Question Paper

Exam Date & Time: 28-Dec-2019 (09:30 AM - 12:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES End semester theory examination November-2019 I SEMESTER B.Sc.(Applied Sciences) in Engg

MECHANICS OF SOLIDS [ICE 111]

Marks: 50

2)

Duration: 180 mins.

Answer all the questions.

- ¹⁾ A compound tube consists of a steel tube 200 mm in internal diameter and ⁽⁵⁾ 10 mm thickness and an outer brass tube 220 mm internal diameter and 10
 - ^{A)} mm thickness. The two tubes are of same length. The compound tube carries an axial load of 1500 kN. Find the stresses and the loads transmitted to the two tubes. Take E_{Steel} = 200 GPa and E_{Brass} = 100GPa
 - ^{B)} Find the resultant completely with respect to 'A' for the non-concurrent ⁽⁵⁾ system of forces shown in figure.



- ⁽⁵⁾ A ladder of length 5m and weight 120N is placed on a flat floor against a vertical wall. If the coefficients of friction of floor and wall are 0.3 and 0.2 ^(A) and the ladder is considered homogeneous, determine the smallest angle θ the ladder can be placed at the floor for equilibrium.
 - B) Determine the tension in the string and accelerations of blocks A and B (5) weighing 1800N and 600N connected by an inextensible string as shown in figure. Assume pulleys as frictionless and weightless.



Explain (i) D'Alembert's principle (ii) Work-Energy principle

(3)

3)

A) B)

Find the centroid and radius of gyration from the horizontal centroidal axis ⁽⁷⁾ for the channel section having 10 mm thickness shown.



4)

A)

A Bar is composed of two segments as shown in figure. Find the stress ⁽⁶⁾ developed in each material when the temperature is raised by 60° C and the supports are perfectly rigid. Take Modulus of elasticity of steel is 200GPa, Modulus of elasticity of copper is 100GPa, coefficient of thermal expansion for steel is 12×10^{-6} /°C, Coefficient of thermal expansion for copper is 18 $\times 10^{-6}$ /°C.



- ^{B)} Derive an expression for the total extension of the tapered bar of length L , ⁽⁴⁾ circular cross section (smaller diameter at one end " d_1 " varying uniformly to the larger diameter at the other end " d_2 ") , when subjected to an axial tensile load W.
- ⁵⁾ The tractive force exerted by a railway car weighing 100 kN is 3 kN. If the ⁽⁵⁾ frictional resistance is 5 N per kN of the railway car's weight, find the acceleration when it moves on a level track.
 - A bar of 12 mm in diameter is acted upon by an axial load of 20 kN. The (5) change in diameter is measured as 0.003mm. Determine (i) Poisson's ratio (ii) The Modulus of Elasticity. Take the value of Modulus of rigidity as 80 GPa.

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