Code No: 07A1EC03 **Set No. 1**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
CLASSICAL MECHANICS
(Common to Mechanical Engineering, Chemical Engineering, Mechatronics, Production Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Three forces of magnitude 150 N, 300 N and 500 N are acting at the origin O(0,0,0) and are directed from the points A(3,2,4), B(3,-2,-4) and C(-1,-3,-4) respectively to the origin. Determine the magnitude of the resultant. [16]

2. A homogeneous semi circuilar plate of weight 'W' and radius 'a' is supported by three vertical strings so that the plate is horizantal as shown in figure 2. Determine the tensions in the three strings. [16]

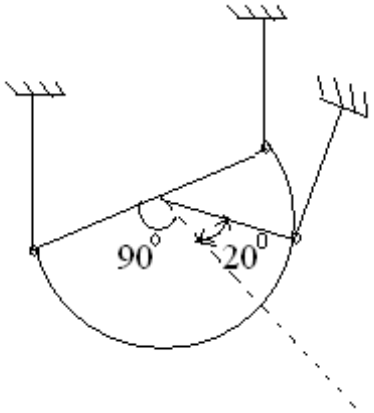

Figure 2

3. (a) Find the centroid of the area shown in figure 3a

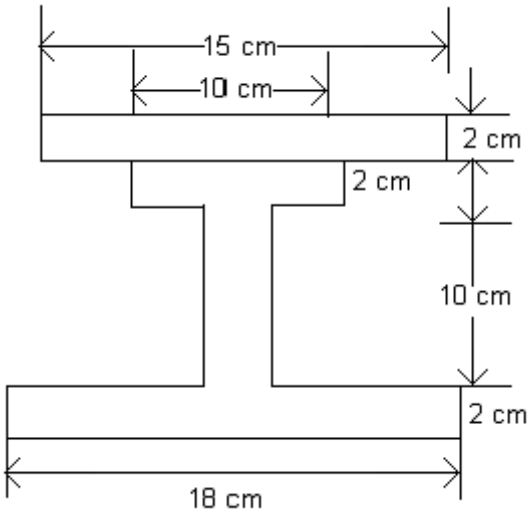

Figure 3a

(b) Determine the coordinates of the centroid of the quadrant PQ of the arc of a circle if raduis 'r' show in figure 3b. [8+8]

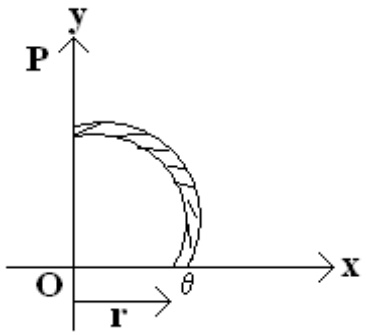

Figure 3b

4. Find the moment of inertia of the plane area shown in figure 4 about X and Y axes through its centroid. [16]

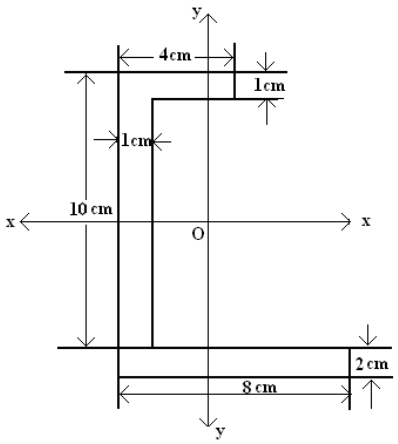

Figure 4

5. Calculate the forces included in the members of the pin-jointed truss shown in figure 5. Show the values on a neat diagram of the truss. [16]

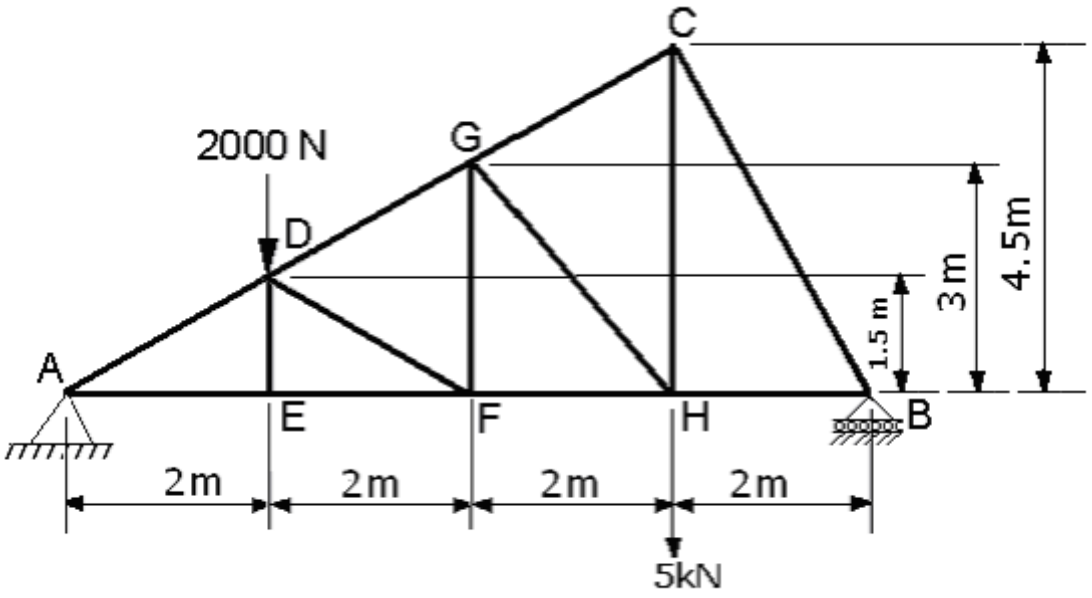

Figure 5

6. (a) The motion of the particle is defined by the relation $x = 6t^4 + 8t^3 - 14t^2 - 10t + 16$, where x and t are expressed in meters and records, respectively. Determine the position, the velocity, and the acceleration as the particle when t = 3s.

   (b) A car is tested for acceleration and braking. In the street - start acceleration test, the elapsed time is 8 seconds for a velocity increase from 8 km/h to 80 km /h. In the braking test, the distance traveled is 40m during braking to a stop from 80 km / hr. Assuming constant values of acceleration and deceleration, determine

   i. the acceleration during the street - start test

   ii. the deceleration during the braking test. [8+8]

7. (a) A 500kg communications satellite is in a circular geosynchronous orbit and complete one revolution about the earth in 23 hrs and 58min at an attitude of 35800 km above the surface of the earth. The radius of the earth is 6510km. Determine the Kinetic energy of the satellite.

   (b) Express the acceleration of gravity 'g' at an altitude 'h' above the surface of the earth in terms of the acceleration of gravity g_o. at the surface the earth, the altitude h, and the radius R of the earth. [8+8]

8. A homogeneous wire is bent to form closed semi-circular shape of radius 320 mm. Pinned at A and point B is pushed down 30 mm and released, determine the magnitude of the acceleration of B, 10 secs later. As shown in figure 8. [16]

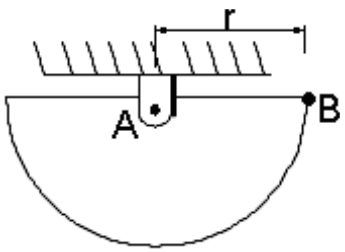

Figure 8

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Code No: 07A1EC03 **Set No. 2**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
CLASSICAL MECHANICS
(Common to Mechanical Engineering, Chemical Engineering, Mechatronics, Production Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Determine the magnitude and direction of a single force which keeps the system in equilibrium. The system of forces acting is shown in Figure 1. [16]

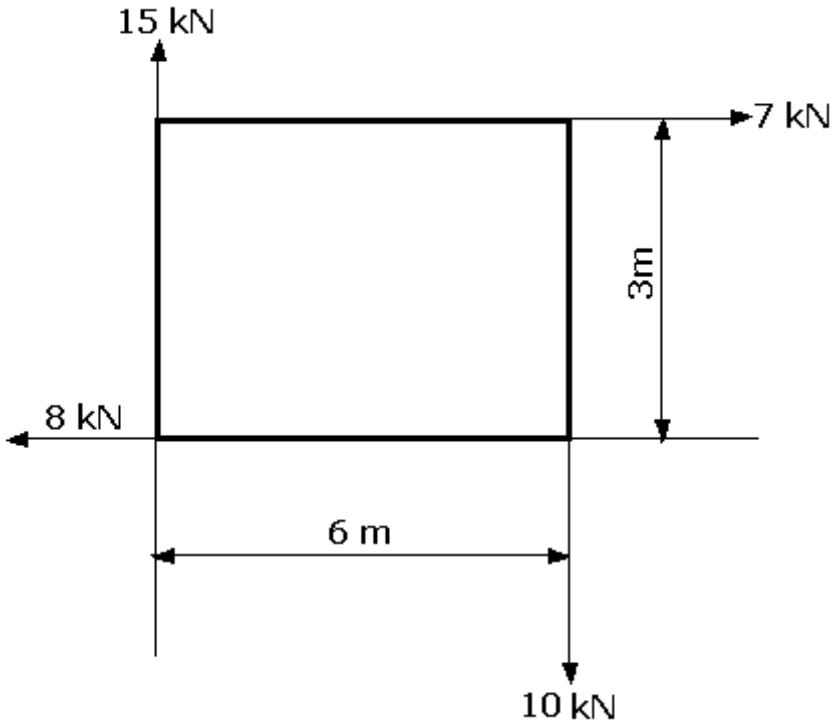

Figure 1

2. Five strings are tied at a point and are pulled in all directions, equally spaced, from one another. If the magnitude of the pulls on three consecutive strings is 70 N, 40 N and 55 N respectively, find graphically the magnitude of the pulls on two other strings, if the system is in equilibrium. [16]

3. (a) Find the centroid of the plane area shown in figure 3a.

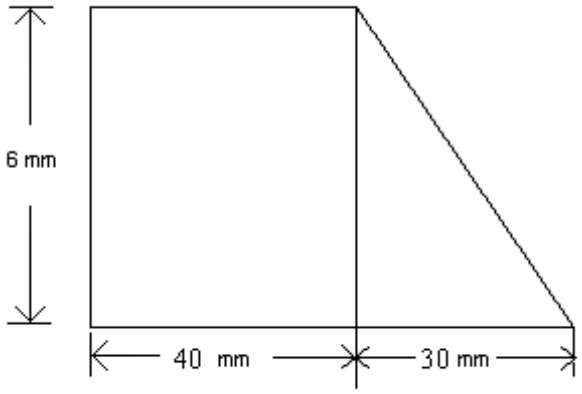

Figure 3a

(b) Determine the centre of gravity of a homogeneous hemisphare of radius 'a' [8+8]

4. Find the moment of inertia of the plane area shown in figure 4 about X and Y axes through its centroid. [16]

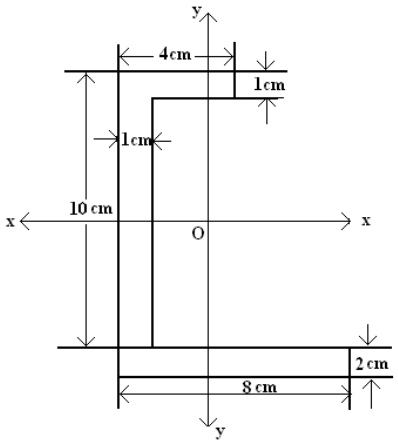

Figure 4

5. Calculate the forces induced in the member of a pin-jointed truss shown in figure 5. [16]

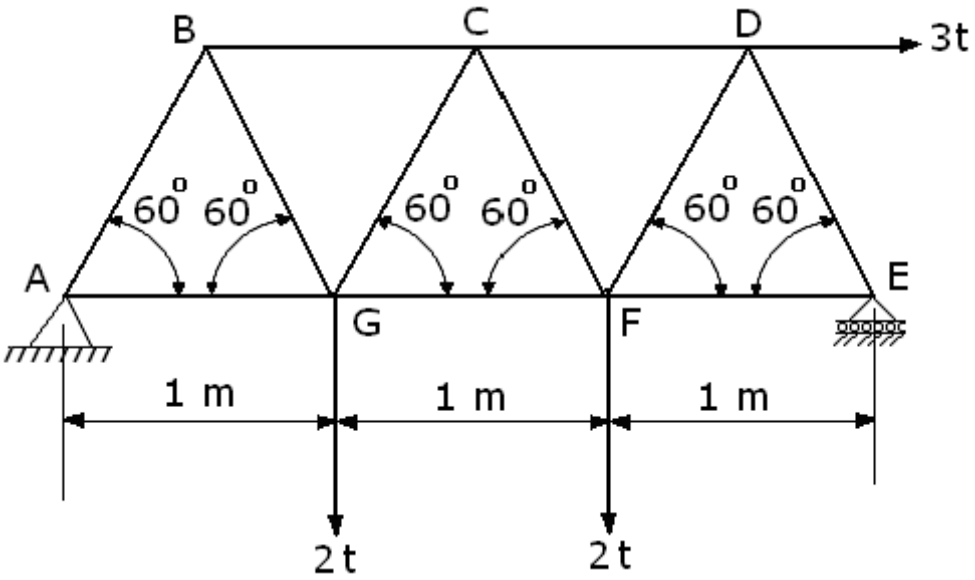

Figure 5

6. (a) Define curvilinear linear motion of a particle.

   (b) Show that the system of the effective forces for a rigid slab in plane motion reduces to a single vector, and express the distance from the mass center G of the slab to the line of action of this vector in terms of the centroidal radius of gyration $\overline{k}$ of the slab, the magnitude $\overline{a}$ of the acceleration of G, and the angular acceleration α. [4+12]

7. (a) State the Principle of conservation of momentum

   (b) A golfer hits a 46gm ball with an initial velocity of 48 m/s at angle of 24^0 with the horizontal. Determine

      i. the initial KE of the ball

      ii. the KE of the ball when it reaches its maximum height. [4+12]

8. The block vibrates in SHM with a period of 5s when the two springs of constants K_1 & K_2 are connected in series and 2s when they are in parallel. Determine the ratio K_1 / K_2 at the two spring constants. [16]

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Code No: 07A1EC03 **Set No. 3**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
CLASSICAL MECHANICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Three forces of magnitude 150 N, 300 N and 500 N are acting at the origin O(0,0,0) and are directed from the points A(3,2,4), B(3,-2,-4) and C(-1,-3,-4) respectively to the origin. Determine the magnitude of the resultant. [16]

2. Determine the resultant of the force system shown in figure 2 graphically. [16]

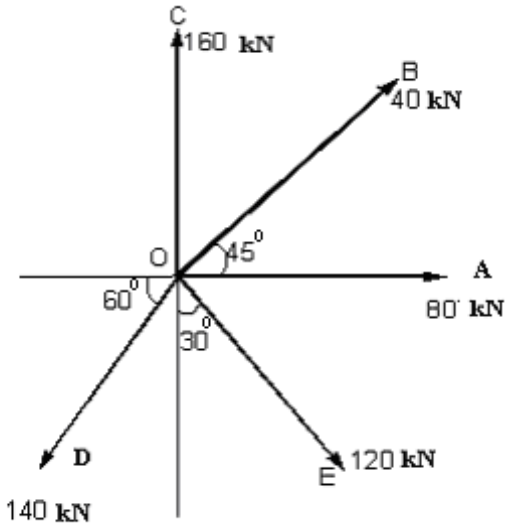

Figure 2

3. Find the centroid of the area shown figure 3. [16]

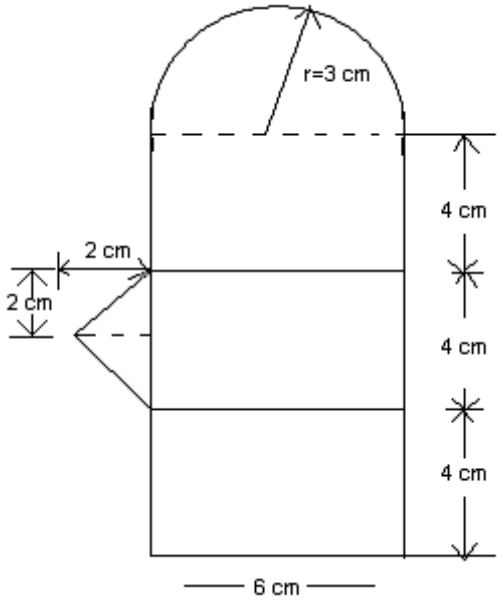

Figure 3

4. Find the moment of inertia of the plane area shown in figure 4 about X and Y axes through its centroid. [16]

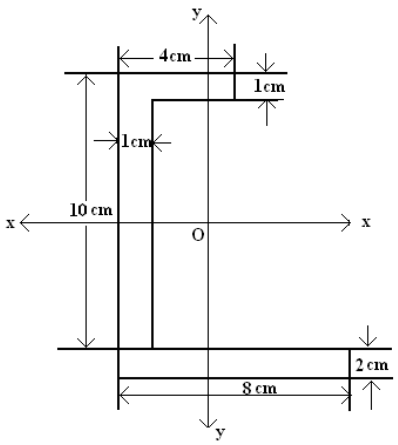

Figure 4

5. A pin jointed frame is supported at A and B and loaded as shown in figure 5. Find the forces in all the members of the frame and state in each case, whether the force is tensile or compressive. [16]

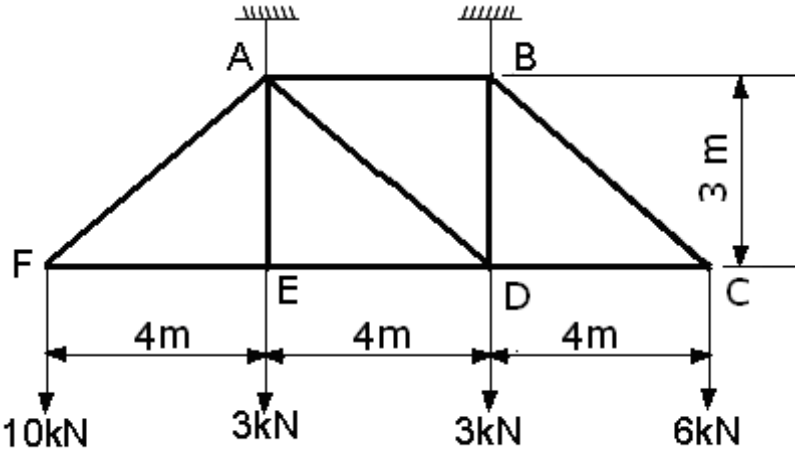

Figure 5

6. Bars AB and BE, each of weight 3.2 kg are welded together and are pin-jointed to two links AC and BD. The assembly is released from rest in the position shown in figure 6 and Neglecting the masses of the links determine

   (a) the acceleration of the assembly

   (b) the forces in the links. [16]

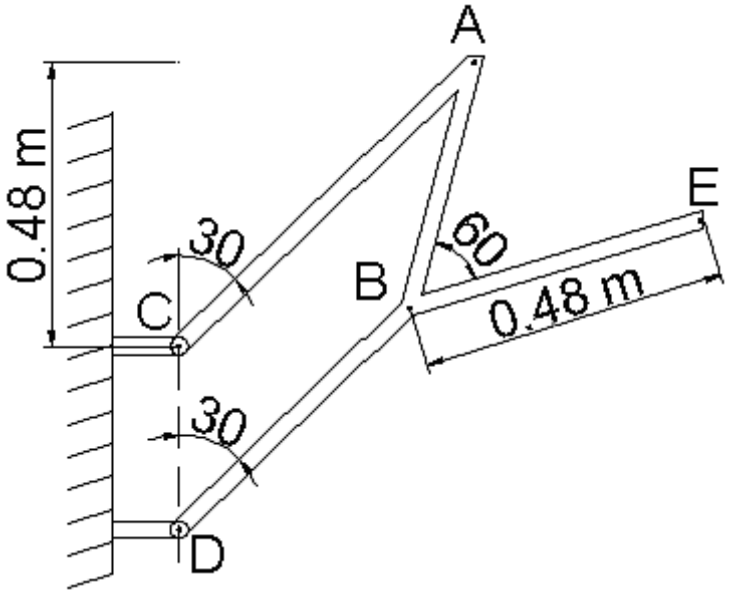

Figure 6

7. A solid cylinder of weight W and radius 'r' rolls, down an inclined plane which makes angle θ with the horizontal axis. Determine the minimum coefficient of friction and the acceleration of the mass center for rolling, without slipping. [16]

8. Derive an equation of motion for free vibration of mass m shown in figure 8 and determine the natural frequency. [16]

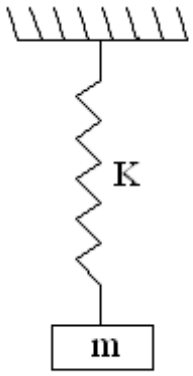

Figure 8

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Code No: 07A1EC03 **Set No. 4**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
CLASSICAL MECHANICS
(Common to Mechanical Engineering, Chemical Engineering, Mechatronics, Production Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The resultant of the two forces when they act at an angle of 65^0 is 20 N. If the same forces are acting at right angles their resultant is 16.5 N. Determine the magnitude of the two forces.
   (b) A force of 100N makes angles of 30^0, 60^0 and 100^0 with x,y, z axes respectively. Find the components of the force along the x,y and z axes. [8+8]

2. Five strings are tied at a point and are pulled in all directions, equally spaced, from one another. If the magnitude of the pulls on three consecutive strings is 70 N, 40 N and 55 N respectively, find graphically the magnitude of the pulls on two other strings, if the system is in equilibrium. [16]

3. Find the centroid of the shaded area shown in figure 3. [16]

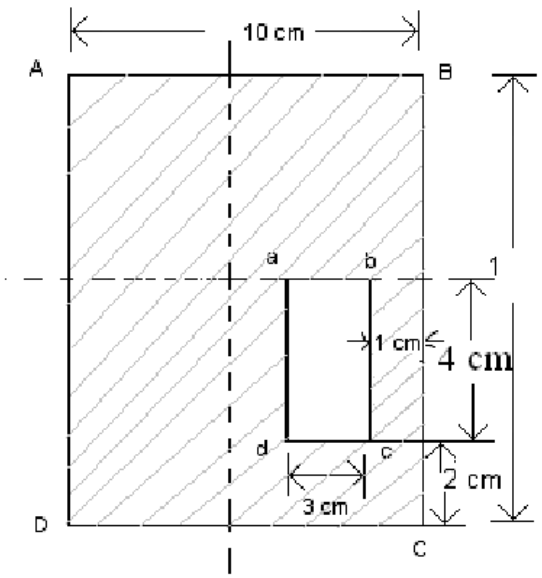

Figure 3

4. Find the moment of inertia of the plane area shown in figure 4 about X and Y axes through its centroid. [16]

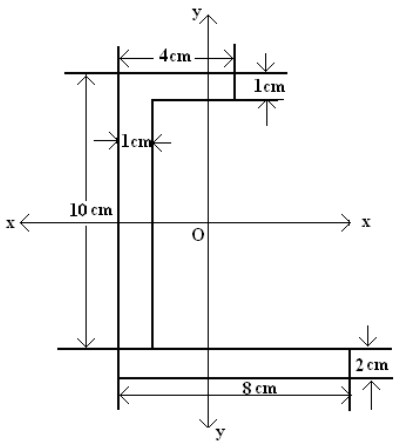

Figure 4

5. Tabulate the member forces for the structure shown in figure 5. [16]

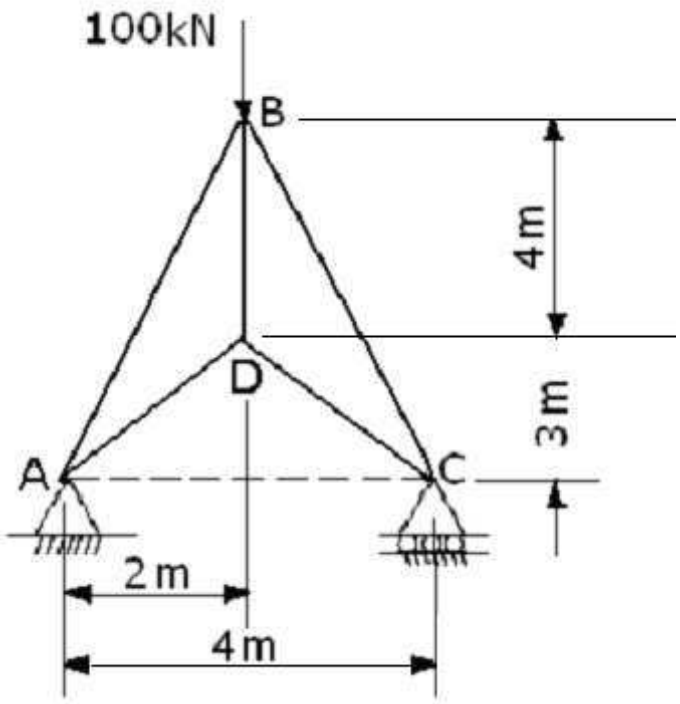

Figure 5

6. (a) Define curvilinear linear motion of a particle.
   (b) Show that the system of the effective forces for a rigid slab in plane motion reduces to a single vector, and express the distance from the mass center G of the slab to the line of action of this vector in terms of the centroidal radius of gyration $\overline{k}$ of the slab, the magnitude $\overline{a}$ of the acceleration of G, and the angular acceleration α. [4+12]

7. (a) A body of mass 18 kg slides up an incline of 30^0 under the action of an applied force 300N along the incline and in the presence of friction, $\mu = 0.2$. If the body moves from rest determine, after a period of 6 secs;

i. Acceleration of the body
ii. Distance traveled by the body
iii. Kinetic energy of the body
iv. Work done on the body.

(b) A 2kg collar can slide without friction along a horizontal rod as shown in figure 7b and is released from rest at A. The undeformed lengths of springs BA & CA are 30cm and 25cm respectively and the constant of each spring is 490KN/m. Determine the velocity of the collar when it has moved 3 cm to the right.

[8+8]

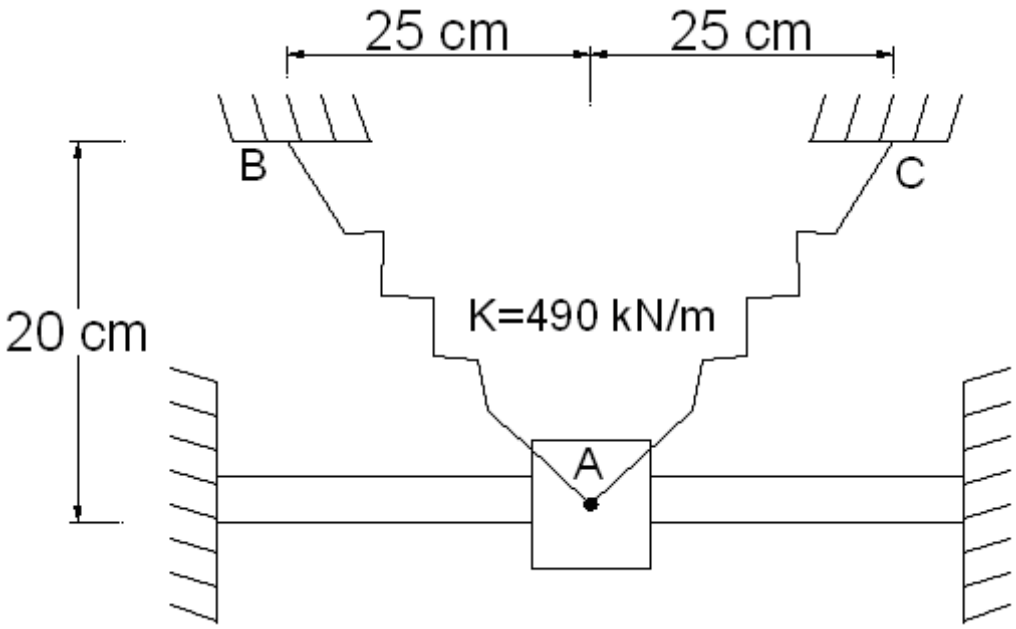

Figure 7b

8. Derive an expression for the equation of motion of a simple pendulum employing the principle of conservation of energy. Also find the frequency and time period.

[16]

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