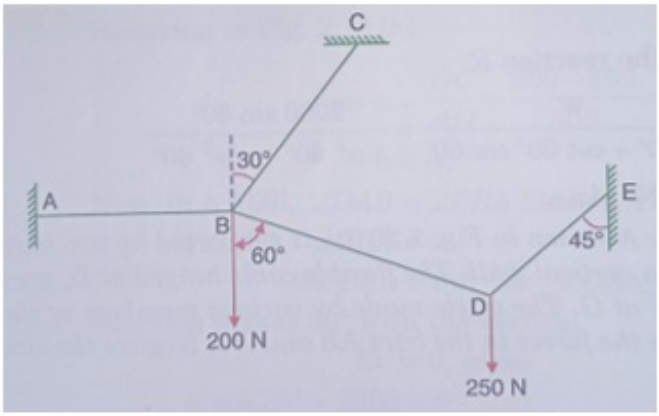

FIG. Q.NO. 2B

3) A) A rigid bar of length 600mm and negligible weight hangs by means of two bars of length 1.2m each as shown in **FIG.Q.NO.3A**. At what distance from the aluminum bar a vertical load W = 100kN be applied so that the rigid bar remains horizontal. The cross- sectional area of aluminum bar is 1000mm^2 and that of steel bar is 500mm^2. Take E_s = 200GPa and E_{al} = 65GPa. (5)

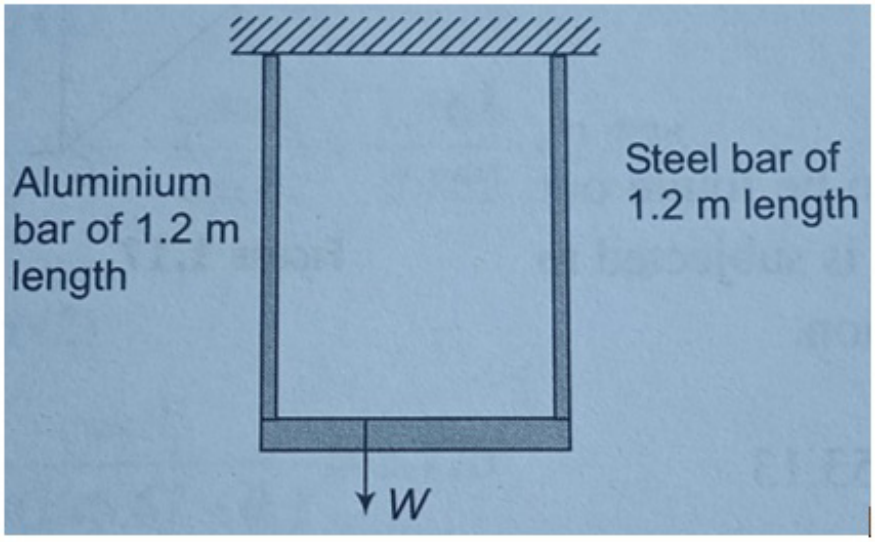

FIG. Q.NO. 3A

B) Find the coordinates of the centroid of the shaded area with respect to the axes shown (normal X and Y axis) in **FIG.Q.NO.3B**. All dimensions are in mm. (5)

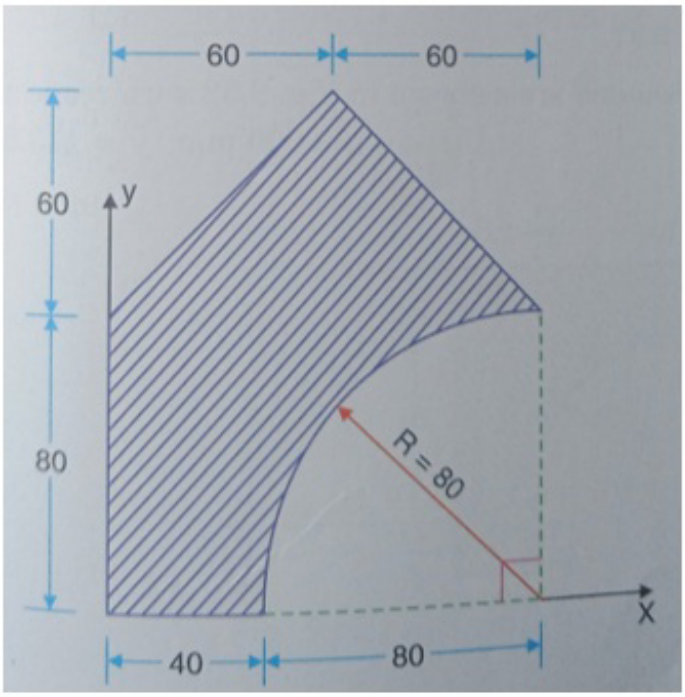

FIG. Q.NO. 3B

4) A) A steel cube of size 300mm x 200mm x 250mm is subjected to forces as shown in **FIG.Q.NO.4A**. If E_s = 200GPa and Poisson's ratio is 0.33, determine the change in dimensions and volume of the block. [Note that the Force is given in MN means Mega Newton]. (5)

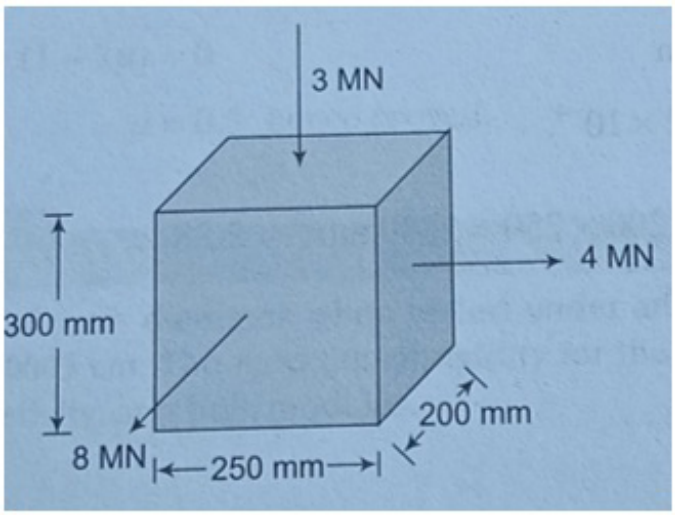

FIG. Q.NO. 4A

B) A 1.5m long steel bar having circular cross-section is subjected to an axial load of 100kN. Determine the minimum diameter of the bar so 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)

5) Give any four laws of dry friction and explain the Force-couple system. (5)

A)

B) Determine the reactions developed in the cantilever beam loaded as shown in (5)

FIG.Q.NO.5B

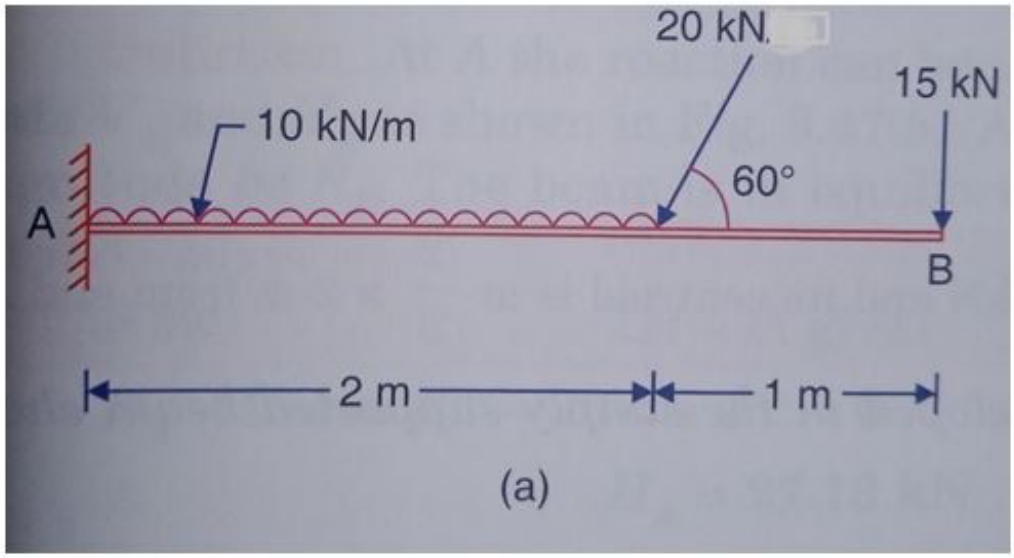

FIG. Q.NO. 5B

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