Code No. 5015 / O

FACULTY OF ENGINEERING & INFORMATICS

B.E. I – Year (Old) Examination, January 2016

Subject: Engineering Mechanics

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

Note: Answer all questions from Part A. Answer any five questions from Part B.

PART – A (25 Marks)

1 State Lami's theorem and its application. 2

2 The greatest and least resultants of two forces F_1 and F_2 are 17 and 3N respectively. Determine the angle between them when their resultant is $\sqrt{149}$ N. 3

3 Define coefficient of friction and cone of friction. 3

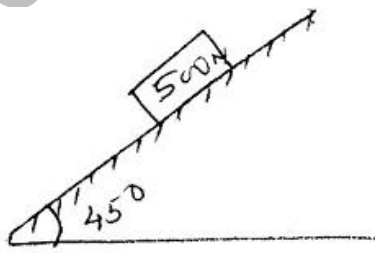
4 Determine the C.G of a semicircle of radius R. 3

5 Define parallel axis theorem and radius of gyration. 2

6 Differentiate between rectilinear and curvilinear motion. 2

7 A stone is thrown vertically upwards and returns to earth in 5 seconds. How high does it go? 3

8 A 500 N body is initially stationary on a 45^o incline as shown in figure. The coefficient of kinetic friction between the block and incline is 0.5. What distance along the incline must the weight slide before it reaches a speed of 12 m/sec? 3



9 Det State D'Alembert principle? 2

10 Write the kinetic equations for the transition of a particle. 2

PART – B (50 Marks)

11 Determine the resultant force and moment acting on the body whose centroid is (2, 2, 2) due to following forces.

$M_1 = 12i + 10j + 8k$ at A (0, 2, 0)
$M_2 = 4i + 10j – 8k$ at B (2, 1, 2)
$M_3 = (i + 2j + 3k)$ at D = (2, 4, 3)
$F_1 = (4i + 5j – 6k)$ at C = (4, 3, 4)
$F_2 = (5j – 5k)$ at B (2, 5, 7)

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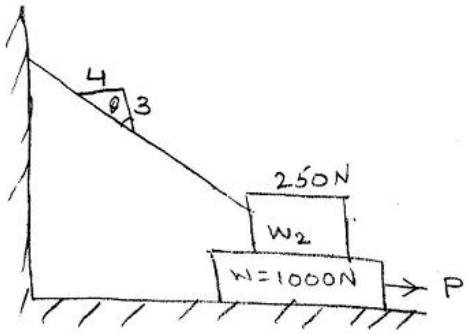
12 A block of weight W_1 = 1000 N rests on a horizontal surface and supports on top of it another block of weight W_2 = 250 N as shown in figure. The block W_2 is attached to a vertical wall by the inclined string AB. Find the magnitude of the horizontal force 'P' applied to the lower block as shown that will be necessary to cause slipping to impend. The coefficient of static friction for all surfaces is 0.3.



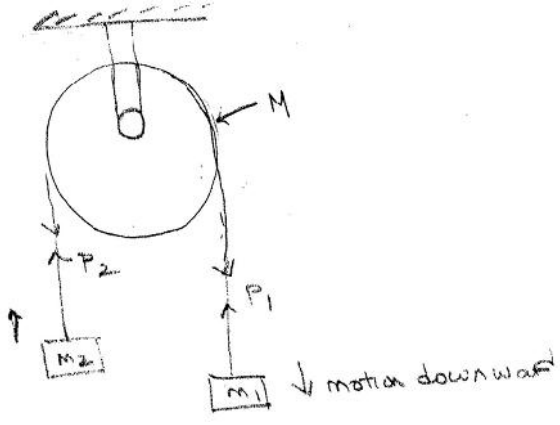
13 A cylinder of diameter 500 mm and height 1200 mm has mass density of 8000 kg/m^3. Find out mass moment of interia of cylinder
   a) With respect to the axis of the cylinder
   b) About a line which coincides with an end face of the cylinder and passing through the centre of this face.

14 With an initial velocity 126 m/s a bullet is fired upwards at an angle of elevation of 35^o from a point on a hill and strikes a target which is 100 m lower than the point of projection. Neglecting air resistance, calculate
   i) Maximum height to which it will rise above the horizontal plane from which it is projected
   ii) Velocity with which it will strike the target. Take g = 9.81 m/s^2.

15 a) Explain how a simple pendulum differ from a compound pendulum, briefly with the help of differential mathematical equations.
   b) Determine the stiffness in N/cm of a vertical spring to which a weight of 50 N is attached and is set vibrating vertically. The weight makes 4 oscillation per second.

16 A homogeneous solid cylinder of weight 100 N whose axis is horizontal rotates about its axis, in frictionless bearings under the action of the weight of a 10 N block which is carried by a rope wrapped around the cylinder. What will be angular velocity of cylinder two seconds after the motion starts? Assume the diameter of cylinder as 100 cm.

17 Two masses of 120 kg and 50 kg are supported by a rope passing over the pulley. The mass of the pulley is 60 kg. Find the tensions in the rope of both sides and linear acceleration also. Neglect the weight of the rope. Consider the pulley as solid disk.



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Code No. 5007 / N

FACULTY OF ENGINEERING AND INFORMATICS

B.E. I-Year (New) (Supplementary) Examination, January 2016

Subject : Engineering Mechanics

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

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1 State and explain the principle of transmissibility. 2

2 Determine x, y and z component of 100 N force passing from origin to a point (3,4,5). 3

3 What is meant by free body diagram? In what sense the diagram is free. 2

4 Explain cone of friction. What is its significance? 3

5 What are the applications of theorem of pappus? 2

6 What is polar moment of inertia for hollow circular section? 2

7 Determine the mass moment of inertia of a right circular cylinder of height h and radius r about centroidal axis normal to the longitudinal axis. 3

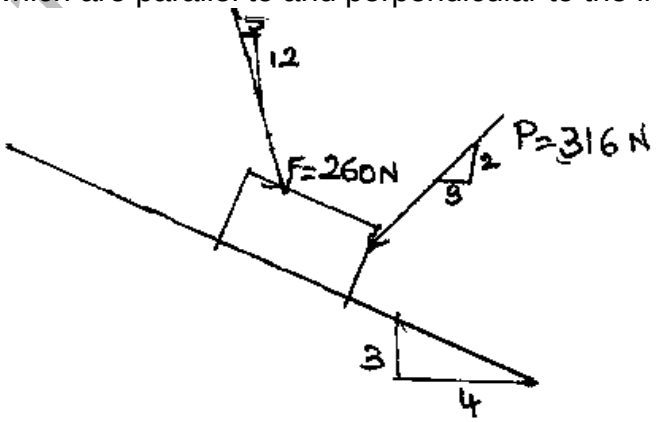
8 An automobile A is moving at 6 m/s and accelerating at 1.5 m/s^2 to overtake another automobile B which is 115.2 m ahead. If automobile B is moving with 18 m/s and decelerating 9 m/s^2 how soon will A pass over. 3

9 State D' Alembert principle. 2

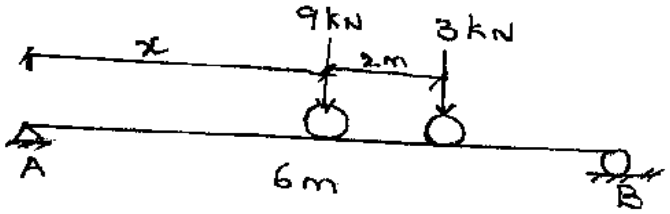
10 A body of mass 2kg is thrown up vertically with a kinetic energy of 490 joules. If the acceleration due to gravity is 9.8 m/s^2 find the height at which the kinetic energy of the body becomes half of its original value. 3

PART – B (50 Marks)

11 a) Referring to the figure below determine the components of force P and F along x-y axis which are parallel to and perpendicular to the incline.



b) Two wheel loads on a small tractor crossing 6 m span as shown below. Find the distance x at which support reaction at A is twice that of B.



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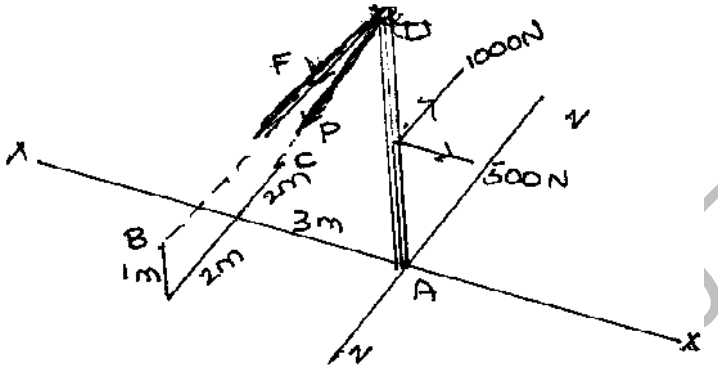
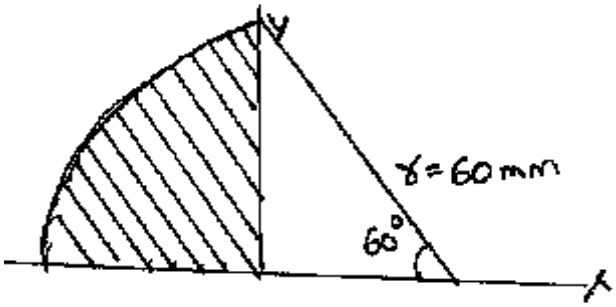
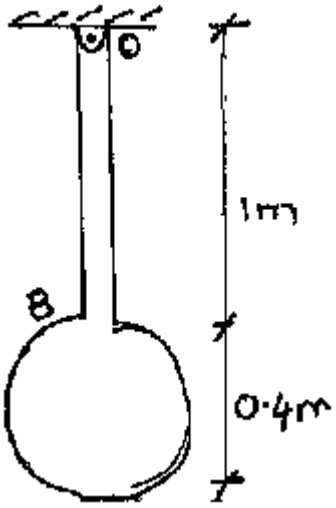
12 A mast mounted on a ball and socket joint at A and supported by two guy wires B and C. It is subjected to forces 1000 N parallel to Z axis and 500 N parallel to X axis at midpoint of the mast. Find the tension in the wires and reaction at A



13 a) Determine the centroid of the shaded area which is bounded by a straight line and a circular curve as shown in figure below.



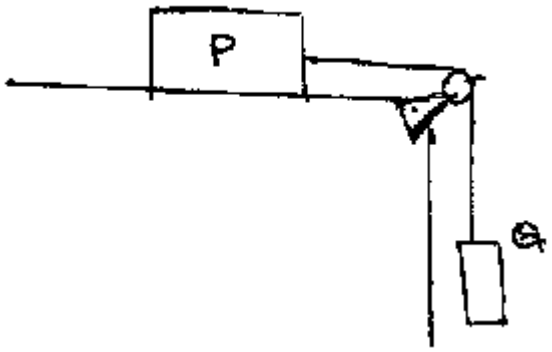
b) The pendulum consists of a circular rod OB and sphere each having a weight of 50 N and the assembly is suspended from hinge O determine the mass moment of inertia of the pendulum about an axis passing through hinge and normal to the plane of paper.



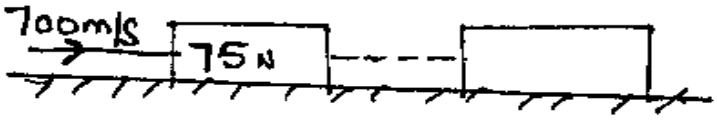
14 A balloon rises from the ground with a constant acceleration of 3.5 m/s^2 five seconds later a stone is thrown vertically up from the launching pad calculate the minimum initial velocity of stone for it to just touch the balloon.

15 Two blocks A and B are released from rest on a 30^0 incline when they are 15 m apart the coefficient of friction under the upper block A is 0.20 and under the lower block B is 0.40 calculate elapsed time until they touch after they touch and move as unit what will be the contact force between them $W_A = W_B = 750N$.

16 Find the acceleration of moving bodies as shown below Take mass of P = 150 kg and that of Q = 120 kg the coefficient of friction between the surface of contact is 0.20 also find tension in connected string.



17 A bullet weighing 0.5 N and moving at 700 m/s penetrates 75 N body as shown in figure below and emerges with a velocity of 200 m/s how far and how long does the body then move.



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