King Mongkut's University of Technology Thonburi

Midterm Examination

Semester 1 Academic Year 2017

CVE 232 Engineering Mechanics II — 2nd Year International Program

Date of Examination: Thursday, 28th September, 2017 — Time:13.00-16.00.

Instruction:

1. There are 12 questions. Total score of this exam is 40 marks. Attempt all questions.
2. This exam consists of 8 pages (including this page).
3. **Textbooks and written materials are not allowed** in the examination room.
4. **A calculator is allowed** in the examination room.
5. Write your name and student ID on each page.
6. The answers must be **written in ENGLISH**.

Examiners : Asst.Prof.Dr. ChainarongAthisakul

Tel. 02-470-9143

Student Name:_____ **I.D.Number**_____ **Seat Number**_____

This examination paper has been approved by the Department of Civil Engineering

(Assoc.Prof. Dr. SutatLeelataviwat)
Head of the Civil Engineering Department

Student Name:_____ **I.D. Number**_____**Seat Number**____

1. Write the equation that represents the principle of impulse and momentum. (1 marks)

2. Write the equation that represents the principle of work and energy. (1 marks)

3. A 1200 kg mass starts from rest at t =0. The components of the total force on the mass from t = 0 to t = 10 sec are given by the following equations.

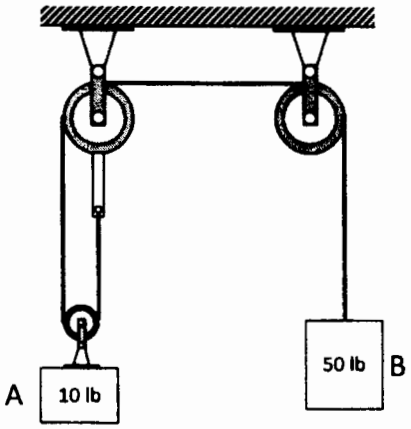
   $\sum F_x = 720t$ N.

   $\sum F_y = 2160 - 360t$ N.

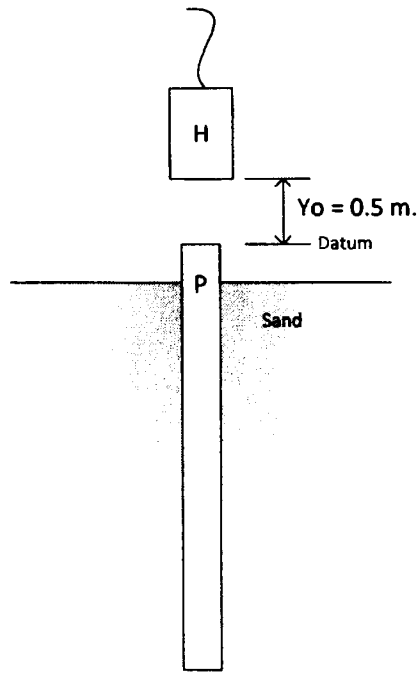
   $\sum F_z = 0$

   Determine the mass's velocity at t = 10 sec. (2 marks)

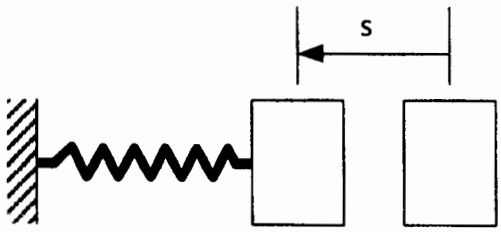
4. Determine the velocity of each block 2 seconds after the blocks are released from rest. Neglect the mass of the pulleys. (5 marks)



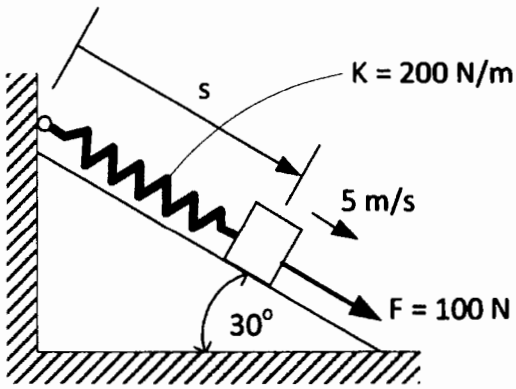
5. A 1000 kg pile P shown in Fig. is driven into the ground using a 500 kg hammer H. The hammer falls from rest at a height y_o=0.5 m and strikes the top of the pile. Determine the impulse which the hammer impacts on the pile if the pile is surrounded entirely by loose sand so that after striking, the hammer does not rebound off the pile. (6 marks)



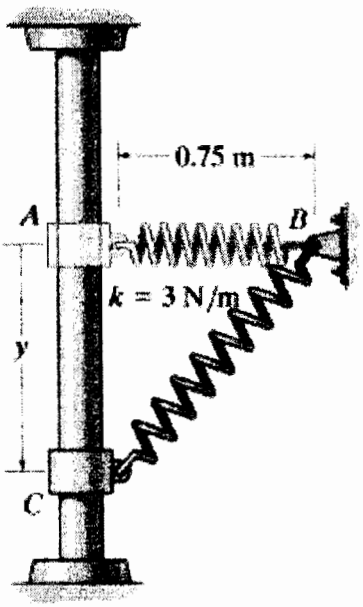
6. A spring force is $F = 5s^2$ N/m. The spring is compressed by s = 0.5 m as shown in Fig. Determine the work done on a particle attached to the spring. (2 marks)



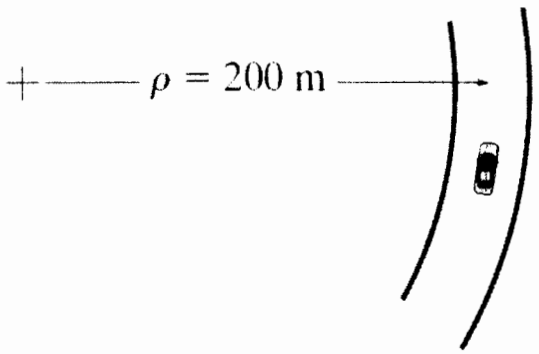
7. When s =0.5 m, the spring is unstretched and the 8 kg block has a speed of 5 m/s down the smooth plane. Determine the distance s when the block stops. (4 marks)



8. A smooth 3-kg collar, shown in Fig., fits loosely on the vertical shaft. If the spring is unstretched when the collar is in the position A, determine the speed at which the collar is moving when y = 1 m, if it is released at A with an upward velocity $v_A = 2$ m/s. (3 marks)

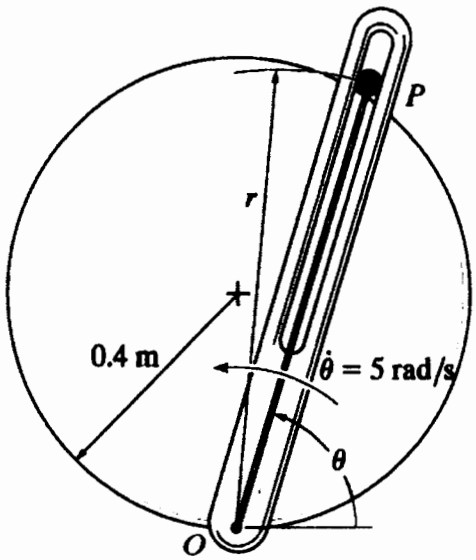


9. Determine the minimum coefficient of static friction between the tires and the road surface so that the 1.5 Mg car does not slide as it travels at 100 km/h on the curved road. Neglect the size of the car. (3 marks)



10. The smooth particle has a mass of 80 g. It is attached to an elastic cord extending from O to P and due to the slotted arm guide moves along the *horizontal* circular path $r = (0.8\sin\theta)$ m. If the cord has a stiffness k = 30 N/m and an unstretched length of 0.25 m, determine the force of the guide on the particle when θ = 60°. The guide has an angular velocity $\dot{\theta}$ = 5 rad/s and an angular acceleration $\ddot{\theta} = 3$ rad/s^2. (6 marks)

Given: $v_r = \dot{r},\ v_\theta = r\dot{\theta},\ a_r = \ddot{r} - r\dot{\theta}^2,\ a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta}, \sum F_r = ma_r, \sum F_\theta = ma_\theta$



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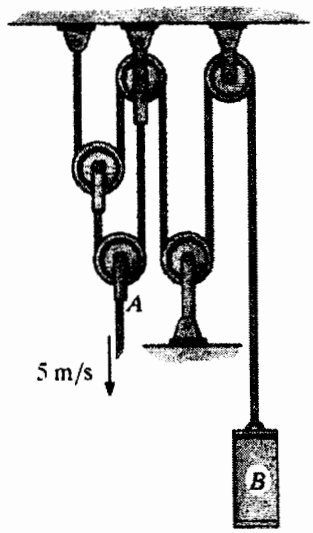
11. If end A of the rope moves downward with a speed of 5 m/s, determine the speed of cylinder B. (3 marks)



12. The acceleration of the train during the interval of time from t = 2 sec to t = 4 sec is $a = 2t$ m/s^2, and at t = 2 sec its velocity is $v = 180$ km/hr. What is the train's velocity at t = 4 sec, and what is its displacement from t = 2 sec to t = 4 sec. (4 marks)