Hall Ticket Number:

Code No.: 1216 N

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. I Year II-Semester (New) Examinations, May-2016

Engineering Mechanics-II
(Civil, Mech. & EEE)

Time: **3** hours Max. Marks: **50**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (15 Marks)

1. How product of inertia is useful in design? [1]
2. A car starts from rest and accelerates uniformly for a time of 5 seconds for a distance of 95m. Determine the acceleration of the car. [1]
3. What do you mean by rigid body motion? [1]
4. State work-energy principle for connected bodies. [1]
5. In a laboratory experiment with simple pendulum it was found that it took 36s to complete 20 oscillations when the effective length was kept at 80cm. Calculate acceleration due to gravity from these data. [1]
6. Derive the mass moment of inertia of a slender rod shown in figure 1 about the axis drawn at point P. The rod has uniform mass of 'm'. [2]

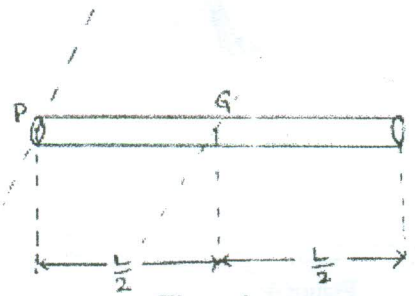

Figure 1

7. The velocity of a particle moving along a space curve is $\bar{v} = 2t\hat{\imath} + 3t^2\hat{\jmath} - t^3\hat{k}$. Find out the acceleration at the instant where radius of curvature is 0.5m. [2]
8. A block of weight 300N is resting on a rough surface with coefficient of friction between the block and surface being 0.2. A downward force P is applied on the block at angle of 30^0 to the horizontal. Find the force P required to give an acceleration of $2.5m/s^2$ in the horizontal direction. [2]
9. A block of mass 0.5kg slides down an incline of inclination 30^0 and length 10m. Find the work done by force of gravity. [2]
10. A block of mass 10kg executes simple harmonic motion under the restoring force of a spring. The time period of the oscillation is given by 3.14s. Find out the spring constant. [2]

Part-B (5 × 7 = 35 Marks)

11. a) Determine the product of inertia of shaded area shown in Figure 2 with respect to X and Y axes ? [3]

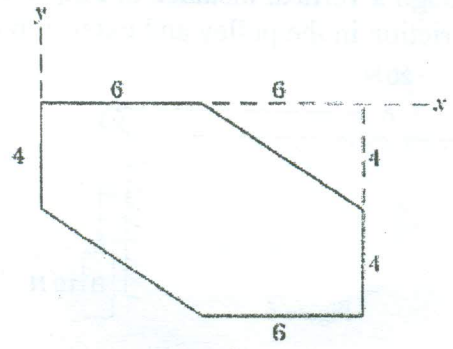

Figure 2

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b) Determine the mass moment of inertia of the T section shown in figure 3 with respect to X axis. The section has uniform mass 'm'. [4]

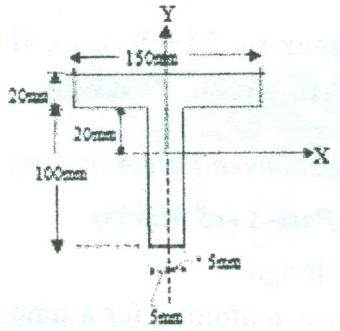

Figure 3

12. a) A particle moves in x-y plane with a constant acceleration of $1.5 m/s^2$ in the direction making an angle of 35^0 with the x axis. At t =0 the particle is at the origin and its velocity is 8m/s along the x axis. Find the position and velocity at t=4 s. [3]

b) A jet plane travels along a vertical parabolic path defined by the equation $y = 0.4x^2$. At point A, the jet has a speed of 200 m/s, which is increasing at the rate of $0.8 m/s^2$. Find the magnitude of plane's acceleration when it is at point A. [4]

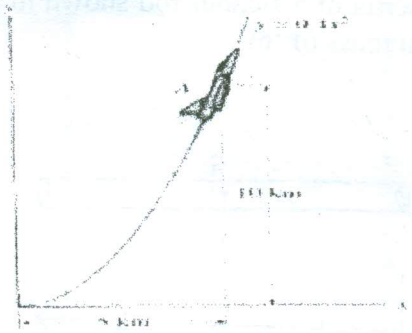

Figure 4

13. a) A chain of length L and weighing 'w' per unit length is released from the rest on a smooth table when the position is as shown in the figure 5. Determine the velocity of the chain when the last link leaves the table. [3]

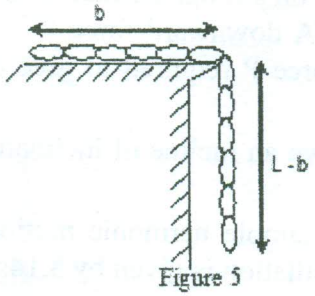

Figure 5

b) Two blocks shown in figure 6 have weights A = 20N and B = 10N, the coefficient of friction between the block A and the surface is 0.25. If the system is released from the rest and block B falls through a vertical distance of 2m, what is the velocity attained by the block B. Neglect the friction in the pulley and extension of the string. [4]

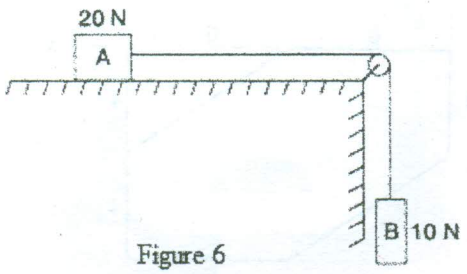

Figure 6

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14. a) By using work energy equation calculate the velocity and acceleration of block A and block B shown in figure 7 after block A has moved 1.5m from rest. The coefficient of friction is 0.3 and the pulleys are frictionless and weightless. Also calculate the tension in the spring. [4]

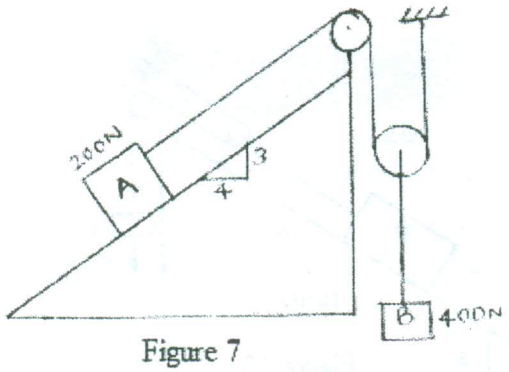

Figure 7

b) A 5kg mass drops from a height of 1.5m on a spring. The spring has stiffness of 2000N/m. What will be the speed of the block when the spring is compressed 60mm? [3]

15. a) A compound pendulum consists of a slender rod of length 610mm weighing 27N to which is attached a solid circular disc of 305mm diameter that weighs 36N. Compute the period of small oscillations. (see Figure 8) [3]

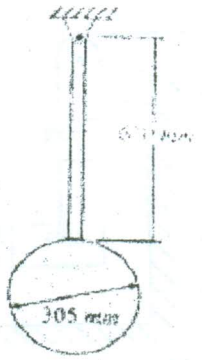

Figure 8

b) A pendulum having a time period of 1 sec. is installed in a lift. Determine its time period when i) the lift is moving upwards with an acceleration of g/10 ii) the lift is moving downward with an acceleration of g/10. [4]

16. a) Determine the mass moment of inertia of solid cone of height h and base radius r about its axis of rotation. The specific weight is uniform and can be taken as 780N/m^3. (see Figure 9) [4]

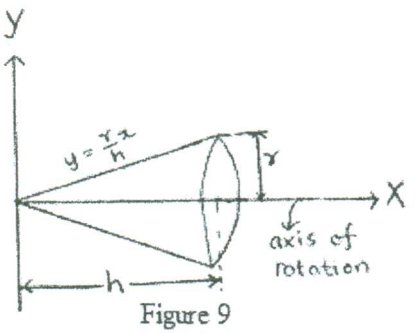

Figure 9

b) A stone is dropped from the top of the cliff 120m high and one second after wards another stone is thrown down and strikes the first stone when it has reached the foot of the cliff. Find the velocity with which the second stone was thrown. Neglect the air resistance. [3]

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17. Answer any ***two*** of the following: [7]

a) Compute the acceleration of body 'B' and the tension in the cord supporting body 'A'. (see Figure 10)

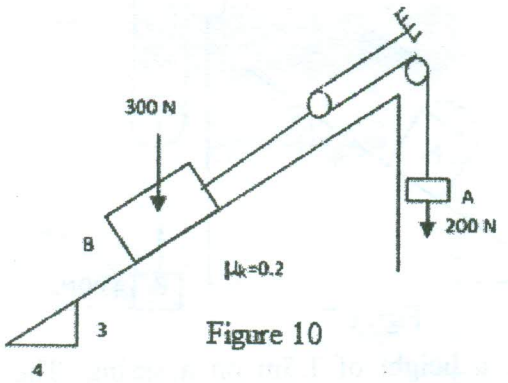

Figure 10

b) The system shown in figure 11 is connected by flexible, inextensible cord. If the system starts from rest, find the distance d between A and the ground so that the system comes to rest with body B just touching A. The coefficient of friction between C and the surface is 0.30.

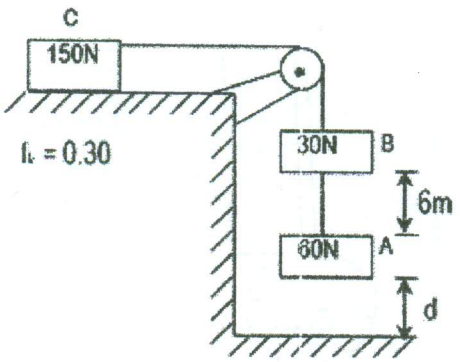

Figure 11

c) Derive the expression for time period of simple harmonic motion.