Subject Code: R13110/R13 **Set No - 1**

I B. Tech I Semester Supplementary Examinations Sept. - 2014

ENGINEERING MECHANICS

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, AME, Min E, PE, Metal E)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

*****

PART-A

1.(i) Define coplanar, non concurrent forces and coplanar concurrent forces.
(ii) State the conditions for equilibrium of a rigid body in three dimensions.
(iii) Locate the centriod of a T-section of flange 7cm x 2 cm and web 7 cm x 3 cm.
(iv) Define mathematically the radius of gyration of an area about the centriodal axis.
(v) What is polar moment of inertia and product of inertia?
(vi) A 500 kg block rests on a horizontal plane. Find the acceleration of the block if 2500N force is applied as shown in the figure.1 Take coefficient of friction as 0.22.

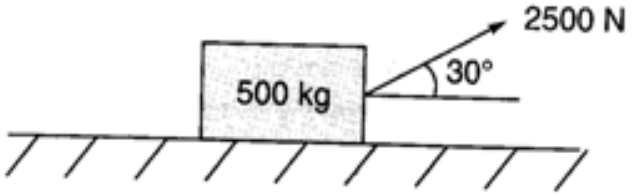

Figure.1

[3+2+5+4+4+4]

PART-B

2.(a) A body of weight 400N is pulled up along an inclined plane having an inclination 30^0 to the horizontal .If the coefficient of friction between the body and the plane is 0.3 and the force is applied parallel to the inclined plane, find the force required. Find also the work done on the body if the distance travelled by the body is 10m along the plane.
(b) State and derive the impulse momentum principle.

[10+6]

3.(a) A vertical boom AE is supported by three wires AB,AC and AD where these are anchored at points B,C and D respectively. The height of the peak point of the boom is 12m from the ground. If the tensile force in wire AD is 252N.Determine the forces in the wires AC and AB so that the resultant force on A is vertical. Consider the coordinates as A(0,12,0), B(0,0,-9),C(-4,0,3) and D (6,0,4)
(b) Define the terms moment of inertia and projectile.

[12+4]

4.(a) Locate the centriod for the shaded area as shown in figure.2

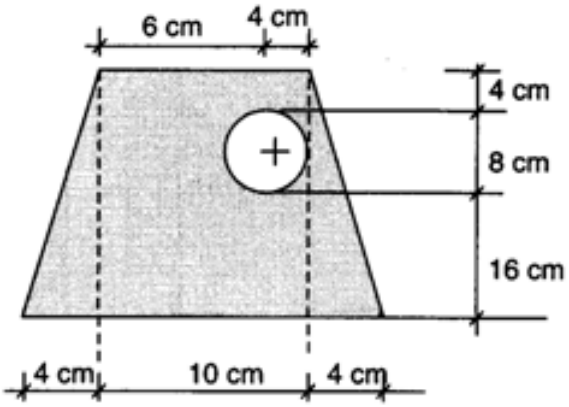

Figure.2

(b) Find the Mass Moment of inertia of a rectangular lamina

[12+4]

5.(a) An aeroplane is flying horizontally at a height of 900m.A bomb is released from the aeroplane when the speed of aeroplane is 700kmph. Determine the time required for the bomb to reach the ground and the horizontal distance travelled by the bomb during flight

(b) State laws of friction.

[12+4]

6.(a) Two blocks shown in figure.3 below are originally at rest. Determine (i) the acceleration of each block (ii) tension in cables. Assume the effect of friction in the pulleys, between the blocks and inclines as negligible. Mass of the pulley can also be neglected.

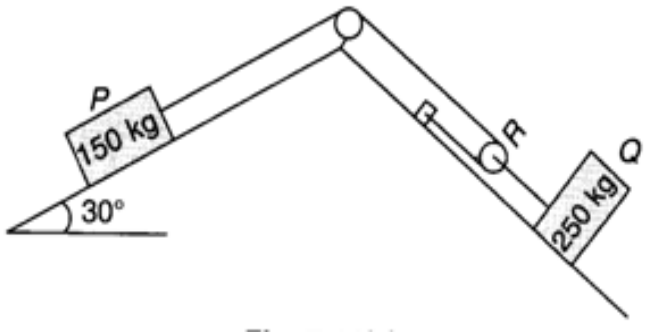

Figure.3

(b) State and prove Pappus theorem-I.

[12+4]

7.(a) Two forces of magnitude 340N and 300N are acting at a point O .If the angle between the forces is 60^0, determine the magnitude of the resultant force. Also, find the direction of the resultant with the horizontal force.

(b) A ball of mass 100gmis moving towards a bat with a velocity of 25m/s as shown in the figure.4. When hit by the bat, the ball attains a velocity of 35m/s. If the ball and bat are in contact for a period of 0.02 sec, determine the average impulse force exerted by the bat on the ball during the impact.

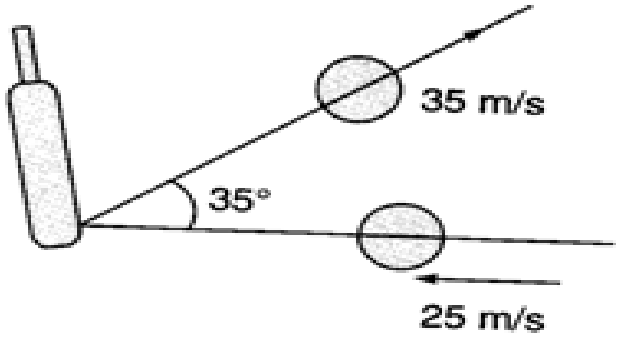

Figure.4

[6+10]

Subject Code: R13110/R13 **Set No - 2**

I B. Tech I Semester Supplementary Examinations Sept. - 2014

ENGINEERING MECHANICS

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, AME, Min E, PE, Metal E)

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*****

PART-A

1.(i) State and prove Varignon's principle.
(ii) Define Free Body Diagram. Draw F.B.D for a body of weight W placed on a table.
(iii) Derive an expression for C.G of a plane area using method of moments.
(iv) Differentiate between Area Moment of Inertia and Mass Moment of Inertia
(v) A body is rotating with an angular velocity of 6 radians/sec. After 5 seconds the angular velocity of the body becomes 14 radians/sec. Determine the angular acceleration of the body.
(vi) What are the units of work? What is the relation between work done and power?

[3+3+4+4+4+4]

PART-B

2.(a) A mass of12kg travelling to the right with a speed of 8m/sec collides with another mass of 20kg travelling to the left with a speed of 25m/s. If the coefficient of restitution is 0.60, find the velocities of the particles after collision and loss of kinetic energy. What is the impulse acting on either particle during impact?
(b) What is the principle of transmissibility?

[12+4]

3.(a) Determine the centroid of the shaded area shown in the figure.1

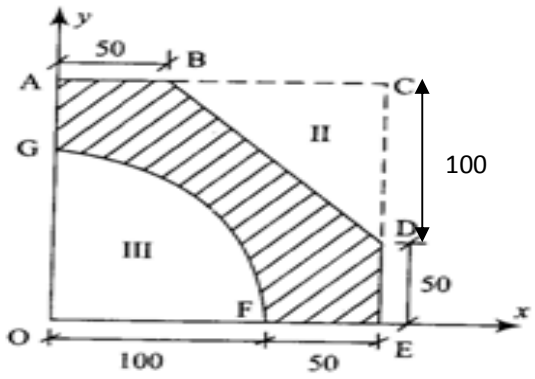

Figure.1

(b) Derive the mass moment of inertia of a right circular cone with respect to an access through the apex of the cone and perpendicular to its longitudinal axis.

[8+8]

4.(a) A stone is thrown vertically upwards at a point on a bridge located 40m above the water. If it strikes the water after 4sec determine the speed at which the stone was thrown up.

(b) Two cylinders of diameters 30cm and 80cm weighing 60N and 220N respectively are placed as shown in figure.2, assuming all the contact surfaces to be smooth. Find the reactions.

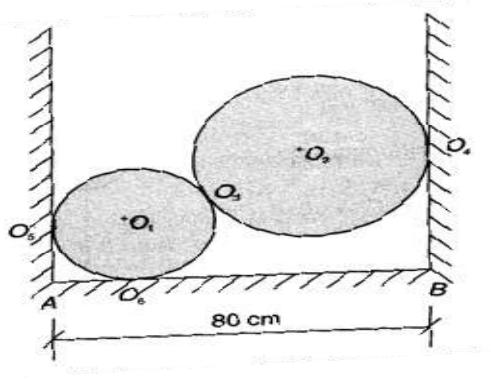

Figure.2

[8+8]

5.(a) A block weighing 1000N is kept on a rough plane inclined at 40^0 to the horizontal The coefficient of friction between the block and the plane is 0.4. Determine the smallest force inclined at 15^0 to the plane required just to move the block up the plane.

(b) State the impulse –momentum principle

[12+4]

6. A block and pulley system is shown in the figure.3. The pulley is friction less. Find the tension in the cable and the velocity of 50kg block after it has moved a distance of 1.5m when the system starts from rest. Neglect the mass of the pulley. Take the coefficient of kinetic friction between the blocks and plane as 0.25. Use the principle of work and energy.

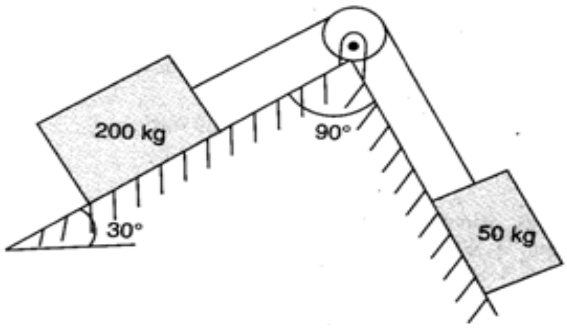

Figure.3

[16]

7.(a) Prove that moment of inertia of a triangular section about the base of the section is $bh^3/12$.

(b) Derive the relation between angular velocity and linear velocity.

[8+8]

Subject Code: R13110/R13 **Set No - 3**

I B. Tech I Semester Supplementary Examinations Sept. - 2014

ENGINEERING MECHANICS

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Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

*****

PART-A

1.(i) State triangular law of forces.
(ii) State and prove parallel axis theorem
(iii) State any two laws of friction.
(iv) A particle moves along the x-axis and its position is expressed as $x = 3.5\ t^3-7t^2$, where x is in metres and t is in seconds. Determine the displacement during three seconds.
(v) Define coefficient of restitution.
(vi) Find the centre of gravity of a quarter circle.

[2+5+2+3+4+2+4]

PART-B

2.(a) Find the mass moment of inertia of T-section shown in the figure.1,about x-x axis passing through its centroid.

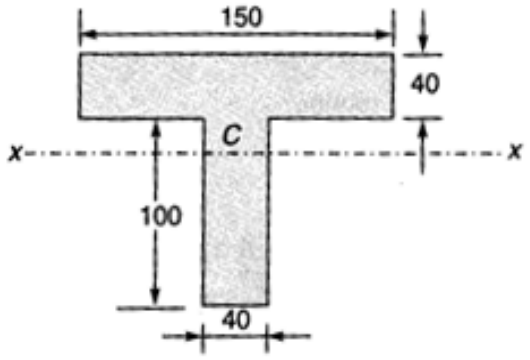

Figure.1

(b) The motion of a particle is given by the relation $x = 4t^3-20t^2+20t +8$. When does the velocity of the particle become zero?

[10+6]

3.(a) A block of wood of weight 1200N is placed on a smooth inclined plane which makes an angle 30^0 with the horizontal. Find the work done in pulling the block up for a length of 8m.

3.(b) Determine the centriod of the shaded area as shown in figure.2.

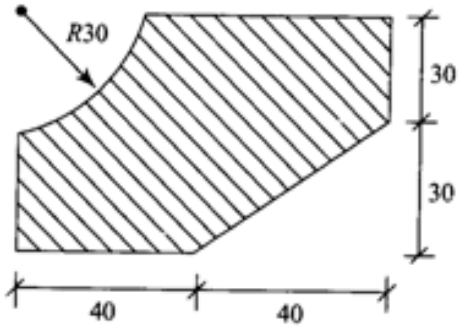

Figure.2

[8+8]

4.(a) Write short notes on (i) cone of friction (ii) Angle of repose (iii) Angle of friction
(b) State and prove Varignon's Theorem
(c) Define projectile.

[9+5+2]

5.(a) Define (i) coefficient of restitution (ii) work-energy principle for the body under translation.
(b) Two cylinders of diameters 25cm and 60cm weighing 50N and 180N respectively are placed as shown in the figure.3, assuming all the contact surfaces to be smooth. Find the reactions.

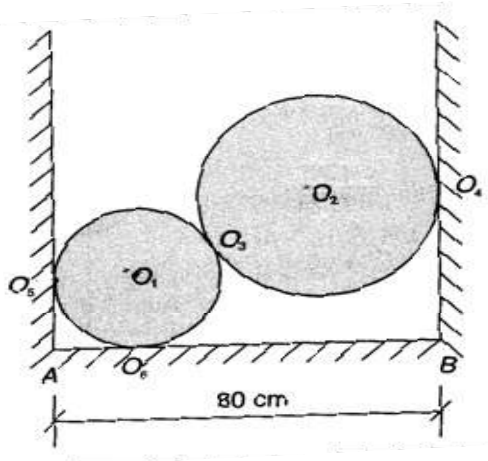

Figure.3

[6+10]

6. Two blocks shown in the figure.4, start from rest. Determine the acceleration of each and the tension in each chord. Assume that horizontal plane and pulley are frictionless and the pulley is of negligible mass.

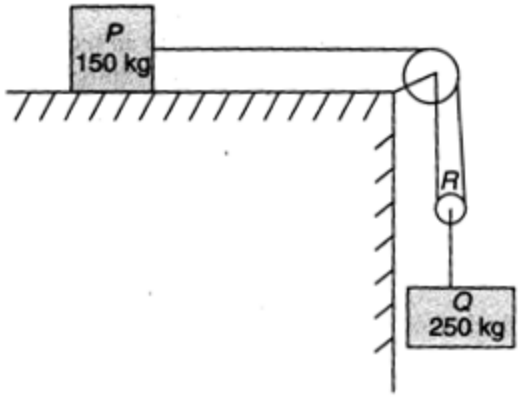

Figure.4

[16]

7.(a) From the top of a tower of height 70m,a bullet is fired at an angle of 60^0 with the horizontal with a velocity of 120m/s. Calculate the maximum height attained by the bullet and the time interval

(b) Determine the centroid of the arc of the circle.

[10+6]

Subject Code: R13110/R13 **Set No - 4**

I B. Tech I Semester Supplementary Examinations Sept. - 2014

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*****

PART-A

1.(i) Which theorem is used for the equilibrium of a particle applied with the system of concurrent coplanar forces.
(ii) With the help of a simple example illustrate and define F.B.D
(iii) Distinguish between rectilinear motion and curvilinear motion.
(iv) State the laws of static friction
(v) State the principle of work energy
(vi) Locate the centroid of a right angled triangle.

[3+4+4+3+4+4]

PART-B

2. Determine the moment of inertia about its horizontal axis for the plane section as shown in figure.1.

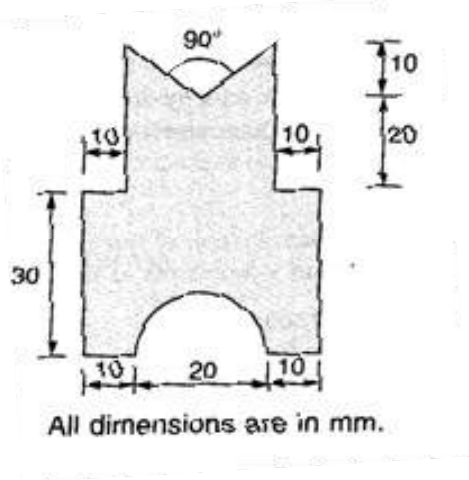

Figure.1

[16]

3.(a) Derive an equation for the path traced by a projectile when projected into space with a velocity 'u' at an angle 'α' with the horizontal.
(b) State and prove parallel axis theorem.

[8+8]

4.(a) A bullet of mass 30 gm is fired into a body of mass 10kg, which is suspended by a string 0.8m long. The bullet gets embedded in the body and due to the impact, the body swings through an angle of 30^0. Find the velocity of the bullet.

4.(b) Locate the centroid for the area shown in the figure.2

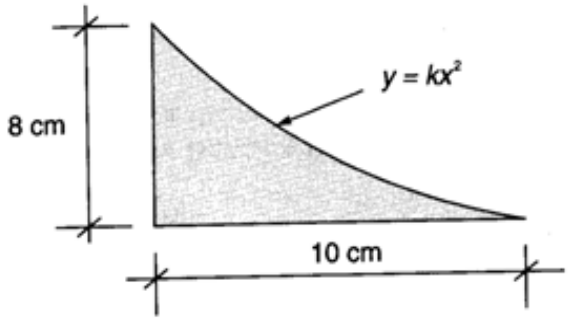

Figure.2

[8+8]

5.(a) A system of four forces acting on a body is shown in the figure.3. Determine resultant force and its direction.

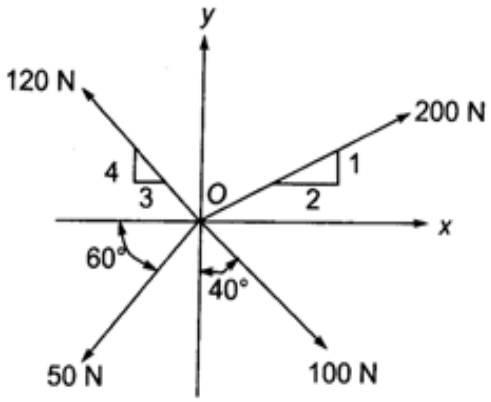

Figure.3

(b) A block weighing 1200N is kept on a rough plane inclined at 30^0 to the horizontal, The coefficient of friction between the block and the plane is 0.3. Determine the smallest force inclined at 20^0 to the plane required just to move the block up the plane.

[4+12]

6.(a) For a pulley of diameter 2m, $a_n = 4m/s^2$ and $\alpha_t = 9.17$ rad/s^2, find the total acceleration.

(b) Derive work energy equation.

[4+12]

7.(a) Differentiate between rectilinear motion and curvilinear motion

(b) A mass of14kg travelling to the right with a speed of 9m/sec collides with another mass of 25kg travelling to the left with a speed of 30m/s. If the coefficient of restitution is 0.60 find the velocities of the particles after collision and loss of kinetic energy.

[6+10]