Subject Code: R13210/R13

I B. Tech II Semester Regular/Supply Examinations July/Aug. - 2015
ENGINEERING MECHANICS
(Common to ECE, EEE, EIE, Bio-Tech, E Com.E, Agri. 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. (a) State and prove parallelogram law of forces.
   (b) Write the steps for drawing the F.B.D.
   (c) Describe the method of finding centre of gravity of composite bent wires.
   (d) Define the term radius of gyration. Write the units.
   (e) Distinguish between centroidal rotation and non-centriodal rotation.
   (f) Explain the concept of work? What are the units of work?

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

PART –B

2. (a) Block A has mass of 20kg and block B has a mass of 10kg.Knowing that the coefficient of friction is 0.15,between the two blocks and zero between the block B and the slope, find the magnitude of frictional force between the two masses. What is the force in the string tying the blocks? Refer the fig.1given below. Take g= 9.81 m/s^2
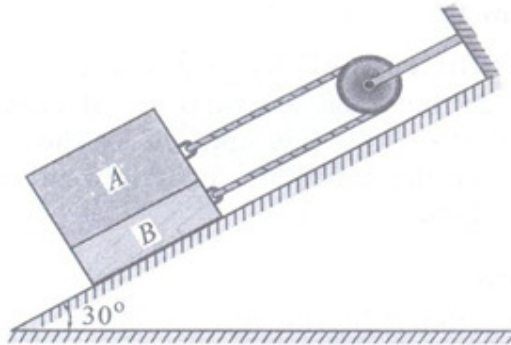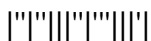

Fig:1

   (b) Classify the force system.

   [12+4]

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3. Two spheres A and B are resting in a smooth vessel as shown in the fig.2. Draw the free body diagrams of A and B showing all the forces acting on them, both in magnitude and direction. Radius of spheres A and B are 250mm and 200mm respectively.
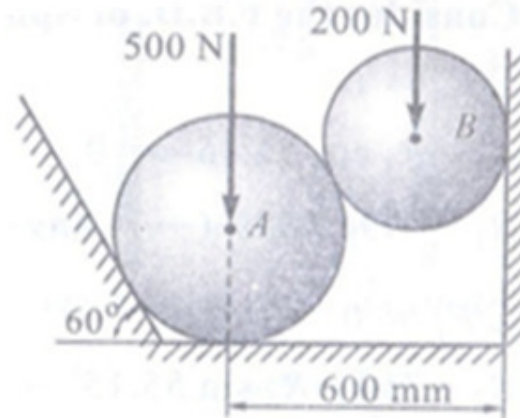

Fig.2

[16]

4. (a) Differentiate between centriod and centre of gravity.
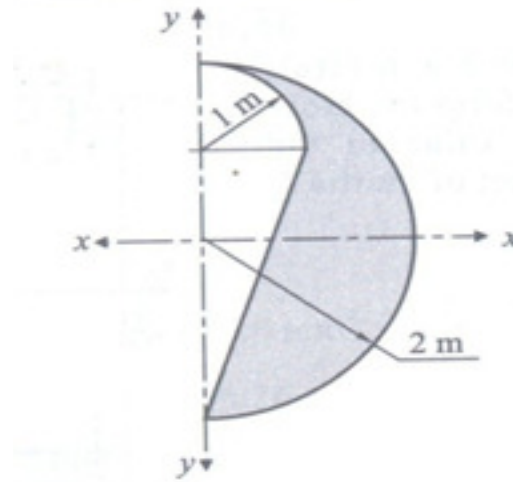   (b) Find the centriod of the following shaded area as shown in fig.3.
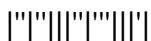

Fig.3

[8+8]

5. (a) State and prove perpendicular axis theorem.
   (b) Find the moment of inertia of the plane shown in the fig.4, about centriodal x and y-axis.
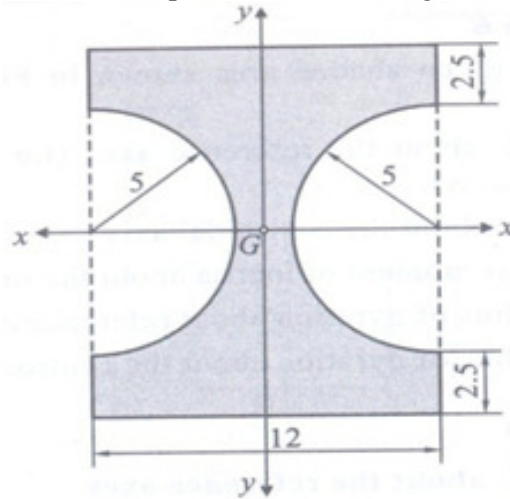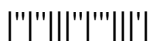

Fig.4

[8+8]

6. (a) Differentiate kinematics and kinetics?
   (b) A stone is dropped from the top of a tower 50m high. At the same time another stone is thrown up from the foot of the same tower with a velocity 25m/s. At a distance from top and after how much time the two stones cross each other.

[8+8]

7. (a) Derive work energy equation for translation.
   (b) A man of weight 70kg standing at the end of a small boat of weight 35kg fires a bullet of mass 25gm to hit a wooden block of weight 2.25kg resting on the shore. If the bullet embedded block starts moving 5m/s, determine the velocity of the boat.

[8+8]

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PART-A

1. (a) State and prove principle of transmissibility of forces.
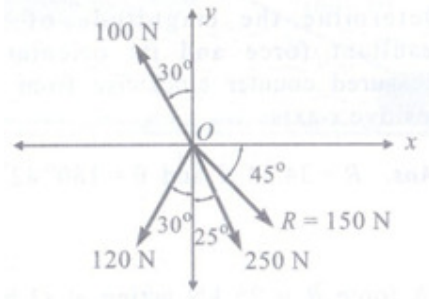   (b) Find the fourth force so as to give the resultant of the system of force as shown in the fig.1 below

Fig.1

   (c) Describe the method of finding centroid of composite areas.
   (d) Define the term moment of inertia. Write the units.
   (e) Distinguish between rectilinear motion and curvilinear motion.
   (f) Write the salient features of conservative force.

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

PART –B

2. (a) Two cylinders each of diameter 100mm and each weighing 200N are placed as shown in the fig.2 below. Assuming that all the contact surfaces are smooth, find the reactions at A, B and C.
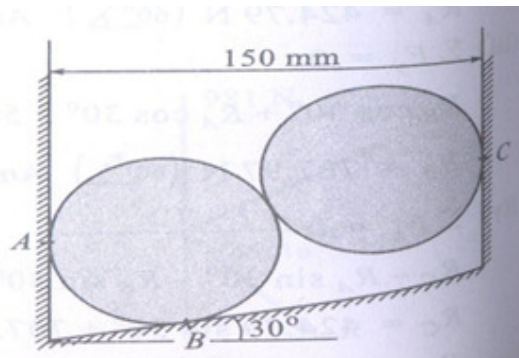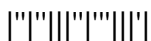

Fig.2

   (b) State and prove Varignon's theorem.

                                                                              [8+8]

Page 1 of 2

3. (a) Write the laws of friction. Prove that angle of friction is equal to angle of repose.
   (b) What is meant by (i) Resolution of force (ii) Composition of force
                        (iii) Moment of force (iv) Moment of couple

                                                                              [8+8]

4. (a) Derive the expressions for the centre of gravity of a flat plate
   (b) Find the centroid of the shaded area shown in fig.3.

Fig.3
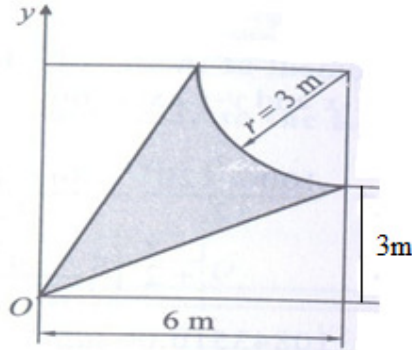   [8+8]

5. (a) Find the mass Moment of Inertia of circular plate of radius R and thickness t about its centroidal axis
   (b) Find the moment of inertia of the plane shown in the fig.4 about centriodal x and y-axis.
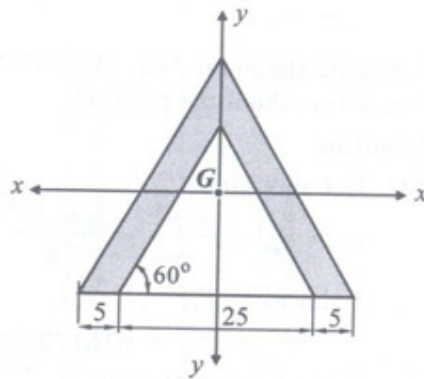

Fig.4
                                                                              [8+8]

6. (a) Derive the relation for component of normal acceleration a_n.
   (b) A stone is dropped from the top of a tower 60m high .At the same time another stone is thrown up from the foot of the same tower with a velocity 30m/s. At a distance from top and after how much time the two stones cross each other.
                                                                              [8+8]

7. (a) Derive the expression for work done and kinetic energy for a rigid body.
   (b) A man of weight 80kg standing at the end of a small boat of weight 40kg fires a bullet of mass 30gm to hit a wooden block of weight 3.25kg resting on the shore. If the bullet embedded block starts moving 6m/s, determine the velocity of the boat.
                                                                              [8+8]
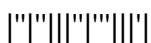
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PART-A

1. (a) Following forces act at a point P, F_1 =50i, F_2 = 30i – 15j, F_3 = -25i-10j+5k.
Determine the resultant and the inclination with the co-ordinate axes.
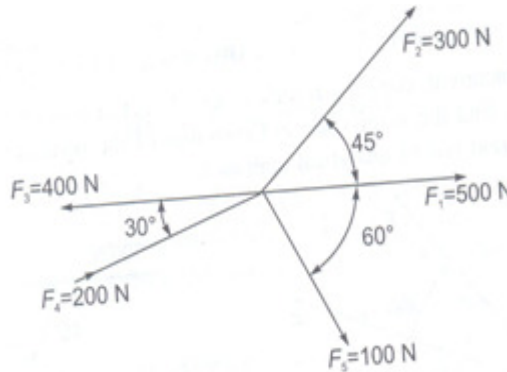   (b) Find the resultant of the given the force system as shown in fig.1.

Fig.1

   (c) Find the centroid of quarter circle
   (d) Derive the moment of inertia of triangle about its base.
   (e) Distinguish between rectilinear motion and curvilinear motion
   (f) Write about the work energy equation.

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

PART –B

2. (a) A 700N force passes through two points A(-,1,-4) towards B(1,2,6).Find the moment force about point C(2,-2,1) and scalar moments of force about line OC where O is the origin.
   (b) State and prove Lami's theorem.

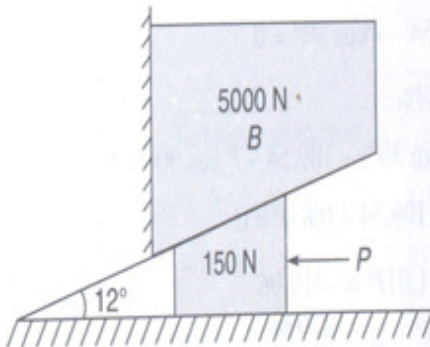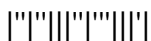[8+8]

3.   Find the value of P in the fig.2 shown below

Fig.2

[16]

|"|"|||"|"|||'|

4. (a) Derive an expressions for the centriod of sector of a circle.
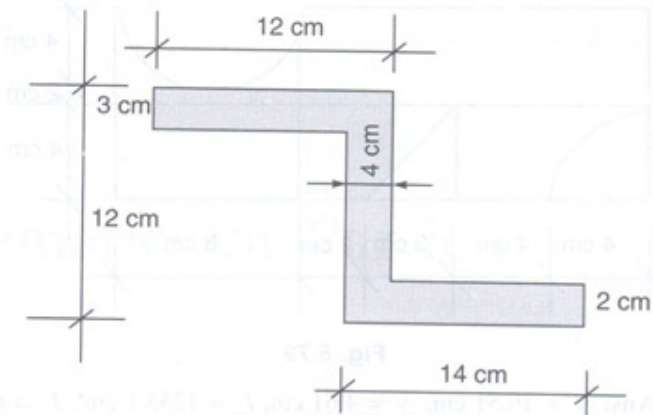   (b) Find the centriod of the shaded area shown in fig.3

Fig.3

[8+8]

5. (a) Find the mass Moment of Inertia of a rectangular lamina.
   (b) Find the moment of inertia of the plane shown in the fig.4 about centriodal x and y-axis.
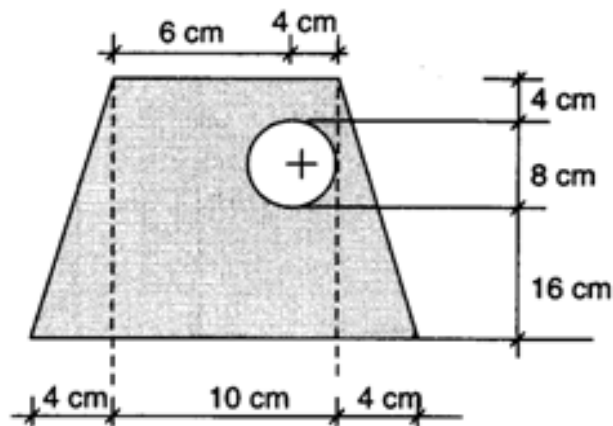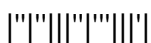

Fig.4

[8+8]

6. (a) Show the relation between rectangular components of normal and tangential components of acceleration.
   (b) A stone is dropped into a well with no initial velocity and after 4.5 sec a splash is heard. If the velocity of sound is 330 m/s, find the depth of the well up to water level.

[8+8]

|"|"|||"|"|"|||"|

7. (a)   Derive the expression for work energy of a rigid body?
   (b)   Two blocks are connected by an inextensible string moving over a frictionless pulley as shown in the fig.5. If the blocks are released from rest, determine the velocity of system after a travel of 4s. Take the coefficient of friction as 0.3.
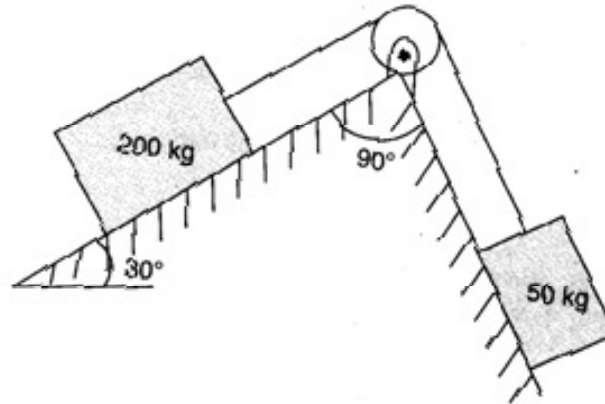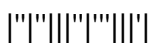

Fig-5

[8+8]

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PART-A

1. (a) What is a vector quantity and scalar quantity? Write the examples.
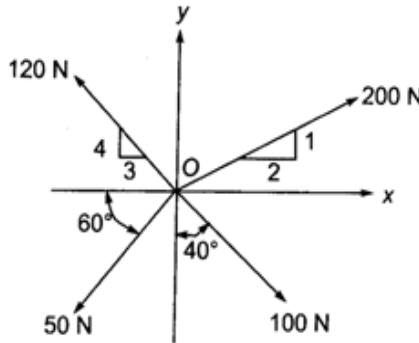   (b) Find the resultant of the given the force system shown in the fig.1 below

Fig.1

   (c) Find the centroid of sector of a circle.
   (d) Define the mass moment of inertia.
   (e) Derive the equation for maximum height for projectile motion
   (f) Write about the work energy equation.

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

PART –B

2. (a) Block A has mass of 30kg and block B has a mass of 20kg.Knowing that the coefficient of friction is 0.20,between the two blocks and zero between the block B and the slope, find the magnitude of frictional force between the two masses. What is the force in the string tying the blocks? Refer the fig.2given below. Take g= 9.81 m/s^2

Fig.2
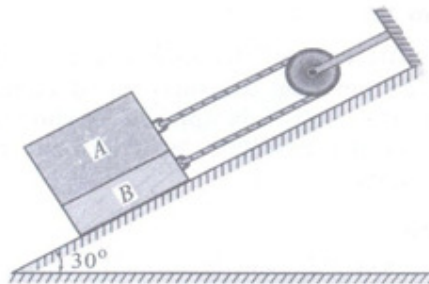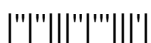   (b) Write about coplanar concurrent forces and non coplanar concurrent forces.

                                                                         [12+4]

Page 1 of 2

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3. (a) Explain and define the term Free Body Diagram. Draw the free body diagram of a ball of weight W, supported by a string AB and resting against a smooth vertical wall at C and also resting against a smooth horizontal floor at D

   (b) State and prove Varignon's theorem

[8+8]

4. (a) Derive an expressions for the centriod of semicircle about base and diametric axis.

   (b) Find the centriod of the shaded area shown in fig.3.
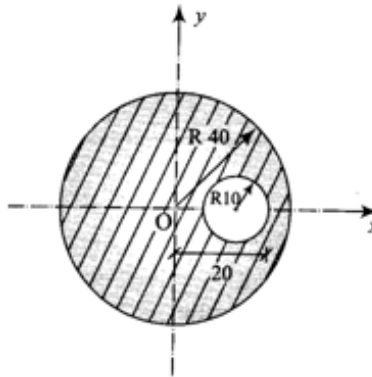

Fig-3

[8+8]

5. (a) Find the mass Moment of Inertia of a rod.

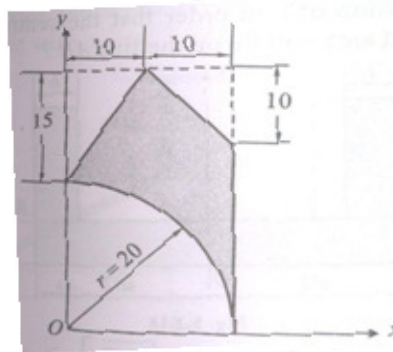   (b) Find the moment of inertia of the plane shown in the fig.4

Fig-4

[8+8]

6. (a) Show the relation between rectangular components and normal and tangential components of acceleration.

   (b) A stone is dropped into a well with no initial velocity and after 5 sec later a splash is heard. If the velocity of sound is 350 m/s, find the depth of the well up to water level.

[8+8]

7. (a) Derive the expression for work energy for a rigid body?

   (b) State D'Alembert's principle for a particle. How is it similar with the equilibrium equations as obtained by Newton's second law?

[8+8]

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