Program: B. Sc.in ME (1st Sem)

Date: 5 March,2024

Time: 2:30 PM to 4:00 PM

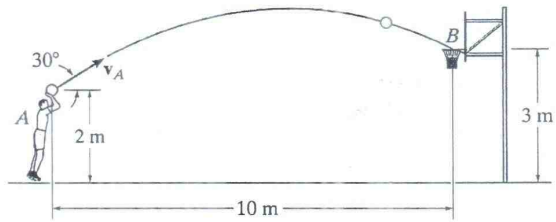
ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination
Course No: ME 4203
Course Title: Dynamics

Summer Semester: A.Y. 2022-2023
Time : 1 Hour 30 min
Full Marks : 75

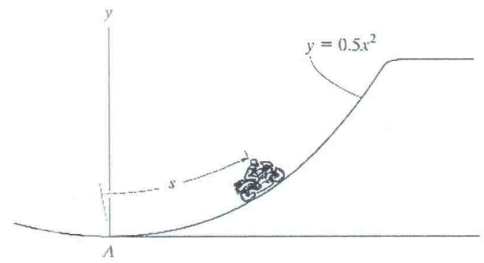
Answer all questions. Each question carries equal marks. The symbols have their usual meanings. Draw the free-body diagram if required. The right column also indicates the course objective (CO) and Program outcome (PO) addressed by each question

Q-01(a). Neglecting the size of the ball, determine the magnitude $\mathbf{V_A}$ of the basketball's initial velocity and its velocity when it passes through the basket. **12.5 (CO1) (PO2)**

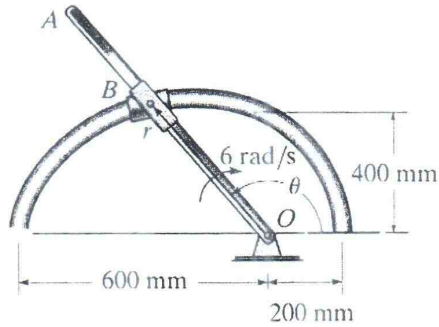


Q-01(b). The motorcycle is traveling at **1 m/s** when it is at A. If the speed is then increased at $\dot{v} = \mathbf{0.1\ m/s^2}$.

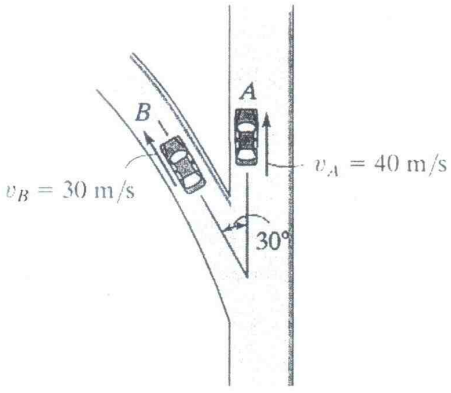
Determine its speed and acceleration at the instant **t=5s**. **12.5 (CO1) (PO2)**



Q-02(a). The rod OA rotates clockwise with a constant angular velocity of **6 rad/s**. Two pin-connected slider blocks, located at B, move freely on OA and the curved rod whose shape is a limaçon described by the equation $\mathbf{r = 200(2 - \cos\theta)\ mm}$. Determine the speed and magnitude of the acceleration of the slider blocks at the instant $\boldsymbol{\theta = 150°}$. **12.5 (CO1) (PO2)**



Q-02(b). At the instant shown, cars A and B are traveling at velocities of **40 m/s** and **30 m/s**, respectively. If B is increasing its velocity by **2 m/s²**, while A maintains a constant velocity, determine the velocity and acceleration of B with respect to A. The radius of curvature at B is $\rho_B = 200$ **m**.



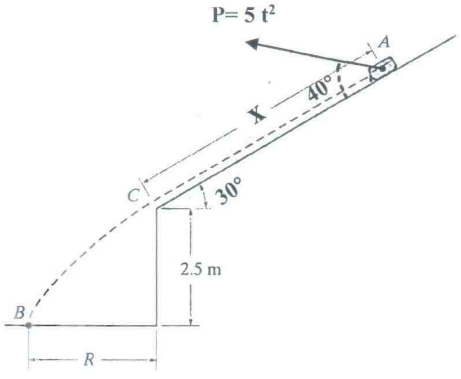
12.5
(CO1)
(PO2)

Q-03(a). A **20-kg** suitcase slides down the smooth ramp of **x** m long in **3s**.

if the suitcase has an initial velocity down the ramp of V_A = **1 m/s**, and the coefficient of kinetic friction along AC is $\mu_k = 0.2$

Determine

i) The velocity and distance (x) at C
ii) The distance R where it strikes the ground at B.
iii) The horizontal and vertical distance from A to B

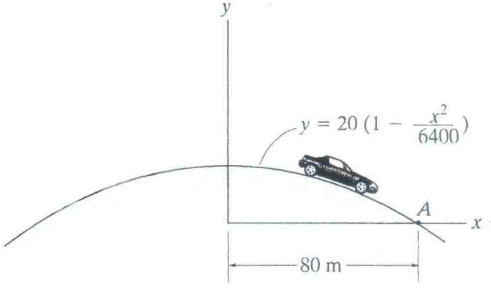


15
(CO2)
(PO2)

Q-03(b). The **0.8-Mg** car travels over the hill having the shape of a parabola. When the car is at **point A** (x=80), it is traveling at **9 m/s** and increasing its speed at **3 m/s²**.

Determine both the resultant normal force and the resultant frictional force that all the wheels of the car exert on the road at this instant.

Neglect the size of the car.



10
(CO2)
(PO2)