Code No: 182AK **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year II Semester Examinations, September - 2023
ENGINEERING MECHANICS
(Common to ME, AE, MIE)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a)	List the types of forces.	[1]
b)	What is the condition for equilibrium of a body?	[1]
c)	State pappu's guldinus theorem-II.	[1]
d)	What is angle of friction?	[1]
e)	State perpendicular axis theorem.	[1]
f)	Express the transfer formular for mass moment of inertia.	[1]
g)	What is constrained motion?	[1]
h)	What is work energy principle?	[1]
i)	Define radius of gyration.	[1]
j)	Express torque in terms of moment of inertia and angular acceleration.	[1]

PART-B

(50 Marks)

2.a) If P =120 N and the resultant of P & Q lies in the positive x-direction, determine Q and the magnitude of the resultant.(Figure 1)

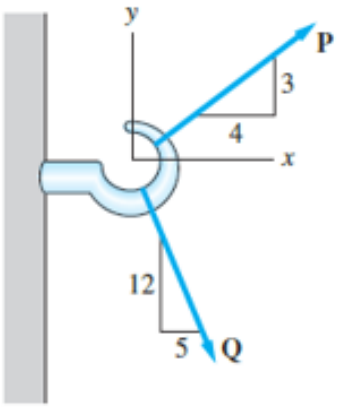

Figure 1

b) Derive parallelogram of force for finding the resultant. [5+5]

OR

3. Determine the tension in cable AD and AE.(Figure 2) [10]

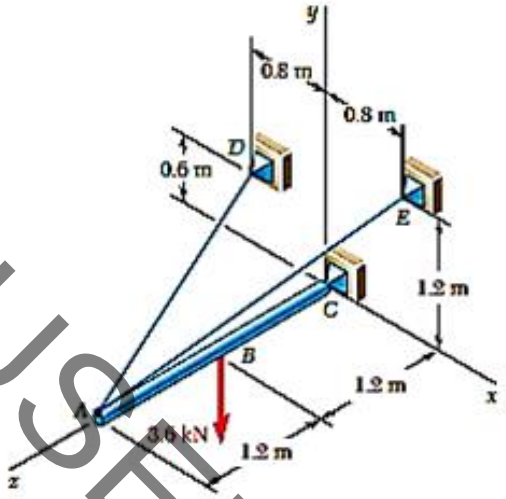

Figure 2

4. Two blocks A & B weighing 100 N and 300 N respectively are resting on a rough inclined plane as shown in figure 3. Find the value of angle θ, when the block B is about to slide. Take coefficient of friction between the two blocks as well as block B and the inclined plane as 0.25. [10]

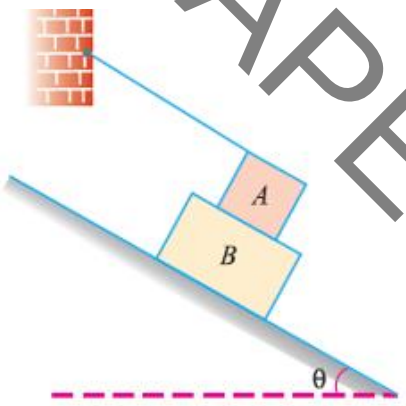

Figure 3

OR

5. A frustum of a solid right circular cone has an axial hole of 50 cm diameter as shown in Figure 4. Determine the centre of gravity of the composite body. [10]

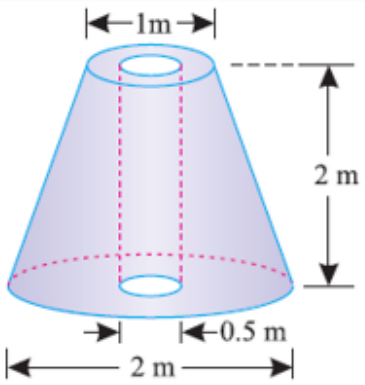

Figure 4

6. Find the moment of inertial about its centroidal X axis.(Figure 5) [10]

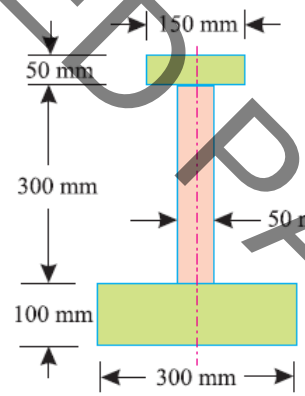

Figure 5

OR

7. A hemisphere of radius 80 mm is cut from a right circular cylinder of diameter 80 mm and height 160 mm as shown in figure 6. Find the mass moment of inertia of the composite body about its base. [10]

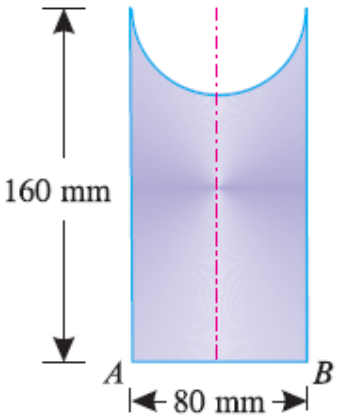

Figure 6

8.a) Two stations P & Q are 5.2 km apart. An automobileStarts from rest from station P and accelerates uniformly to attain a speed of 48 kmph in 30 sec. this speed is Maintained until the brakes are applied. The automobile comes to rest at the station Q with a uniform retardation of 1 m/s. Determine the total time required to cover the distance between these two stations.

b) A long range rifle placed at the point A has a muzzle velocity u = 400m/s. Determine the two angles of elevation θ which will permit the projectile to hit the target B on the mountain.(Figure 7) [5+5]

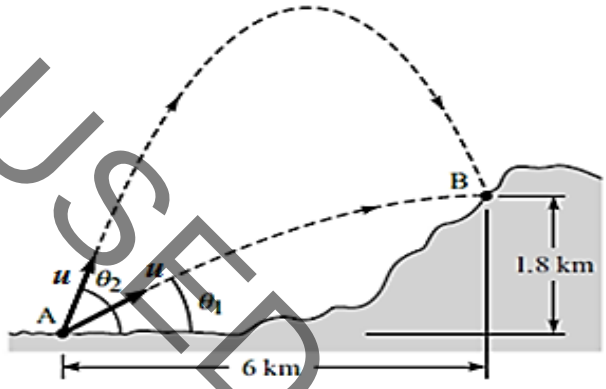

Figure 7

OR

9. A 100 g baseball is pitched with a velocity of 25 m/s toward a batter. After the ball is hit by the bat *B*, it has a velocity of 35m/s in the direction shown in figure 8. If the bat and ball are in contact 0.015 s, determine the average impulsive force exerted on the ball during the impact. [10]

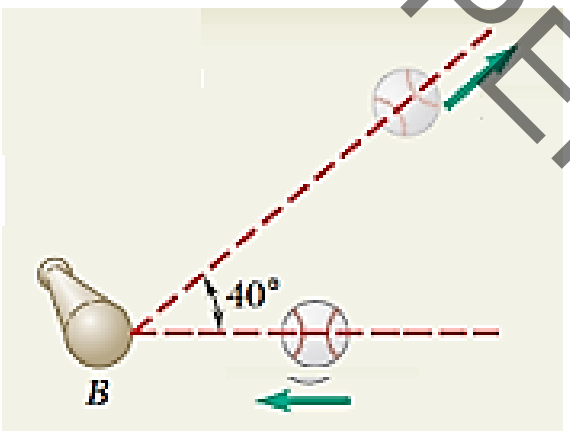

Figure 8

10. Two blocks are joined by an inextensible cable as shown in figure 9. If the system isreleased from rest, determine the velocity of block *A* after it has moved 2 m. Assume that the coefficient of kinetic friction between block *A* and the planeis 0.25 and that the pulley is weightless and frictionless. Use work energy method. [10]

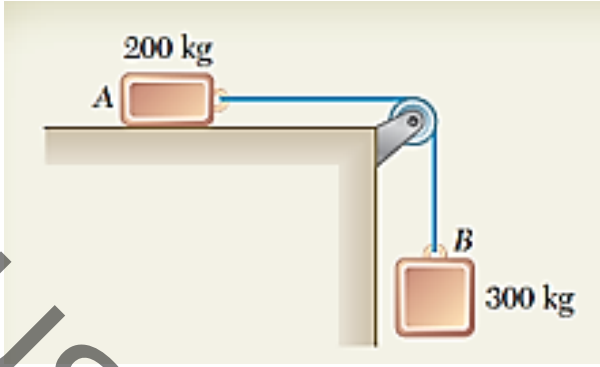

Figure 9

OR

11. The stepped pulley system shown in figure 10, when released from rest, determine the acceleration of the blocks, angular acceleration of the pulley and tension in the strings connecting the blocks. The mass of the pulley is 10 kg and its radius of gyration is 22 cm. Take m_1=40 kg, m_2=25 kg, r_1=20 cm, r_2=25cm. [10]

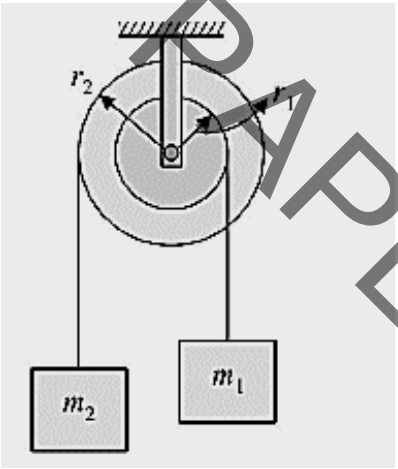

Figure 10

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