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B037313(037)

B. Tech. (Third Semester) Examination, Nov.-Dec. 2021

AICTE ~~(New~~ Scheme)

(Mechanical Engineering Branch)

ENGINEERING MECHANICS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Marks : 35

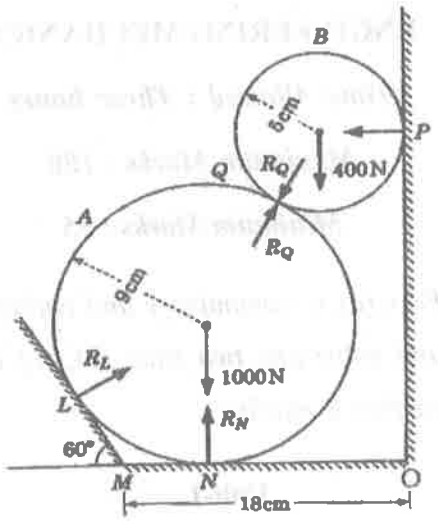
Note : *Part (a) is compulsory and carries 4 marks and solve any* ***two*** *from (b), (c) & (d) and carries 8 marks.*

Unit-1

1. (a) Define the free body diagram of a body in an equilibrium system, and explain its importance. 4

(b) What are the laws to add two forces and several concurrent, coplanar forces? Explain in detail. 8

(c) Two cylinders A and B rest in a horizontal channel as shown in figure. The cylinder A has radius of 9 cm and weight 1000 N whereas the cylinder B has radius of 18 cm and weight 400 N. If the bottom width of the box is 18 cm with one side vertical and other inclined at 60° with horizontal. Determine the reaction at points L, N and P. 8

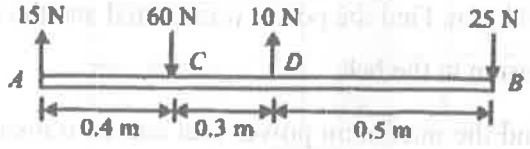


(d) A rigid bar is subjected to a system of parallel forces as shown in figure. Reduce this system to,

(i) A single force system

(ii) A single force moment sytem at A

(iii) A single force moment system at B 8



Unit-II

2. (a) Explain the phenomenon of friction by taking an example of a block placed on a rough surface. 4

(b) A uniform ladder of weight 800 N and of length 7 m rests on a horizontal ground and leans against a smooth vertical wall. The angle made by the ladder with the horizontal is 60°. When a man of weight 600 N stands on the ladder at a distance 4 m from the top of the ladder, the ladder is at the point of sliding. Determine the coefficient of friction between the ladder and the floor. 8

(c) A belt 100 mm wide and 8·0 mm thick are transmitting power at a belt speed of 1600 m/minute. The angle of lap for smaller pulley is 165° and coefficient of friction is 0·3. The maximum permissible stress is belt is 2 MN/m^2. and mass of the belt is 0·9 kg/m. Find the power transmitted and the initial tension in the belt.

Find the maximum power that can be transmitted and the corresponding belt speed. 8

(d) Explain the principle of virtual work with their application. 8

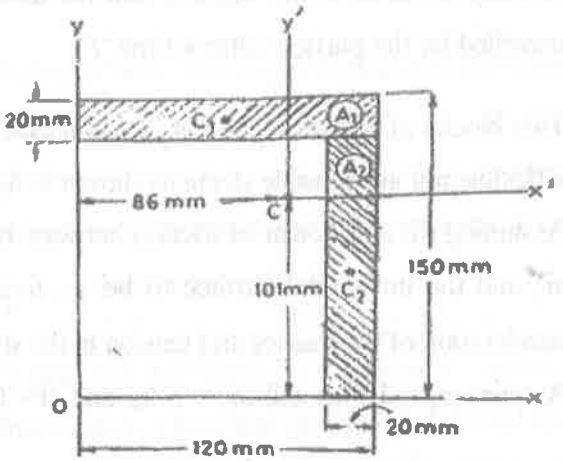
Unit-III

3. (a) Differentiate between polar moment of inertia and product of inertia. 4

(b) Find the coordinates of the centroid C of a circular sector of central angle 2α and radius r, by the method of integration. 8

(c) Determine the moment of inertia of a triangle with respect to its base. 8

(d) Find the moments of inertia of the area of the L sections about x and y axis as shown in figure. 8



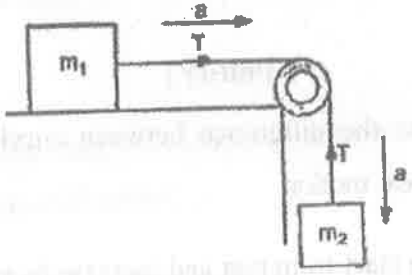
Unit-IV

4. (a) Discuss the difference between curvilinear and rectilinear motion. 4

(b) A train start from rest and increase its speed from zero to v m/s with a constant acceleration of a_1 m/s^2, runs at this speed for some time and finally comes to rest with a constant acceleration a_1 m/s^2. If the total distance travelled is x meters, find the total time t required for this journey. 8

(c) A particle of mass m falls vertically from rest in a medium whose resistance is proportional to the velocity. Determine the velocity and the distance travelled by the particle after a time 't'. 8

(d) Two blocks of masses m_1 and m_2 are connected by a flexible but inextensible string as shown in figure. Assuming the coefficient of friction between block m_1 and the horizontal surface to be μ, find the acceleration of the masses and tension in the string. Assume $m_1 = 10$ kg and $m_2 = 5$ kg and $\mu = 0.25$. 8



Unit-V

5. (a) State D' Alembert's principle. 4

(b) A ball of mass m is dropped on to a spring of

stiffness from a height h. Find the maximum deflection (δ) of the spring. Assume $m = 5$ kg, $k = 500$ N/m and $h = 10$ cm. 8

(c) A gun of mass 3000 kg fires horizontally a shell of mass 50 kg with a velocity of 300 m/s. What is the velocity with which the gun will recoil? Also determine the uniform force required to stop the gun in 0·6 m. In how much time will it stop? 8

(d) A glass ball is dropped on a smooth horizontal floor from which it bounces to a height of 9 m. On the second bounce it rises to a height of 6 m. From what height was the ball dropped and find the coefficient of restitution between the glass and the floor. 8