Code No: 121AC **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, August/September - 2017
ENGINEERING MECHANICS
(Common to CE, ME, MCT, MMT, AE, AME, MIE, PTE, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) State and explain Lami's theorem with a neat sketch. [2]
b) Determine the magnitude of the two forces such that if they act at right angles, their resultant is 15N. But if they act at 60^0 their resultant is 18N. [3]
c) Define friction and classify its types. [2]
d) Explain different arrangements of belt drive used for power transmission. [3]
e) Define centroid and centre of gravity of an area. [2]
f) What is the radius of gyration of a circle of diameter 'd' about its diameter? [3]
g) Distinguish between kinetics and kinematics. [2]
h) A body A is projected vertically upwards from the top of a tower with a velocity of 40 m/s, the tower being 180m high. After t sec, another body B is allowed to fall from the same point. Both the bodies reach the ground simultaneously. Calculate t and the velocities of A and B on reaching the ground. [3]
i) Distinguish between, simple and Compound Pendulums. [2]
j) What differences exist between impulse and momentum? [3]

PART-B

(50 Marks)

2. The angle between the two forces of magnitude 20KN and 15KN is 60^0, the 20KN force being horizontal. Determine the resultant in magnitude and direction if
a) The forces are pulls.
b) The 15KN force is push and 20KN force is a pull. [5+5]

OR

3. A uniform wheel of 60 cm diameter weighing 1000 N rests against rectangular obstacle 15 cm high as shown in figure 1. Find the least force required which when acting through center of the wheel will just turn the wheel over the corner of the block. Find the angle of force with horizontal. [10]

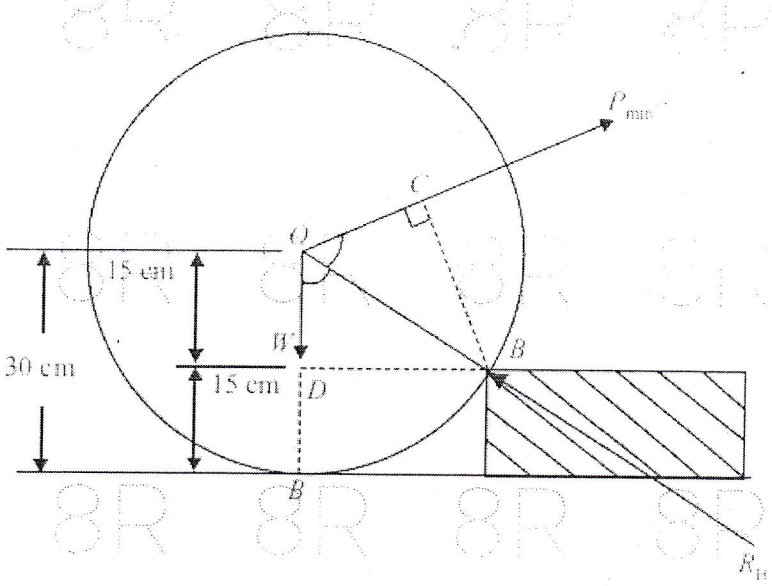

Figure: 1

4. Two Blocks A and B of weight 100 N and 200 N respectively are initially at rest on a 30^0 inclined plane as shown in figure 2. The distance between the blocks is 6 m. The coefficient of friction between the block A and the plane is 0.25 and that between the block B and the plane is 0.15. If they are released at the same time, in what time the upper block (B) reaches the Block (A). [10]

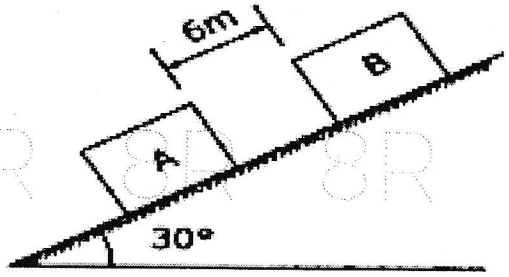

Figure: 2
OR

5. Prove that the ratio of belt tension is given by the $\frac{T_1}{T_2} = e^{\mu\theta}$. [10]

6.a) State and explain Pappus theorems.
b) A semi-circular area is removed from the trepezoid as shown in figure 3. Determine the centroid of the remaining area. [5+5]

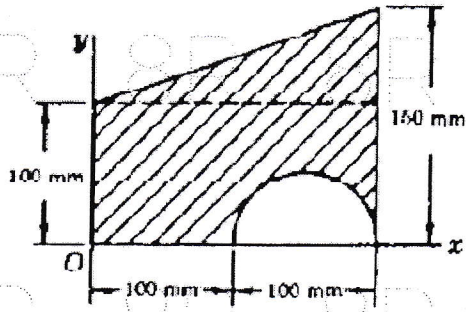

Figure: 3
OR

7. Find out the mass moment of inertia of a right circular cone of base radius R and mass M about the axis of the cone. [10]

8. A point P moves on a circular path in counter clock wise direction so that the length of arc it sweeps out is $s= t^3 +4$. The radius of the path is 7 m. The units of s and t are meter and seconds respectively. Determine the axial components of velocity when t = 1 sec. [10]

OR

9. A homogeneous sphere of mass 150 kg is attached to a slender rod having a mass of 20 kg. In the horizontal position shown in figure 4, the angular speed of the system is 15 rad/s. Determine the magnitude and angular acceleration of the system and the reaction at O on the rod. [10]

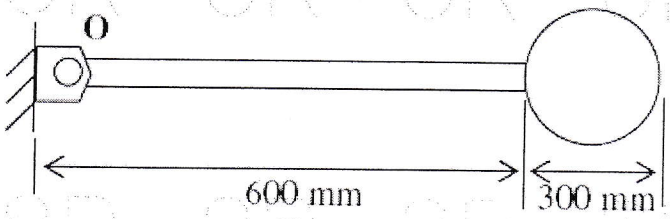

Figure: 4

10. Explain how a simple pendulum differ from a compound pendulum, briefly with the help of differential mathematical equations. [10]

OR

11. With the help of suitable diagrams and examples, explain how the principle of work-energy can be used to analyse connected systems. [10]

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