NATIONAL EXAMINATION - MAY 2015

- 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.

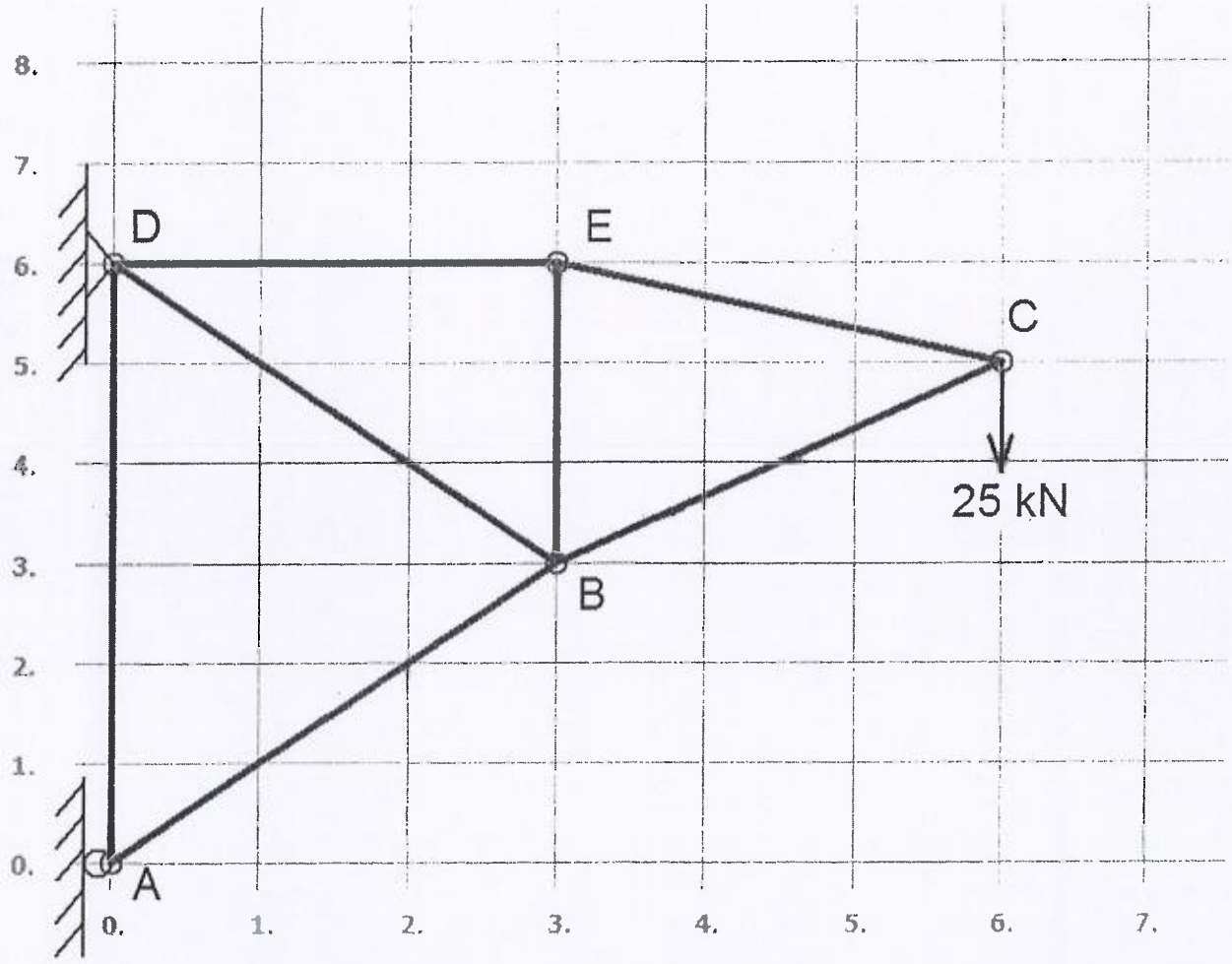

FIGURE 1.

II. (20 Marks)

The boom ***AB*** is held in equilibrium by a ball and socket joint *A* and a pulley and cable system. Using ***Cartesian Vector Methods***, determine the x, y, z components of the reaction at *A* and the tension in the cable ***DEC***.

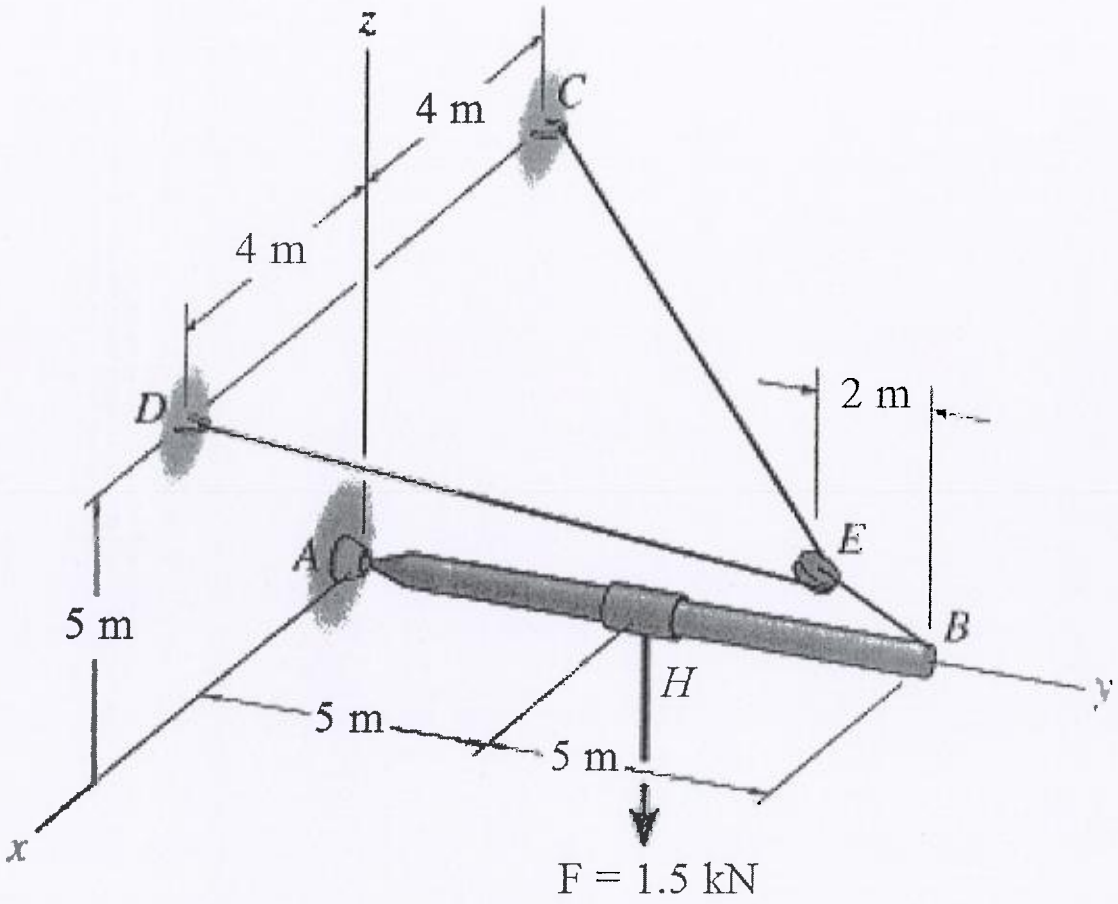

FIGURE 2

III. (20 MARKS)

Blocks ***A*** and ***B*** weigh 11.25 N and 6.75 N, respectively. Using the coefficients of static friction indicated, determine the greatest weight of block ***D*** which will not cause motion. Do not neglect the friction of the rope which contacts the stationary pulley at ***E*** at a contact angle of 90 degrees.

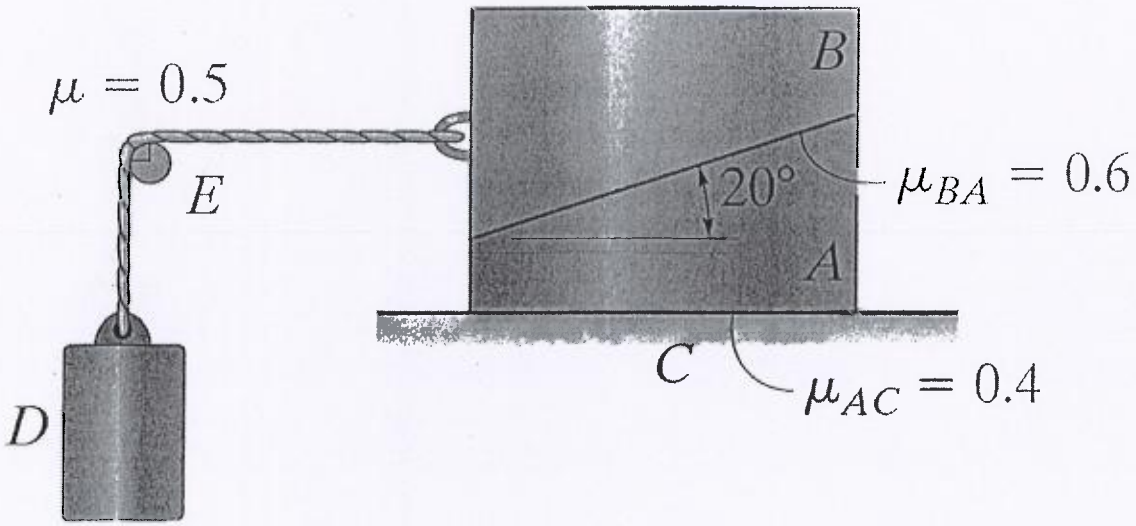

FIGURE 3.

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

IV. (20 Marks)

If the slider block ***A*** is moving to the right at $v_A = 8$ m/s, determine the velocity of blocks ***B*** and ***C*** at the instant shown. Member ***CD*** is pin connected to member ***ADB***.

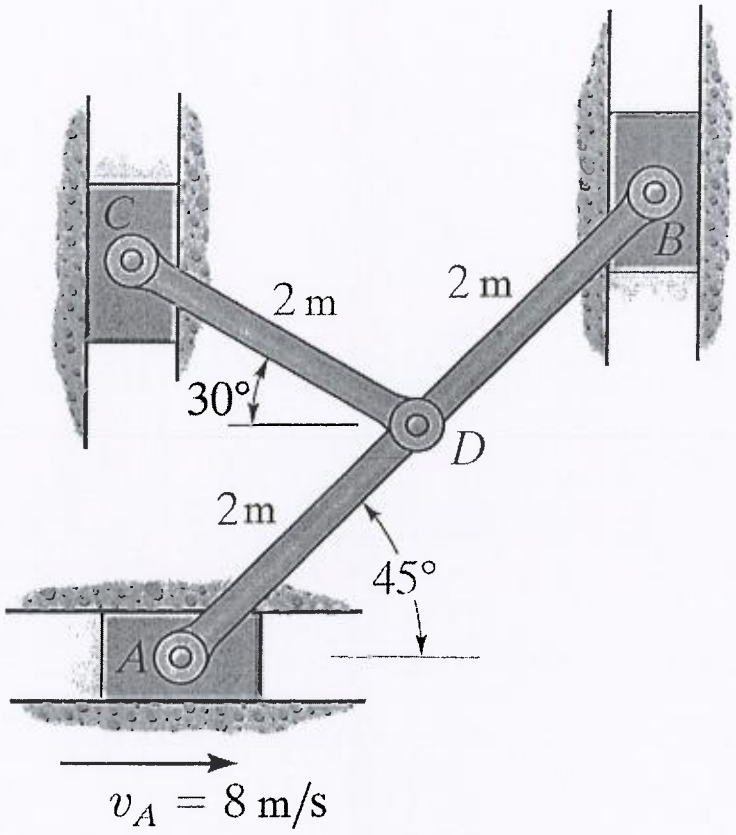

FIGURE 4.

V. (20 marks)

Disks *A* and *B* have a mass of 6 kg and 4 kg, respectively. They are sliding on the smooth horizontal plane with the velocities shown. The coefficient of restitution between the disks is e = 0.6.

a) Determine their velocities just after impact.

b) Clearly indicate their final velocities (magnitudes and directions) on a diagram.

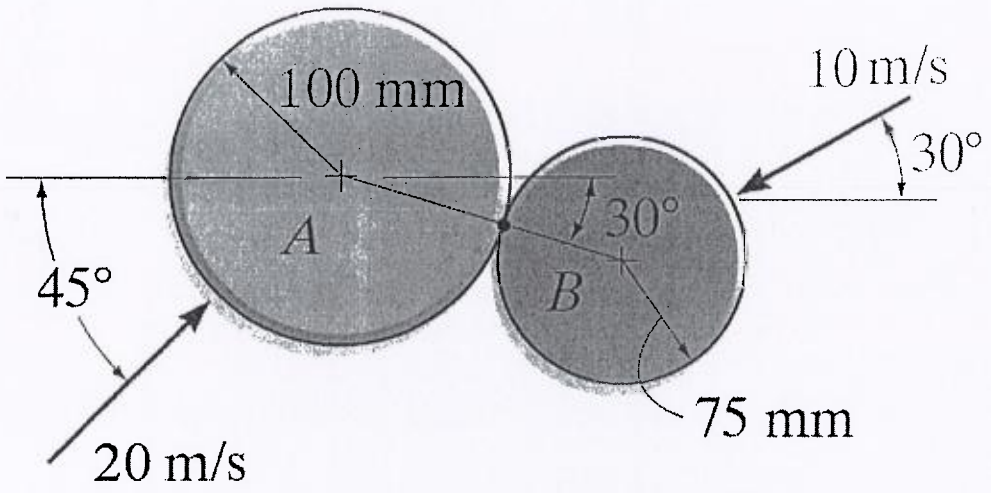

FIGURE 5.

VI. (20 marks)

A uniform disk has a radius of 0.75 feet and weighs 15 lb_f. The disk is pinned at its centre ***O*** and supports block ***A*** that has a weight of 3 lb_f. The cable which is connected to the spring does not slip when contacting the disk. The spring has a spring constant of 80 lb_f/ft. Determine the natural frequency and period of vibration for the system.

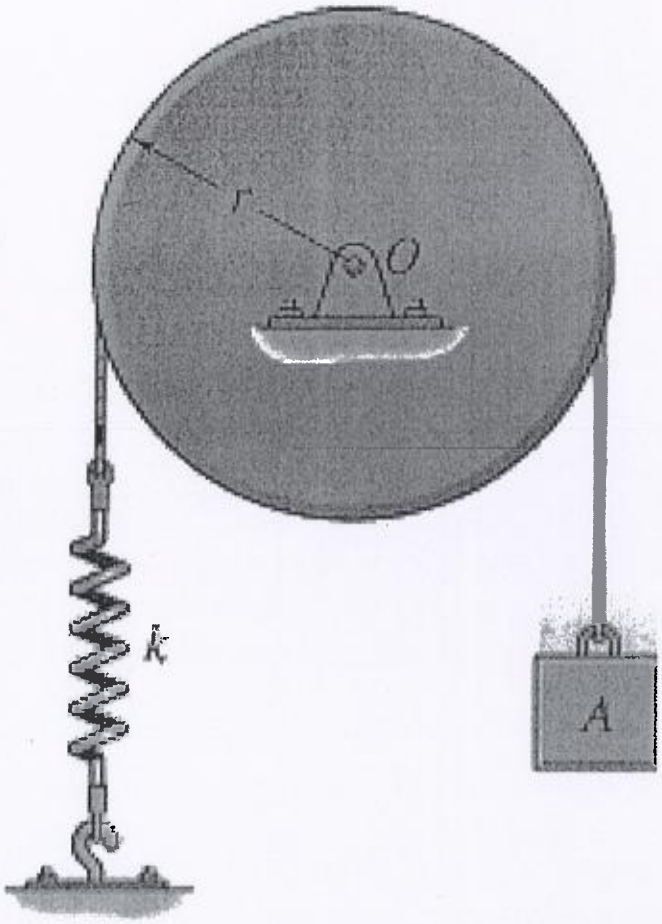

FIGURE 6.