

Subject Code: R13110/R13

Set No - 1

I B.Tech I Semester Regular/Supple. Examinations Nov./Dec. – 2015

**ENGINEERING MECHANICS**

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

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**

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**PART-A**

1. (a) Distinguish between rigid body, deformable body and fluid.
- (b) What is Lami's theorem?
- (c) Derive centroid of a right angled triangle.
- (d) Find the area moment of inertia of a circle.
- (e) Define D'Alembert's principle.
- (f) Define translation and write the equations of translation.

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

**PART-B**

2. (a) A body weighing 60kN rests in equilibrium on a rough plane whose slope is  $30^\circ$ . The plane is raised to a slope of  $45^\circ$ . What is the force applied to the body parallel to the plane that will support the body on the plane?
  - (b) What are the laws to add two forces and several concurrent, coplanar forces? Explain in detail.
- [8+8]
3. (a) Three bars, hinged at A and D and pinned at B and C as shown in Fig.1 below form a four-linked mechanism. Determine the value of P that will prevent movement of bars

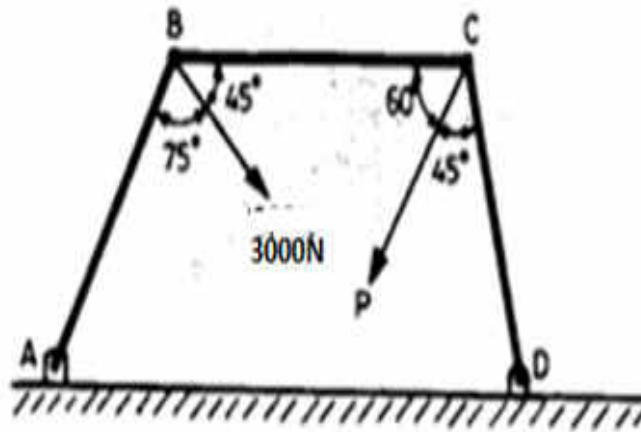


Fig.1

- (b) Define space diagram and free body diagram. Explain with examples.

[10+6]



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4. Find the centroid of the following composite figure.2 given below

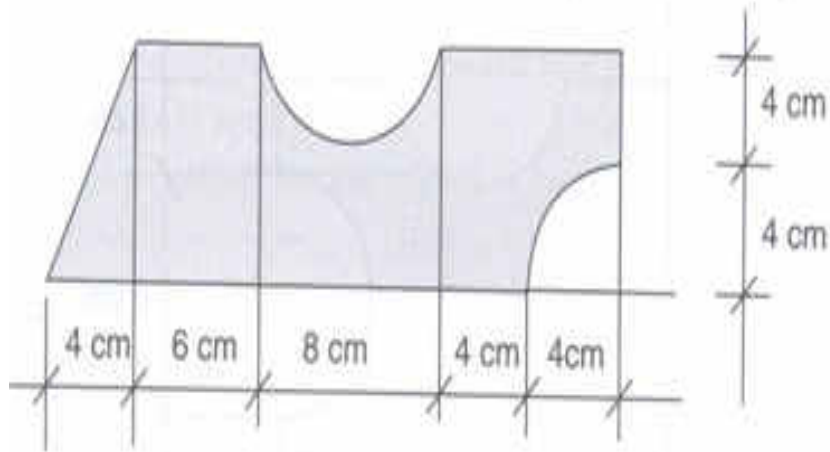


Fig.2

5. (a) State and prove the transfer theorem of mass moment of inertia. [16]  
 (b) What is moment of inertia? Distinguish between area moment of inertia, polar moment of inertia and mass moment of inertia. [10+6]
6. (a) What are different types of motion of rigid body?  
 (b) An object falls from rest from an unknown height. In the last second of its motion the object travels a distance of 50m. If  $g = 9.8 \text{ m/s}^2$  determine (i) height from which the object falls and (ii) total time taken by the object in falling. [8+8]
7. (a) What do you understand by potential energy and kinetic energy of a body?  
 (b) Derive impulse momentum equation. [8+8]

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**PART-A**

1. (a) Define moment of couple.
- (b) What is Varignon's theorem?
- (c) Derive centroid of a quarter circle.
- (d) Find the area moment of inertia of a triangle.
- (e) Differentiate between curvilinear motion and rectilinear motion.
- (f) Define work and energy.

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

**PART-B**

2. (a) A body weighing 70kN rests in equilibrium on a rough plane whose slope is  $30^\circ$ . The plane is raised to a slope of  $45^\circ$ . What is the force applied to the body parallel to the plane that will support the body on the plane?
- (b) State and prove triangular law of forces.

[10+6]

3. Find the forces in the strings PS, PQ and PR. (as shown in fig.1)

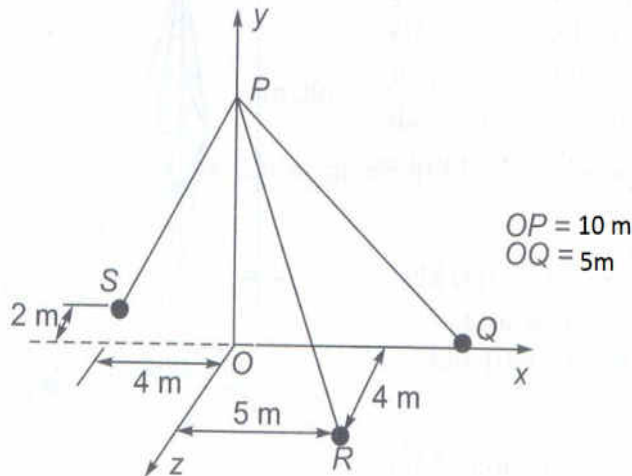


Fig.1

[16]

4. Find the centroid of the following
  - a) Triangle
  - b) Semi circle
  - c) T- section
  - d) Spandrel

[16]



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**Set No - 2**

5. (a) State and prove the parallel axis theorem.  
(b) What is mass moment of inertia of a right circular cone? [6+10]
6. (a) What are different types of motion of rigid body?  
(b) An object falls from rest from an unknown height. In the last second of its motion the object travels a distance of 60m. If  $g = 9.8 \text{ m/s}^2$  determine  
(i) height from which the object falls and (ii) total time taken by the object in falling. [6+10]
7. (a) Derive work energy equation.  
(b) What is fixed axis rotation of motion and plane motion? [9+7]

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**PART-A**

1. (a) What is limiting friction and impending motion?
- (b) Derive converse law of triangle of forces.
- (c) Find the centre of gravity of parallelogram.
- (d) Find the area moment of inertia of a quarter circle of radius R.
- (e) Write about fixed axis rotation.
- (f) State D'Alembert principle.

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

**PART -B**

2. (a) Two identical rollers, each of weight 90N are supported by an inclined plane and a vertical wall as shown in the fig.1. Determine the reactions at the points of supports A,B and C assuming all the surfaces to be smooth. Also find the reaction forces between the spheres.

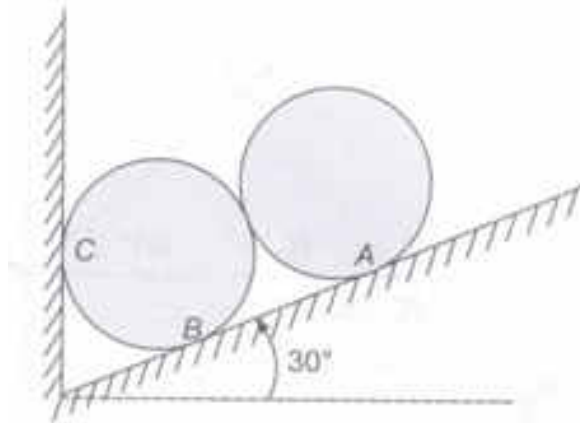


Fig.1

- (b) Define cone of friction and coefficient of friction.

[10+6]



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Set No - 3

3. Three bars, hinged at A and D and pinned at B and C as shown in Fig.2 below form a four-linked mechanism. Determine the value of P that will prevent movement of bars.

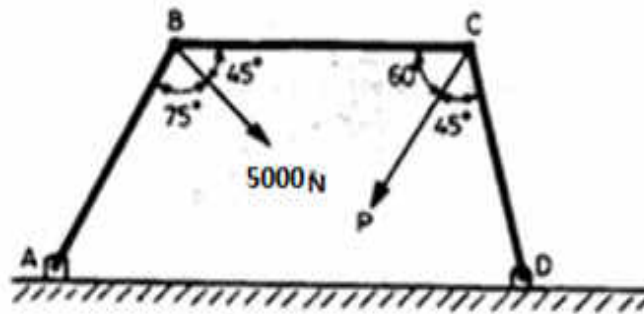


Fig.2

4. (a) State and prove Pappus Theorems I and II.  
 (b) Derive the formula of C.G from first principles.

[16]

5. (a) Find the area moment of inertia for an area shown in the fig.3

[8+8]

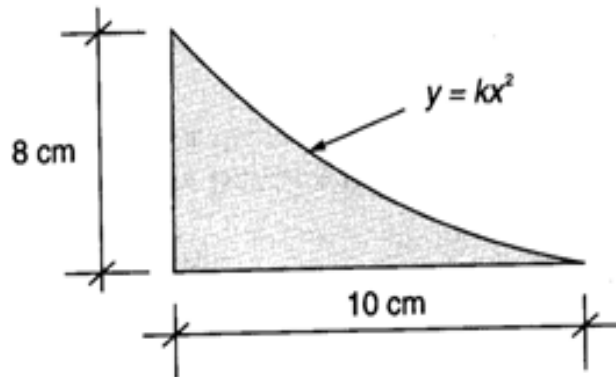


Fig.3

- (b) Find the mass moment of inertia of a thin rod of length L about its centroidal axes  
 6. (a) Distinguish between translation motion and rotational motion.  
 (b) Explain the law of conservation of energy.

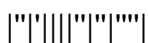
[8+8]

7. (a) Explain the terms momentum of a body and angular momentum of a body.  
 (b) Explain the work energy principle.

[8+8]

[8+8]

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Set No - 4

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\*\*\*\*\*

**PART-A**

1. (a) State Coulomb's laws of friction.
- (b) State the principle of transmissibility of force.
- (c) Derive the centre of gravity of a semi circle.
- (d) Find mass moment of inertia of a solid sphere.
- (e) Define uniform velocity and uniform acceleration.
- (f) Define coefficient of restitution.

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

**PART -B**

2. A block weighing 5000N is to be raised by means of a  $12^\circ$  wedge as shown in fig.1. Assume  $\mu = 0.3$  for all the surfaces of contact. What is the horizontal force P that should be applied to raise the block? Weight of the wedge is 150N.

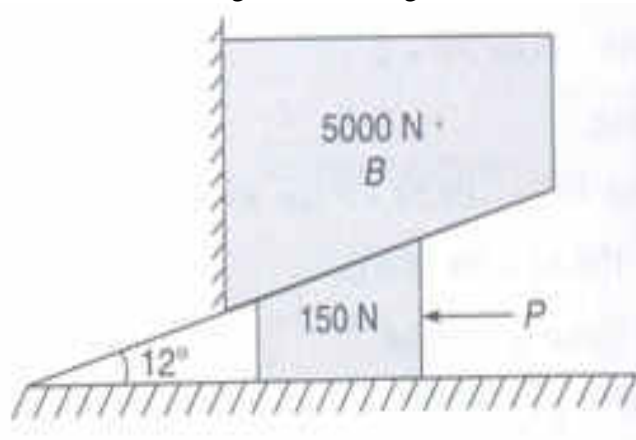


Fig.1

[16]

3. (a) Discuss the graphical method of finding resultant of coplanar forces.
- (b) State and prove Lami's theorem.

[8+8]



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**Set No - 4**

4. Locate the centroid for the shaded area as shown in the fig.2 below.

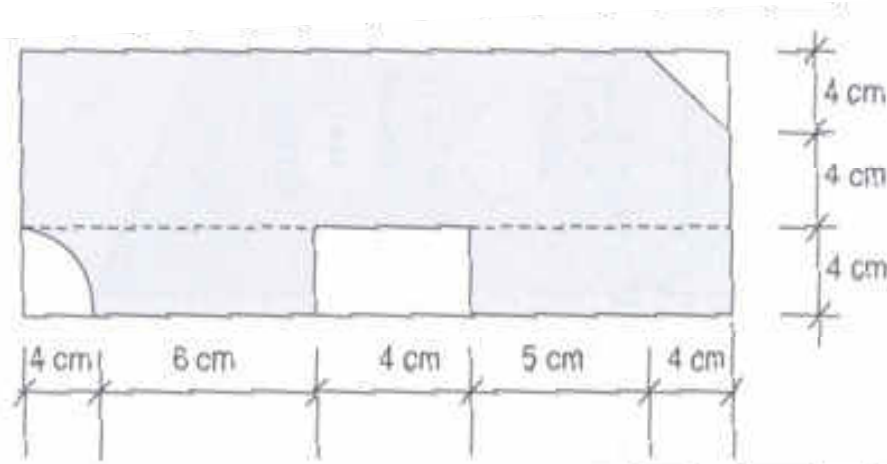


Fig.2

5. (a) State and prove Perpendicular Axis theorem. [16]  
 (b) Find the mass moment of inertia about the centroidal axes for a right circular cone. [6+10]
6. (a) What is the analysis of a rigid body in translation?  
 (b) State and prove D'Alembert's principle. [8+8]
7. (a) Derive impulse momentum equation. [8+8]  
 (b) Prove  $K.E = \frac{1}{2} mv^2$  [8+8]

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