MECH 230 DYNAMICS
PREVIOUS QUIZ 1

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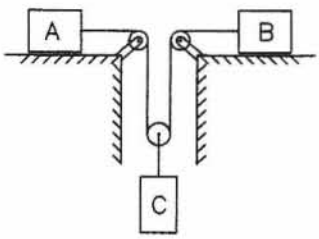
90 minutes open book closed notes quiz

1- Solve the problems on the question sheets.
2- Write your solution in the given space.
3- Use the scratch booklet before writing on the question sheet.
4- The scratch booklet will not be collected and will not be graded.
5- Clarity and neatness are important in grading.

No.1– (20%)

Consider block A of 5 kg, block B of 10 kg, and block C of 10 kg attached by the rope as shown in the figure. All the blocks are in motion. The coefficient of kinetic friction between blocks A and B and the horizontal surface μ_k=0.2



5% 1- Draw the free body diagrams and kinetic diagrams of blocks A, B, and C.

Solution:

NAME: **ID No:**

5% 2- Write the constraint equation relating the accelerations of blocks A, B, and C.

Solution:

5% 3- Apply Newton's 2nd Law – **F**=m**a** – on blocks A, B, and C.

Solution:

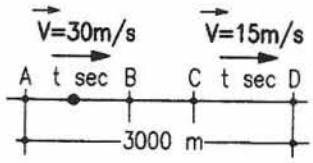
5% 4- Determine the acceleration of each block and the tension in the rope.

Solution:

NAME: **ID No:**

No.2– (20%)

In traveling a distance of 3000 m between points A and D, a particle is driven at 30 m/s from A to B for **t** seconds and at 15 m/s from C to D for **t** seconds. The particle uniformly decelerates for 4 seconds between B and C.



5% 1- Verify that the deceleration of the particle in the interval BC is 3.75 m/s^2.

Solution

5% 2- Determine the distance between B and C.

Solution:

5% 3- Determine the time **t** in seconds.

Solution:

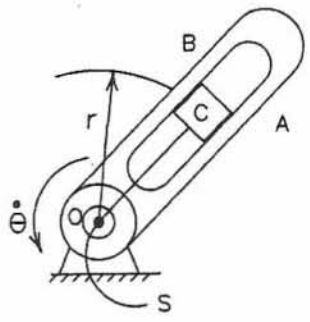
NAME: **ID No:**

5% 4- Determine the distances between AB and CD.

Solution:

No.3– (20%)

The slotted arm revolves in the **horizontal** plane about the fixed vertical axis through point O. The 2 kg slider C is drawn towards O at the constant rate of 0.05 m/s by pulling the cord S. At the instant for which r=0.225 m, the arm has a counterclockwise angular velocity at 6 rad/s and is slowing down at the rate of 2 rad/s^2. The slider moves in the smooth slotted arm.



10% 1- Draw the free body diagram and the kinetic diagram of the slider C in the position shown.

Solution:

NAME: **ID No:**

5% 2- Determine the radial and the transverse components of acceleration of the slider for the position shown.

Solution:

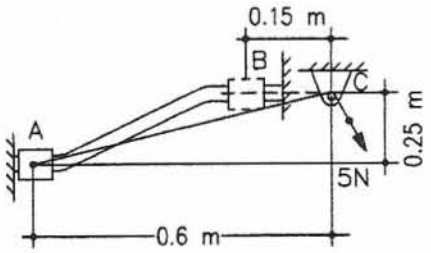
5% 3- For the position shown, determine the magnitude of the force exerted on the slider by the side of the smooth radial slot and determine the magnitude of the tension force in the cord.

Solution:

NAME: **ID No:**

No.4– (20%)

The 0.2 kg slider moves freely along the fixed curved rod from A to B in the vertical plane under the action of the constant 5 N tension in the cord. The slider is released from rest at A.



5% 1- Draw the free body diagram of the slider for an intermediate position between A and B.

Solution:

5% 2- Determine the work of the weight on the slider for the motion from A to B.

Solution:

10% 2- Determine the velocity of the slider when it reaches B.

Solution:

NAME: **ID No:**

No.5– (20%)

The velocity and acceleration of a particle are given, for a certain instant, by $\mathbf{v} = (6\mathbf{i} - 3\mathbf{j} + 2\mathbf{k})$ m/s and $\mathbf{a} = (3\mathbf{i} - 1\mathbf{j} - 5\mathbf{k})$ m/s^2.

10% 1- Determine the angle between the velocity and the acceleration.

Solution:

5% 2- Determine the magnitude of the tangential acceleration.

Solution:

5% 3- Determine the magnitude of the normal acceleration.

Solution: