NATIONAL EXAMINATION - MAY 2013

- STATICS AND DYNAMICS -

(04-BS-3)

3 HOURS' DURATION

Notes:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer-paper a clear statement of any assumption made.

2. This is a **"CLOSED BOOK"** examination. However, candidates may bring **ONE 8½"×11" sheet** of self-prepared notes. Candidates may use one of two calculators, the **Casio** or **Sharp** approved models.

3. Squared paper will be provided, on request of the candidate, as an aid in the conducting of graphical solutions, if that is the method of solution preferred.

4. Candidates are required to complete **2 questions from PART A** and **2 questions from PART B**.

5. If more than four questions are presented for assessment then only the **first four undeleted solutions encountered will be marked**.

6. All questions are of equal value.

7. **Hand in examination question paper and self-prepared note sheet (formula sheet) with solution booklet.**

PART A - STATICS
(ANSWER ANY 2 0F THE 3 QUESTIONS)

I. (20 Marks)

Determine the force in each member of the truss shown and state whether each member is in tension or compression.
NOTE: Each grid division represents a distance of one metre.

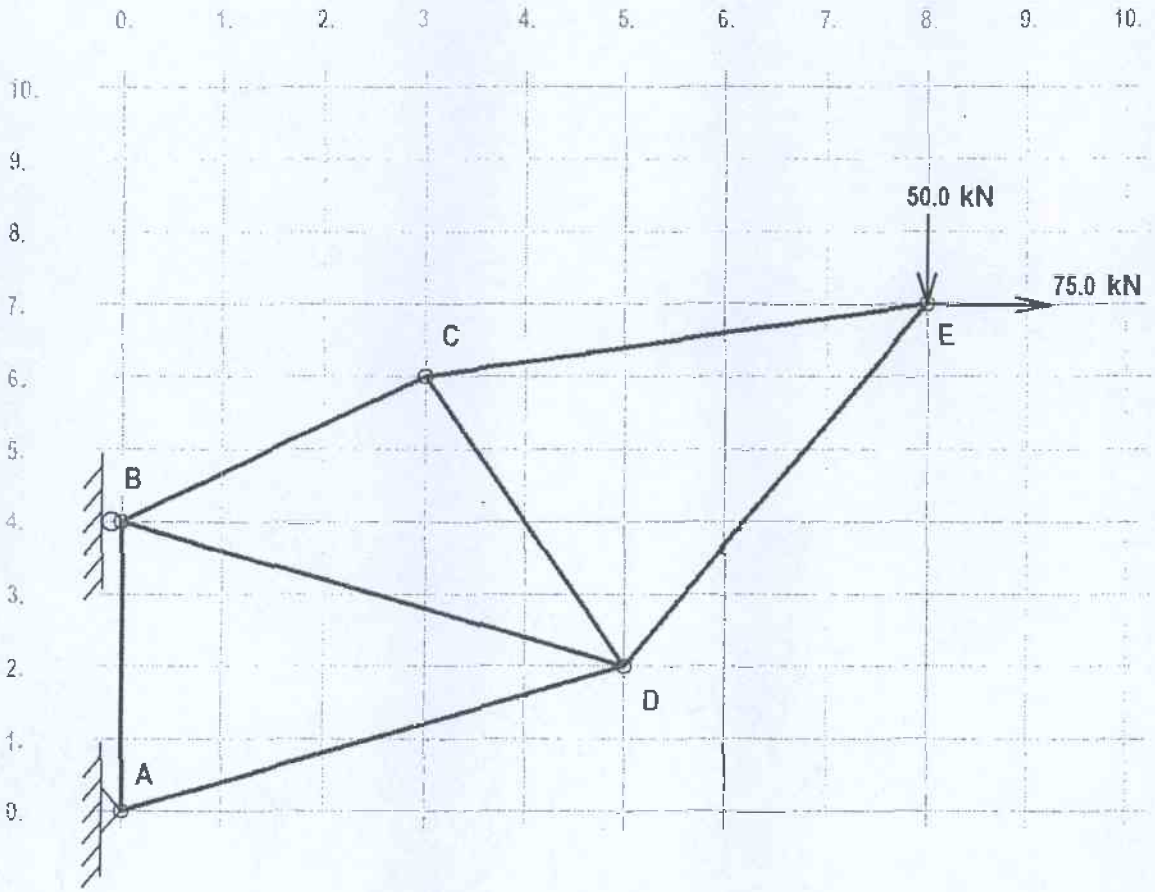

FIGURE 1.

II. (20 Marks)

The weight of the bucket and its contents is 50 lb_f. **Using cartesian vector methods,** determine the forces in the supporting cables AD, BD and CD.

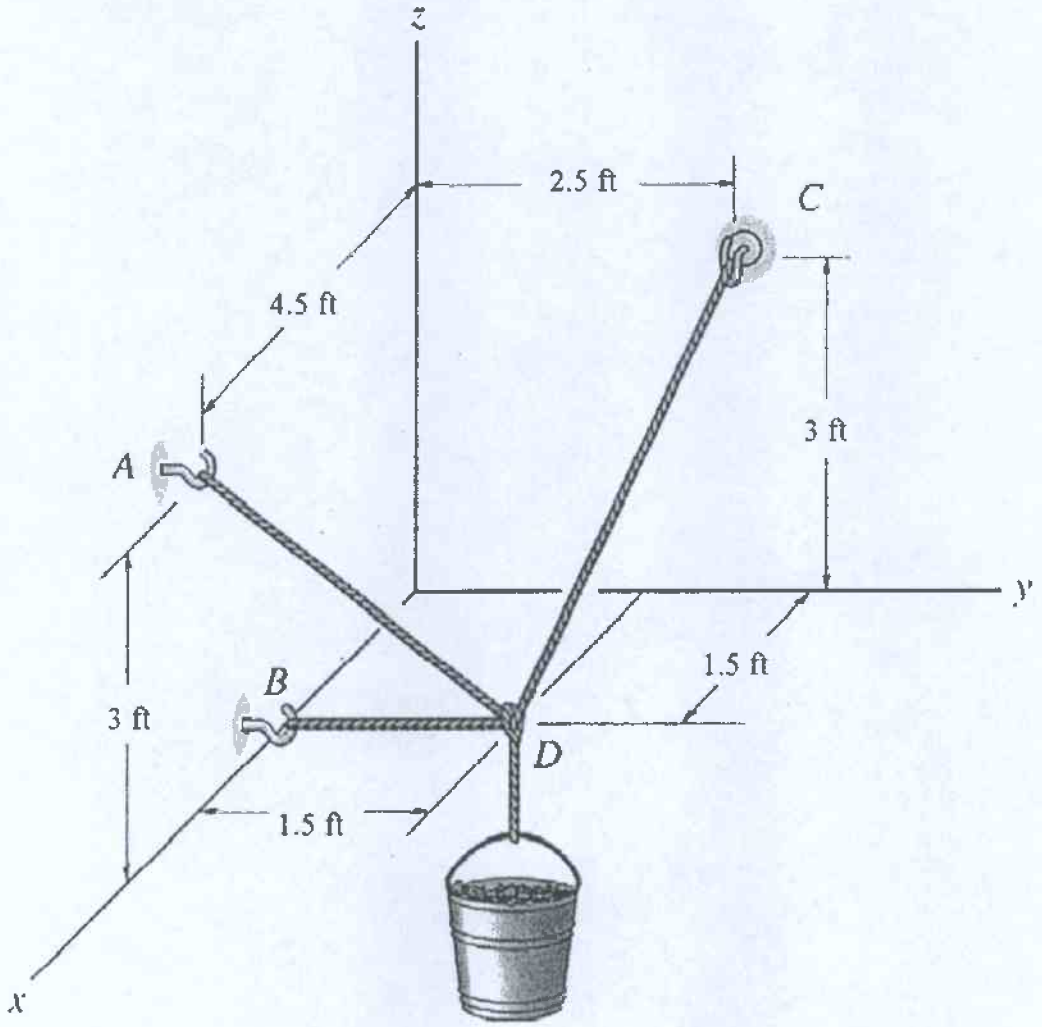

FIGURE 2

III. (20 Marks)

Block A has a mass of 60 kg and rests on surface B for which $\mu_s = 0.25$. If the coefficient of static friction between the cord and the fixed rod at C is $\mu_s' = 0.30$, determine the largest mass of the suspended cylinder D so that block A does not move.

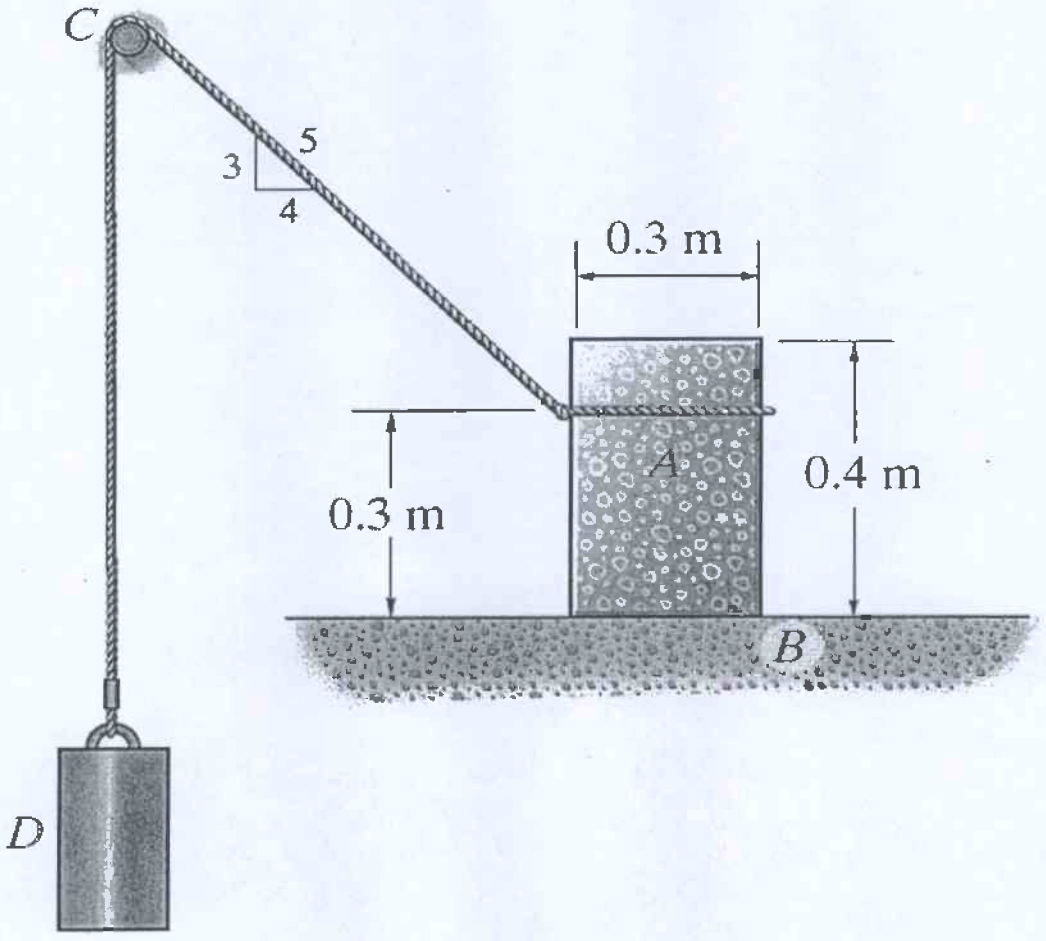

FIGURE 3

PART B - DYNAMICS
(ANSWER ANY 2 0F THE 3 QUESTIONS)

IV. (20 Marks)

If the slider block *A* is moving to the right at $v_A = 2.4$ m/s, determine the velocity of blocks *B* and *C* at the instant shown. Member *CD* is pin connected to member *ADB*.

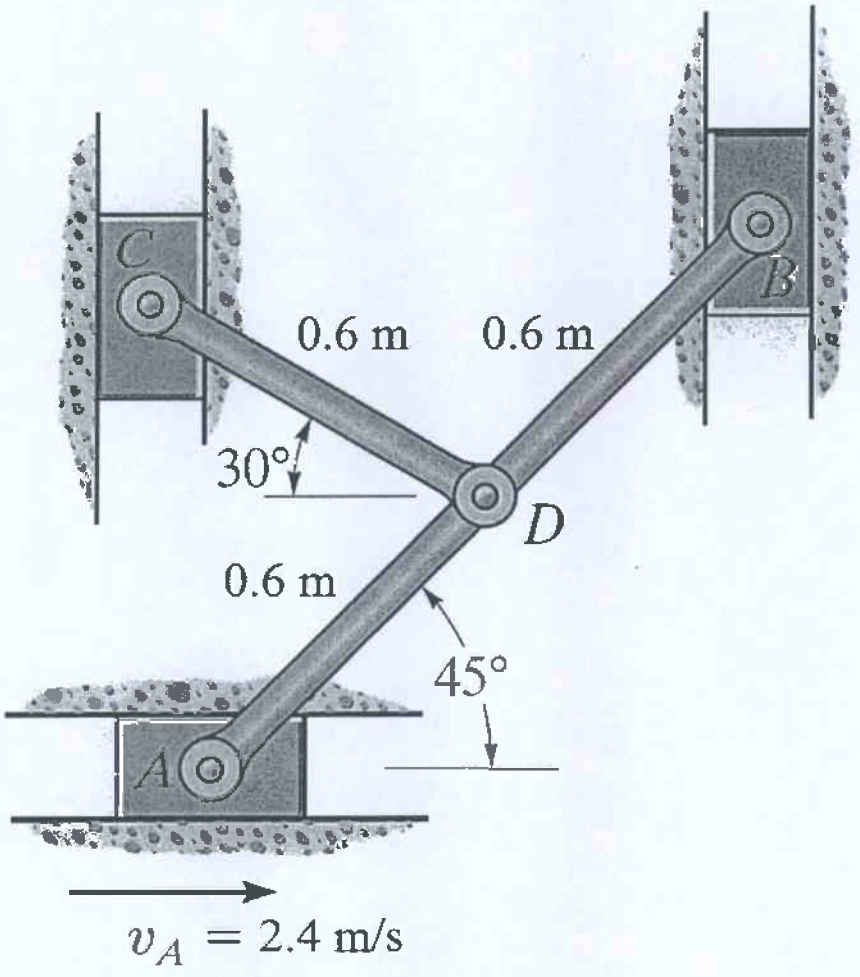

FIGURE 4.

V. (20 marks)

Steel balls which have a mass of 2 kg are released from rest as shown in the figure and strike a 45° smooth inclined surface. If the coefficient of restitution between the ball and the inclined surface is $e = 0.8$, determine;

a) the distance s where the ball strikes the horizontal plane at A.

b) the velocity at which the ball strikes point A.

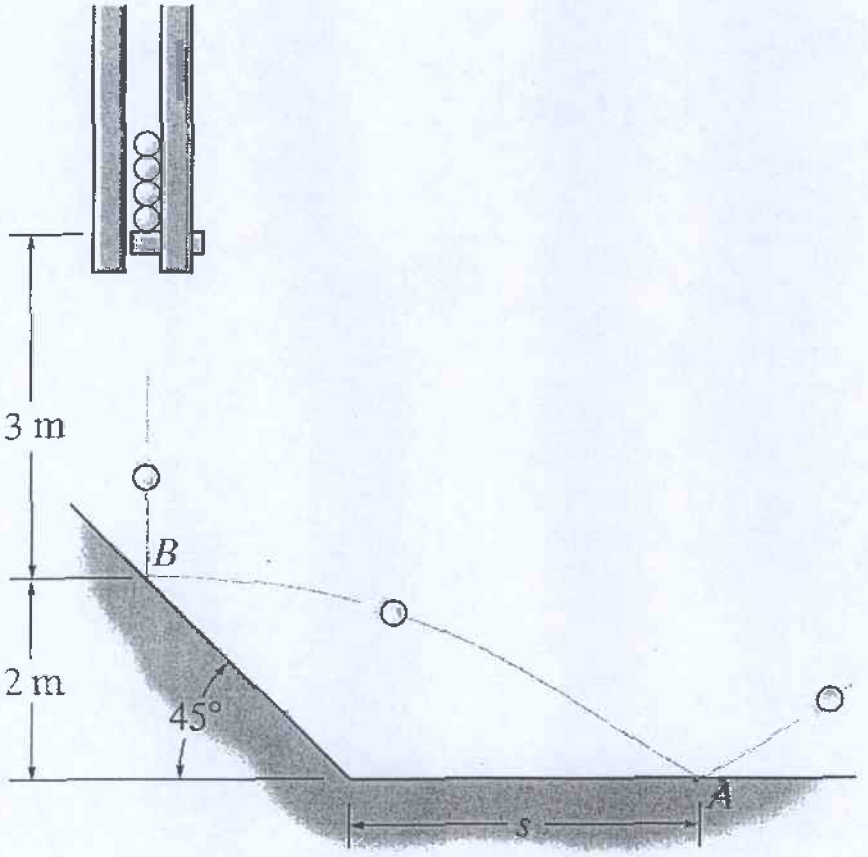

FIGURE 5.

VI. (20 marks)

When the car reaches point *A*, it has a speed of 25 ft/s. If the brakes are applied, its speed is reduced by $a_t = (0.001s - 1)$ ft/s^2. Determine the magnitude of the car's acceleration when it reaches point *C*.

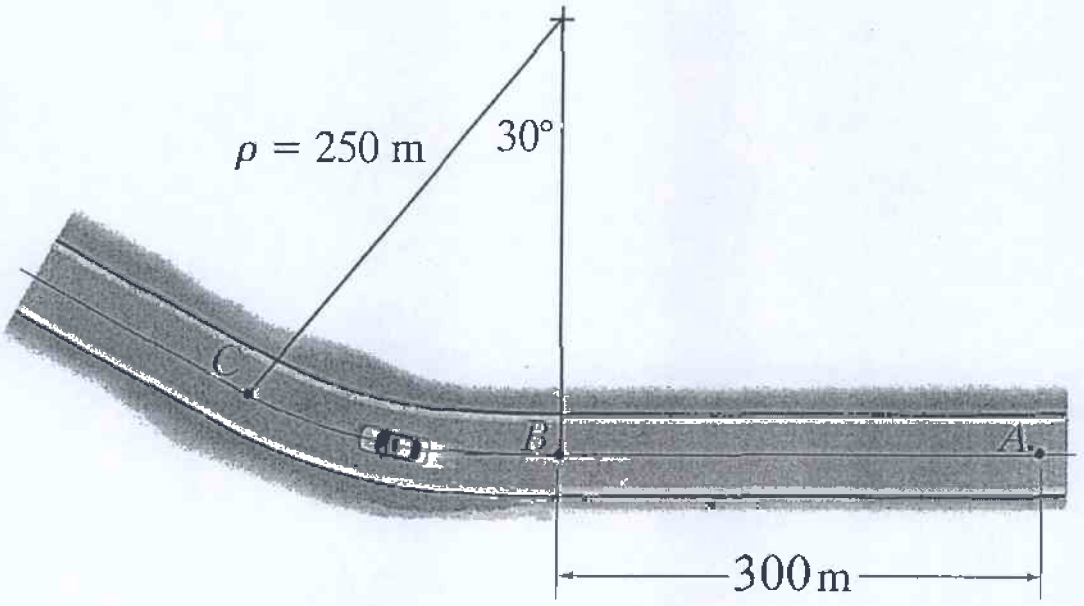

FIGURE 6.