Question Paper

Exam Date & Time: 16-Jan-2024 (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 - S2]

Duration: 180 mins.

Marks: 50

Answer all the questions.

Missing data, if any, may be suitably assumed

- ¹⁾ Determine the moment of inertia of the hatched area shown in the figure ⁽⁵⁾ below about its horizontal centroidal axis.
 - A)



B)

A body of weight 3kN is resting on a rough plane as shown in the Fig. It is ⁽⁵⁾ pulled up the plane by means of a light flexible rope running parallel to the plane and passing over a frictionless pulley at the top of the plane. The portion of the rope beyond the pulley hangs vertically down and carries a weight of 1.5kN at the end. Find the tension in the rope, acceleration with which the body moves up the plane, distance moved by the body in 2secs

after starting from rest. Take coefficient of friction between the body and the plane as 0.2.



- Obtain from first principle the MI of a right angled triangle having base ⁽⁵⁾ width B and height H about its centroidal horizontal axis.
- A)

2)

^{B)} The beam shown in the figure is hinged at A and is on rollers at B. Determine the ⁽⁵⁾ resultant reactions developed at A and B due to the loading shown in the figure.



- Explain with figure the (i) Parallel axis theorem (ii) Dynamic Equilibrium (iii) ⁽⁵⁾ Moment of a couple
- 3)
- A)
- ^{B)} A steel tube of 35mm outer diameter and 30mm inner diameter encloses a ⁽⁵⁾ gun metal rod of 25mm diameter and is rigidly joined at each end. If at a temperature of 40°C there is no longitudinal stress, determine the stresses developed in the rod and tube when the temperature of the assembly is raised to 240°C. Take $\alpha_s = 11 \times 10^{-6}$ /°C, $\alpha_g = 18 \times 10^{-6}$ /°C, $E_s = 205$ GPa and $E_g = 91.5$ GPa.

⁴⁾ Determine the resultant completely and locate it along DC of the system of ⁽⁵⁾ non-concurrent forces shown in Fig. Take the size of grid as 1mx1m.



A steel circular bar has three segments AB, BC and CD as shown in fig, (5)
Determine the length of the middle segment (BC) to have zero elongation of the bar. Take E = 205GPa.



(5)

Calculate the amount of force P required to drive body of weight 5kN upwards, using the massless wedge of angle 15^o as shown in figure. Assume friction coefficient between wedge and body as 0.15 and all other remaining surfaces as 0.2.



B) A square prism of wood 50mm x 50mm in cross section and 300mm long ⁽⁵⁾ is subjected to a tensile stress of 40MPa along its longitudinal axis and lateral compressive stress of 20MPa on one of the lateral face and a lateral tensile stress of 10MPa on the other lateral face. Find the change in dimensions of the prism and the change in volume. Take Poisson's Ratio as 0.4 and E as 1.5x10⁴ N/mm².

-----End-----

A)