Question Paper

Exam Date & Time: 11-Mar-2021 (09:00 AM - 12:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

FIRST SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAR 2021

MECHANICS OF SOLIDS [CIE 1051 - 2020 -PHY]

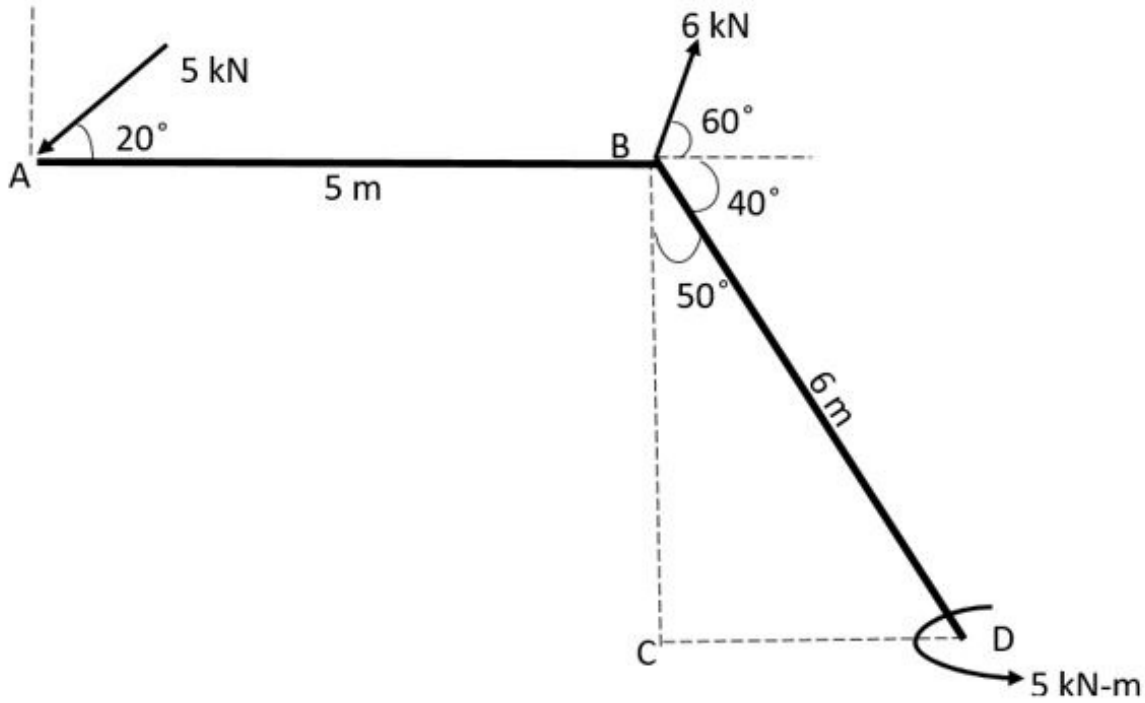
Marks: 50 **Duration: 180 mins.**

A

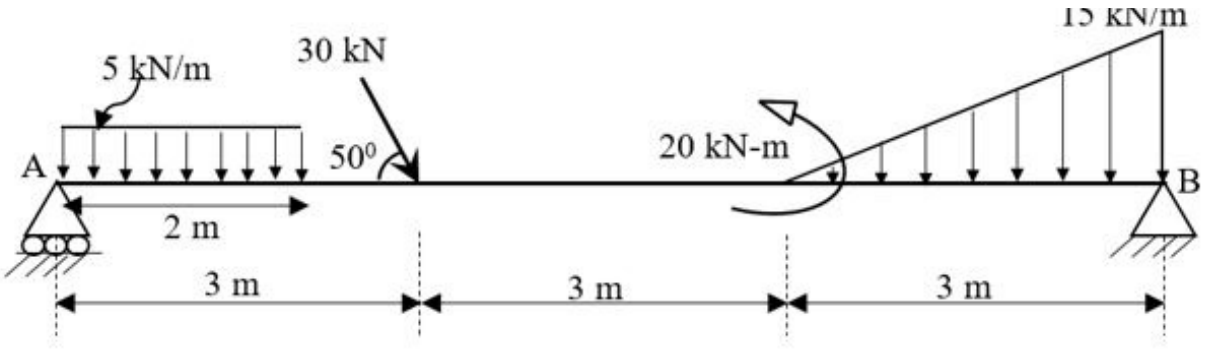
Answer all the questions.

1) A) State and explain the following: (3)
a) Varignon's Theorem
b) Principle of Transmissibility

B) Determine x and y intercept of the resultant of the force system shown with respect to point D. (4)

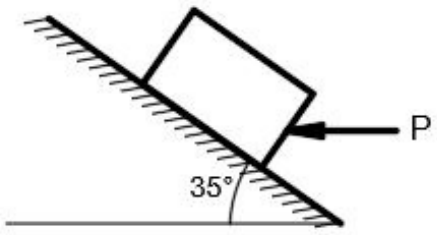


C) Determine the reactions at the supports A and B for the beam loaded as shown in the figure. (3)

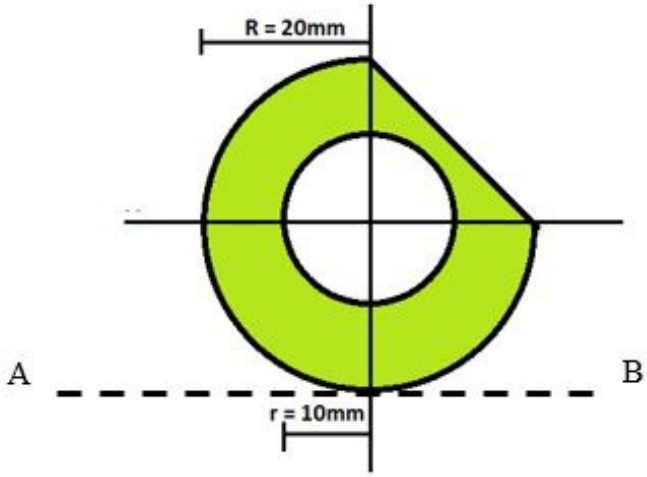


2) A block of weight 500 N rests on a plane inclined at 35° to the horizontal as shown in figure. If a horizontal force of 220 N is just sufficient to stop the motion of the block down the plane, then determine the coefficient of friction between block and plane. Also determine the magnitude of horizontal force required to cause the block to start moving up the plane. (3)

A)

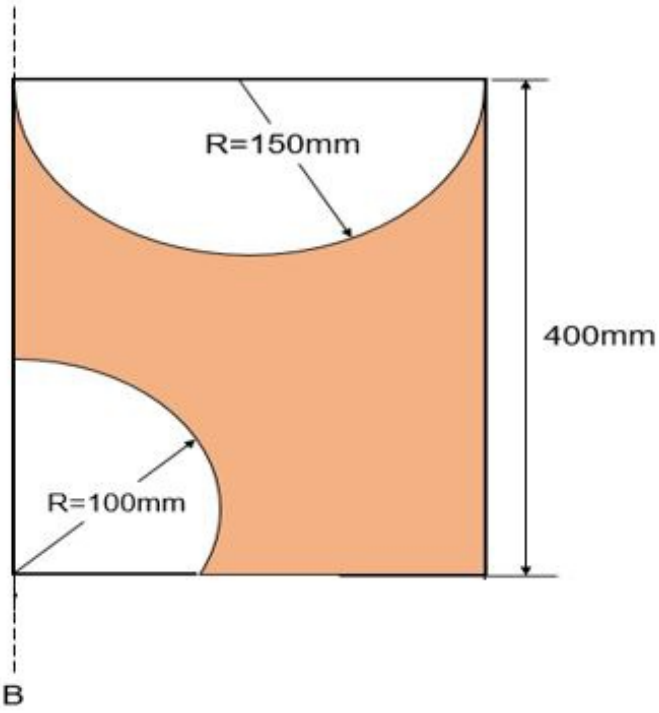


B) Compute centroid for the shaded portion of the given figure with respect to the reference axis AB. (3)



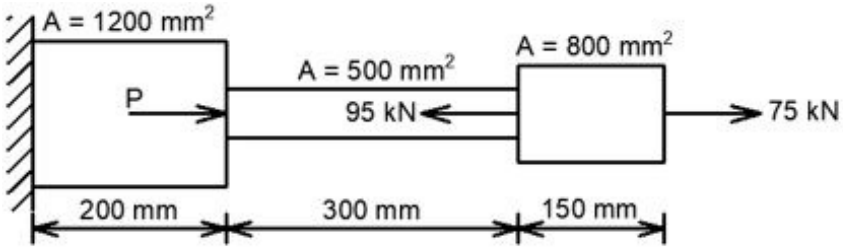
C) Find the Moment of Inertia and radius of gyration of the shaded portion about AB. (4)

A

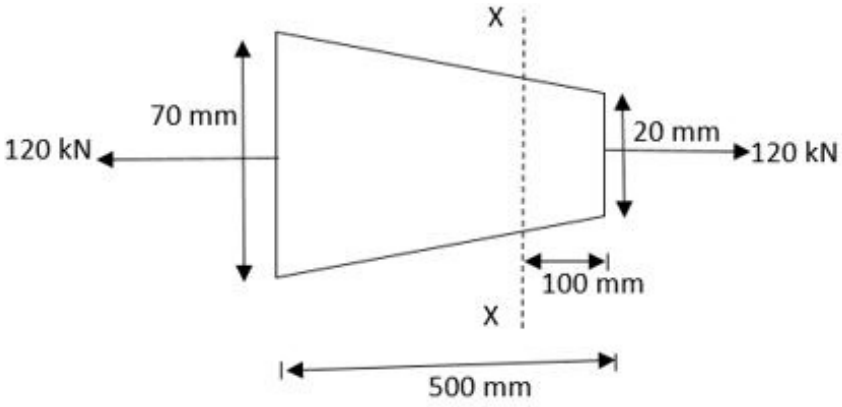


3) (4)

A) Determine the magnitude of the load P necessary to produce zero net change in the length of the bar shown in the figure. Also determine stresses developed in each section. Take E = 200 kN/mm^2.



B) Determine the normal stress of circular bar at a section X-X as shown in the Fig. And also determine the total elongation of the tapered bar. Take E=210 GPa. (3)



C) Explain the state of simple shear. And also prove that for a square section that normal stress acting along the diagonal equal to the shear stress ($\sigma_n = \tau$). (3)

4) (4)

A) A mild steel bar 60 mm square in section and 160 mm long is subjected to

A) axial load of 250 kN. Half the lateral strain is prevented by the application of uniform external pressure of suitable intensity. If E=200 GPa and Poisson's ratio=0.3. Calculate the change in the length of the bar.

B) Calculate 'G' and 'K' of cylinder bar of diameter 30mm, length 1.5m. if longitudinal strain in bar is four times lateral strain. Find the change in the volume. When hydrostatic pressure of 100 N/mm^2. Take E= 1 x 105 N/mm^2. (3)

C) A thin cylindrical pressure vessel has an internal diameter of 150 mm and a wall thickness of 5mm. it is subjected to an internal pressure of $7N/mm^2$. If the cylinder is 900m long and E = 200 GPa, Find the value of Poisson's ratio for the material if the change in volume under this pressure is $15500mm^3$. (3)

5) Explain the following with a sketch (3)

A) A) Why Compound bar is called statically indeterminate and what are its assumptions.
B) Temperature stress and temperature strain

B) A steel bar 60 mm in diameter and 1.5 m long is surrounded by a shell of a cast iron 6 mm thick. Compute the load that will compress the combined bar a total of 1 mm in the length of 1.5 m. Take Modulus of Elasticity for steel, E = 200 GPa, and for cast iron, E = 100 GPa. (3)

C) Find the stresses in the wires of the system as shown in the figure below. If the cross sectional area of the wires is 70 mm^2, the load is 25 kN and the temperature of the system rises by 20 °C. The rigid bar remains horizontal even after loading. Assume E_s = 200 GPa, E_{cu}=100 GPa, α_s =1.2 x 10^{-5}/ ºC, αcu=1.8x 10^{-5}/ ºC. (4)

-----End-----