Question Paper

Exam Date & Time: 08-May-2019 (02:00 PM - 05:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENES I SEMESTER B.Sc.(Applied Sciences) IN ENGINEERING END SEMESTER THEORY EXAMINATION-APRIL/MAY 2019

Engineering Statics and Dynamics [CE 111]

Marks: 100

1)

Answer 5 out of 8 questions.

Missing data can be suitably assumed

i) State and prove parallelogram law of forces

(10)

Duration: 180 mins.

- A) ii) State and prove parallel axis theorem to calculate second moment of area w.r.t the given axis
- ^{B)} For the system of forces shown in figure, resultant R is acting at ⁽¹⁰⁾ B including unknown forces F_C through C and F_A through A. Determine these unknown forces and unknown angle θ .



2)

A) Determine the magnitude and direction of unknown fifth force (10) for the coplanar concurrent force system shown in the figure.



Find the support reactions at A and B for the beam loaded as ⁽¹⁰⁾ shown in the figure.



Determine the axial forces of all the members of the loaded ⁽¹⁵⁾ truss shown in the figure by method of joints.



^{B)} Find moment of inertia of the shaded area about axis AB shown ⁽⁵⁾ in the figure. (Note: All dimensions are in mm)

A)

B)



- ⁴⁾ Obtain expression to calculate moment of inertia of triangular ⁽⁸⁾ area w.r.t its base by direct integration.
 - ^{B)} Determine the position of centroid of an hatched area with ⁽¹²⁾ respect to axis AB.



5)

A)

A block weighing 160 kN is to be raised by means of wedges A ⁽¹⁰⁾ and B as shown in the figure. Find minimum force P to raise the block C upwards, if the co-efficient of friction is 0.25 for all contact surfaces. Self-weight of wedges may be neglected.



^{B)} Determine the magnitude of horizontal force 'P' to be applied on ⁽¹⁰⁾ the ladder as shown in the figure to prevent it from slipping.
Consider the coefficient of friction between wall and ladder as

0.25 and that between ground and ladder as 0.5.



6)

A)

(10)A car weighing 15 kN goes round a flat curve of 50 m radius. The distance between inner and outer wheel is 1.5 m and the C.G is 0.75m as shown in figure. What is the limiting speed of the car on this curve? Determine the normal reactions developed at the inner and outer wheels if the car negotiates the curve with a speed of 40 km/h. Take μ = 0.4.



B) (10)Obtain the relationship between tightside and slackside forces in a rope/belt.

A tram car of weight 120 kN has tractive resistance of 5 N/kN. If ⁽¹⁰⁾ 7) the efficiency of motor is 80%, what power will be required to A) propel the car at a uniform speed of 20 kmph? i) On level surface

- ii) Up an inclination of 1 in 300 and
- iii) Down an inclination of 1 in 300
- B) (10)Obtain work-energy relationship for translation.

- Define the following terms:
- i) Line of impact
- ii) Impact

A)

- iii) Oblique impact
- iv) Collision of restitution

^{B)} Three bodies A, B & C of masses 2 kg, 4 kg and 8 kg respectively move along same straight line and in the same direction with velocities 4 m/s, 1 m/s and (3/4) m/s. If A collides with B and subsequently B collides with C, show that A & B will be brought to rest by collision. Take impact to be elastic.



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(12)