Exam Date & Time: 08-May-2024 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

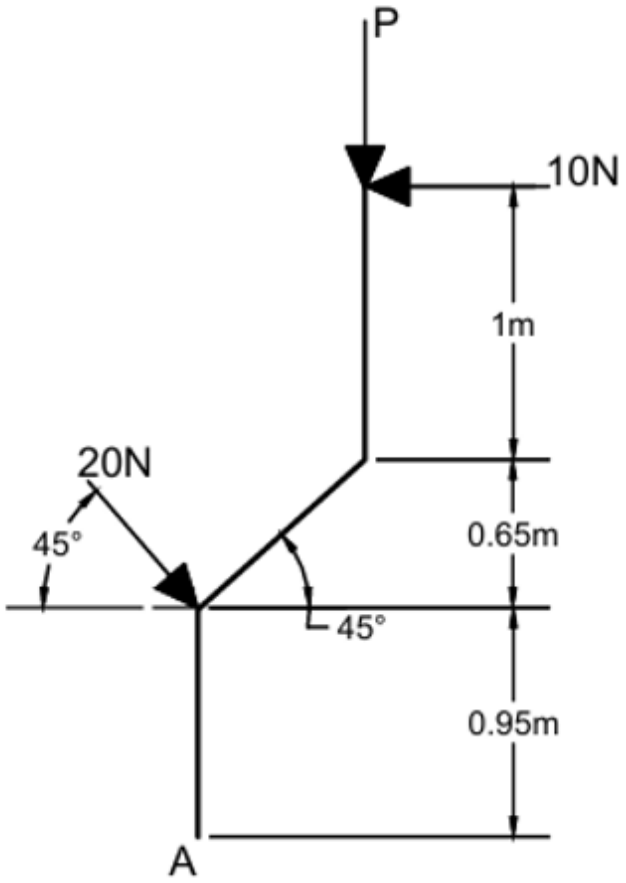
SECOND SEMESTER B.TECH. EXAMINATIONS - APRIL / MAY 2024
SUBJECT: CIE 1071/CIE_1071/CIE 1051-B - MECHANICS OF SOLIDS
MECHANICS OF SOLIDS [CIE 1071-PHY]

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

A

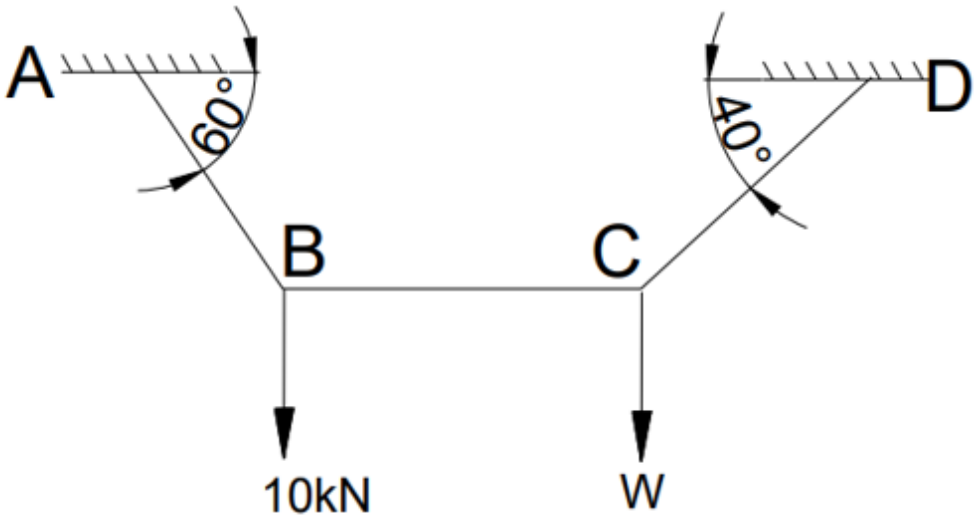
Answer all the questions.

1A) In the force system shown in figure, determine the value of force P such that, the resultant of those forces pass through point A. (5)

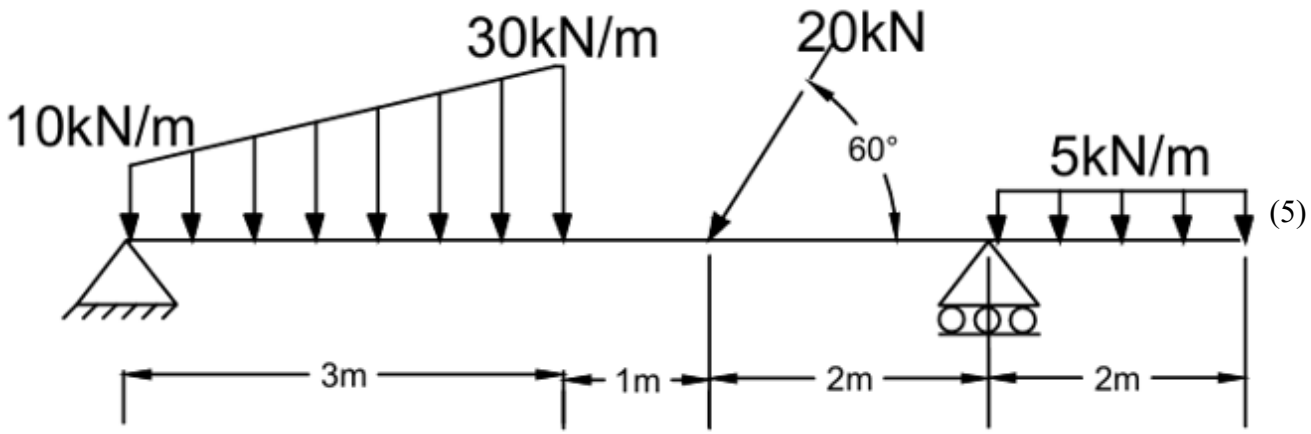


1B) Determine the Poisson's ratio and Modulus of Elasticity, Bulk Modulus and Modulus of Rigidity for a bar with a diameter of 30 mm subjected to a tensile force of 50 kN. The extension measured on a gauge length of 200 mm is 0.090 mm, and the change in diameter is 0.003 mm. (5)

2A) A cable is supported at A & D and loaded at B & C as shown in figure below. Determine the magnitude of force W, such that the segment BC remains horizontal. (5)

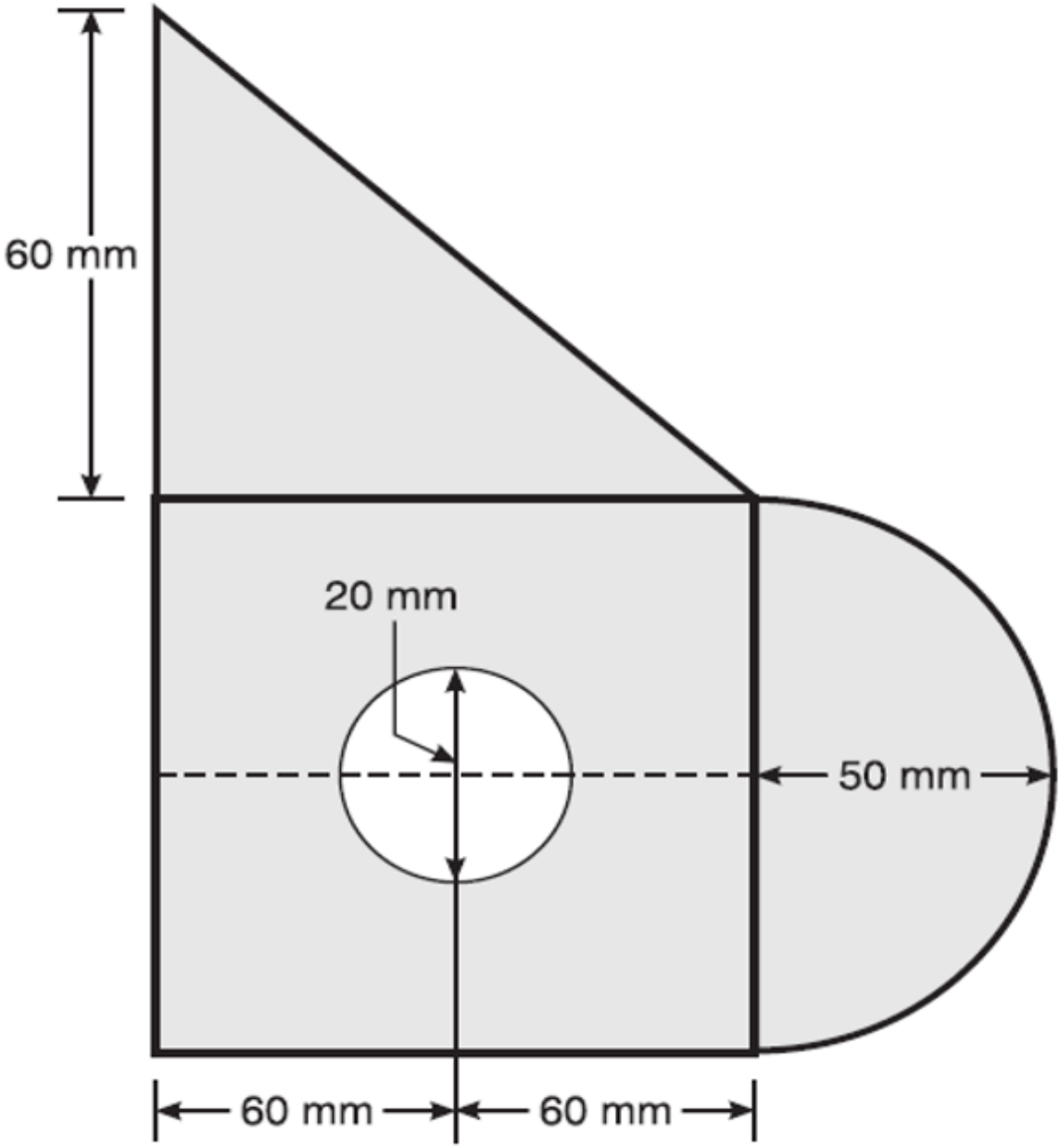


2B) Determine the support reactions for the beam shown in figure

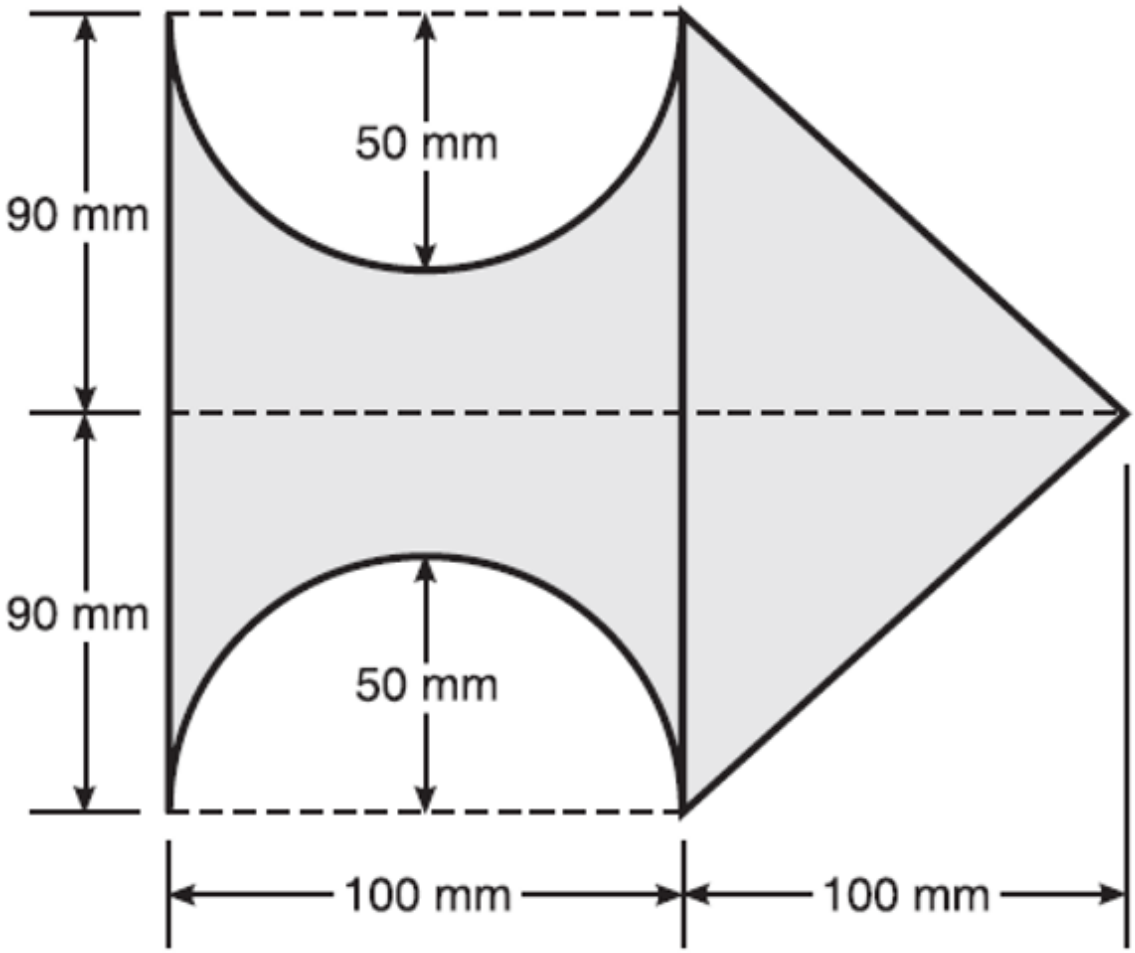


(5)

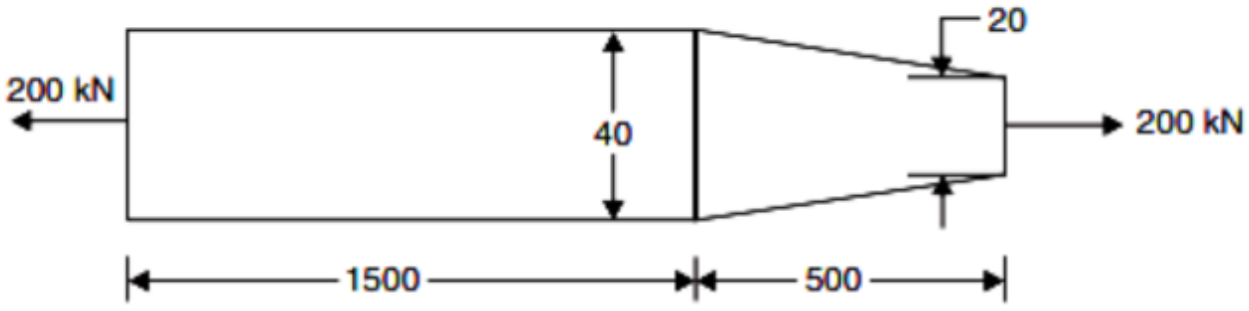
3A) Determine the centroid of the lamina shown in Figure (all dimensions in mm) (5)



3B) Find the moment of inertia of Figure about the centroidal vertical axis (all dimensions in mm). (5)



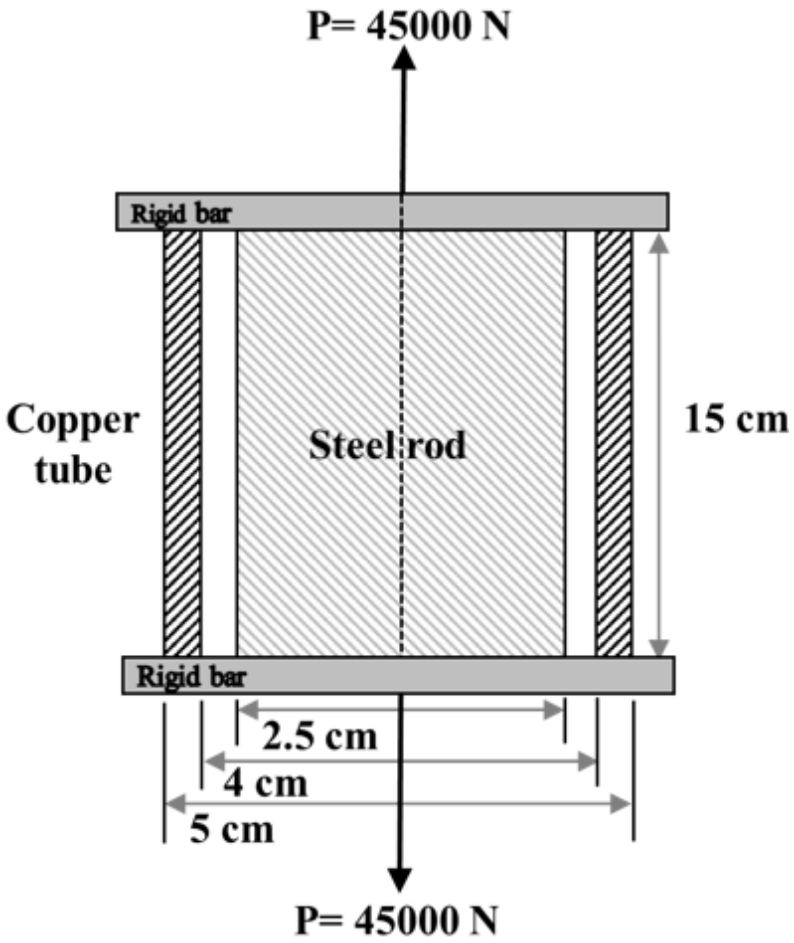
4A) A 2.0 m long steel bar is having uniform diameter of 40 mm for a length of 1 m and in the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Figure. Determine the elongation of this bar when subjected to an axial tensile load of 200 kN. Given E = 200 GN/m^2.



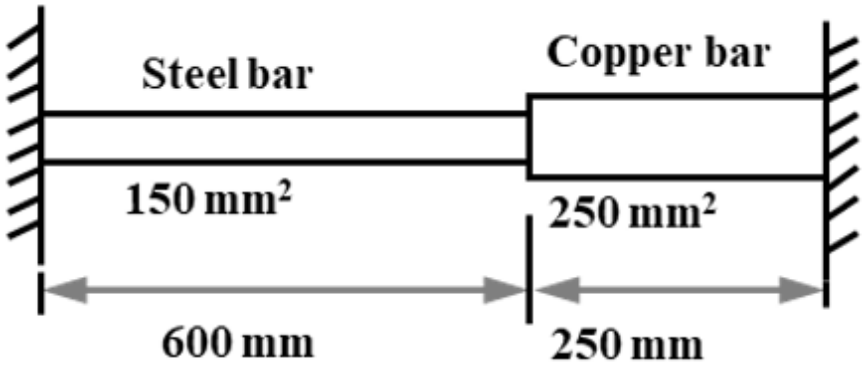
(5)

4B) Derive the relationship between young's modulus of elasticity (E) and modulus of rigidity (G). (5)

5A) Calculate the stresses experienced by the steel rod and copper tube when a compound bar made up of a steel rod of 2.5 cm in diameter, is centrally enclosed within a hollow copper tube with an external diameter of 5 cm, and internal diameter 4 cm, and subjected to an axial pull of 45,000N as shown in figure. Use the modulus of elasticity for steel as 2.1 x 10^5 N/mm^2 and for copper as 1.1 x 10^5 N/mm^2. (5)



5B) A composite bar composed of copper and steel is supported between two points, as illustrated in the figure. Initially stress-free at 52°*C*, what will be the stresses in the two bars when the temperature decreases to 34°*C,* under the following conditions: (a) if the supports are unyielding, (b) if the left supports move closer by 0.15 mm. The cross-sectional area of the steel bar is 150 mm^2, and that of the copper bar is 250 mm^2. Take $\boldsymbol{E_C}$ as 0. 7 x 10^5 N/mm^2 and $\boldsymbol{E_S}$ as 2 x 10^5 N/mm^2. The coefficients of thermal expansion for copper and steel are 25 x 10^{-6} per **°*C*** and 11.9 x 10^{-6} per **°*C*** respectively.



(5)

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