NATIONAL EXAMINATION - DECEMBER 2008

- 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 a **Sharp** approved models. The aid sheet must be submitted with the written exam paper.

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.

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

I. (20 Marks)
Using the method of joints determine magnitude of the force in each of the members for the simple truss shown in figure 1. For each, state if the member is in tension or compression.

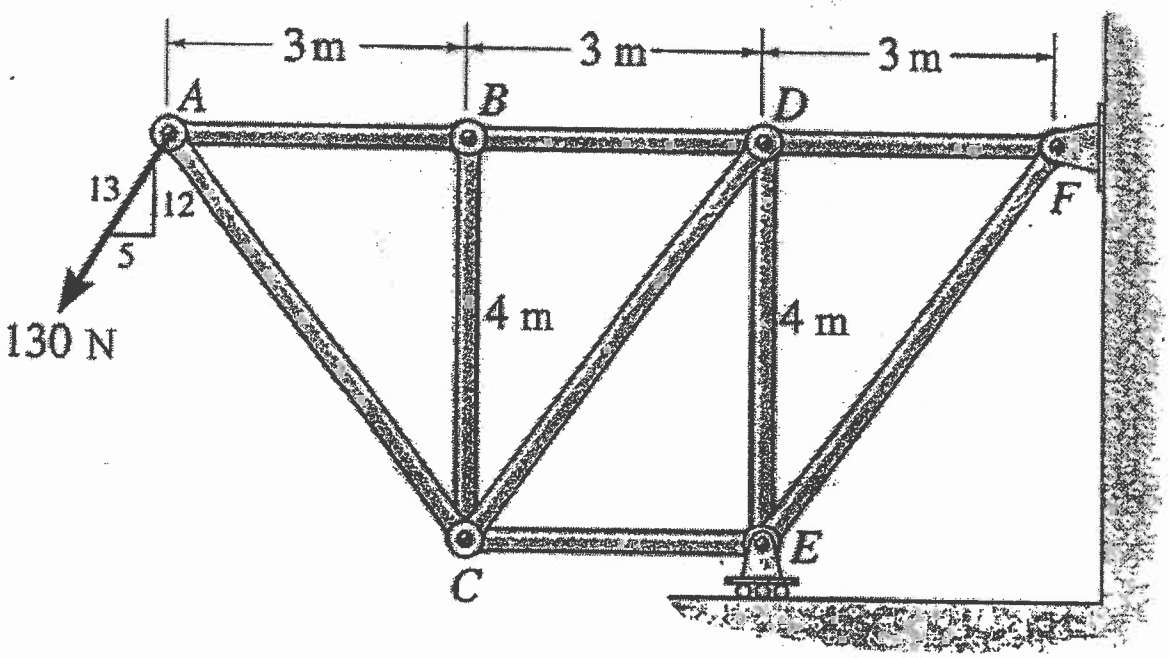

FIGURE 1.

II. (20 Marks)

Two blocks ***A*** and ***B***, each having a mass of 6 kg, are connected by links ***AC*** and ***CB***. The static coefficient of friction is $\mu_s = 0.5$ between the blocks and the contacting surfaces. Determine:

a) the largest force ***P*** which can be applied at point ***C without*** causing the blocks to move.

b) which block would slip first.

Note that ***P*** acts vertically downward and that the weight of the links may be neglected.

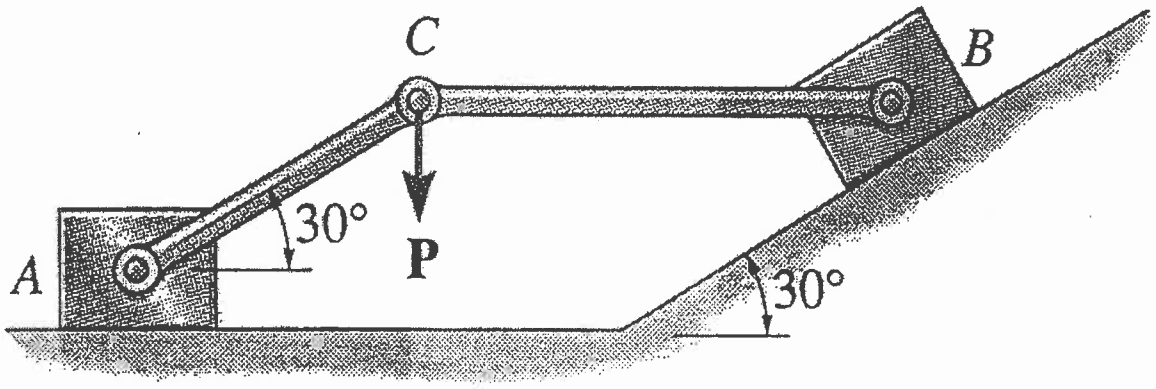

FIGURE 2.

III. **PART A** (10 MARKS) **NOTE: THIS QUESTION HAS TWO PARTS A & B**

Determine the x and y co-ordinates for the centroid of the shaded area shown in figure 3A.

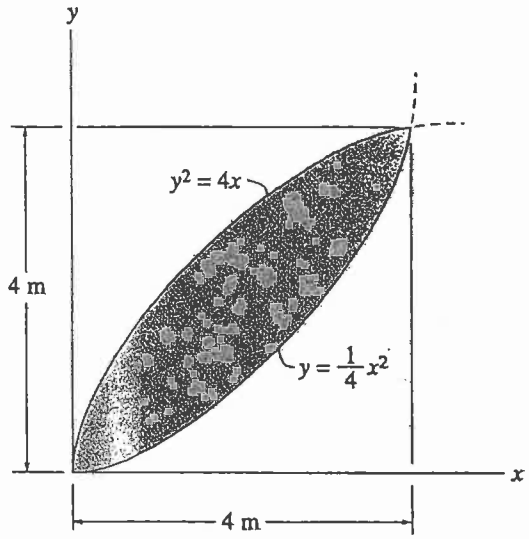

FIGURE 3A.

III. **PART B** (10 MARKS)

Determine the radius of gyration k_y about the y-axis for the parabolic area shown in figure 3B.

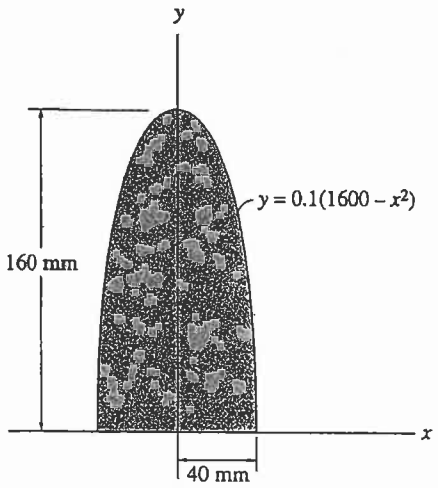

FIGURE 3B.

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

IV. (20 Marks)

A bullet with a mass of 2 grams is shot into a wooden block of mass 4 kg. The bullet becomes embedded in the block. Originally the block is at rest and $\theta = 0°$, when the bullet impacts the block the block swings upward and the angle θ reaches a maximum of 6 degrees. Determine the initial horizontal velocity of the bullet.

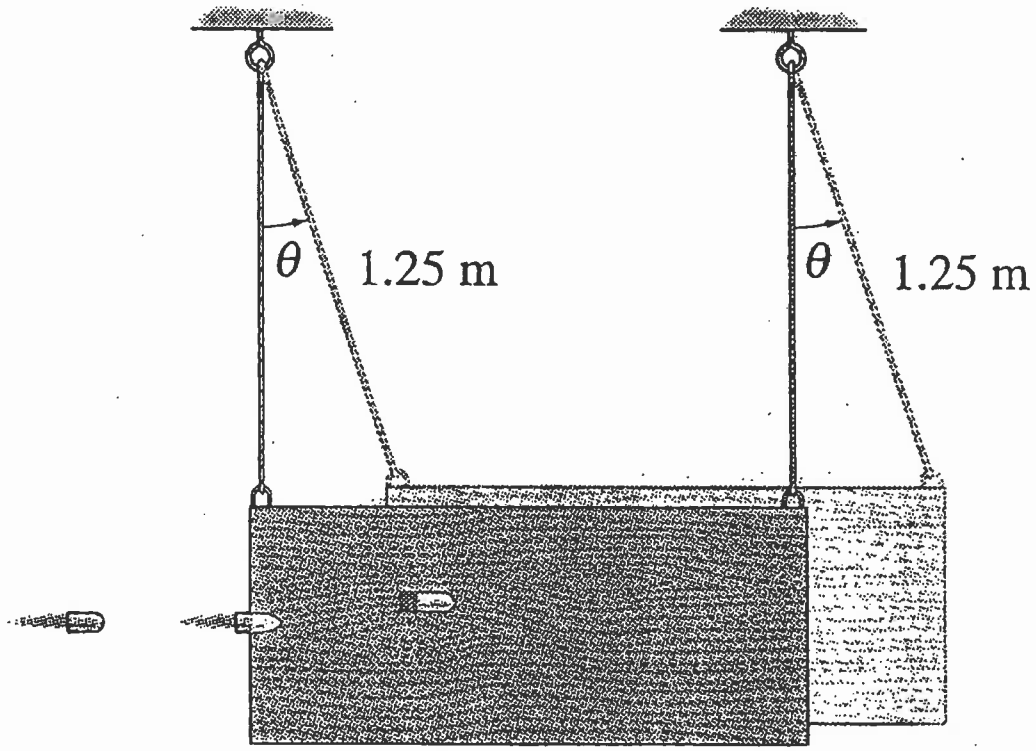

FIGURE 4.

V. (20 Marks)

A homogeneous disk ***A*** has a mass of 10 kg and is connected to a uniform rod ***AB*** which has a mass of 5 kg. If the assembly is released from rest at the position shown in the figure ($\theta = 60°$), determine the angular velocity of the rod when $\theta = 0°$.
Note: Assume the disk rolls without slipping. Also neglect the mass of the collar at ***B*** and any friction between the collar and the guide rod.
The moment of inertia about the centroid of a slender rod: $I = \frac{1}{12} m l^2$

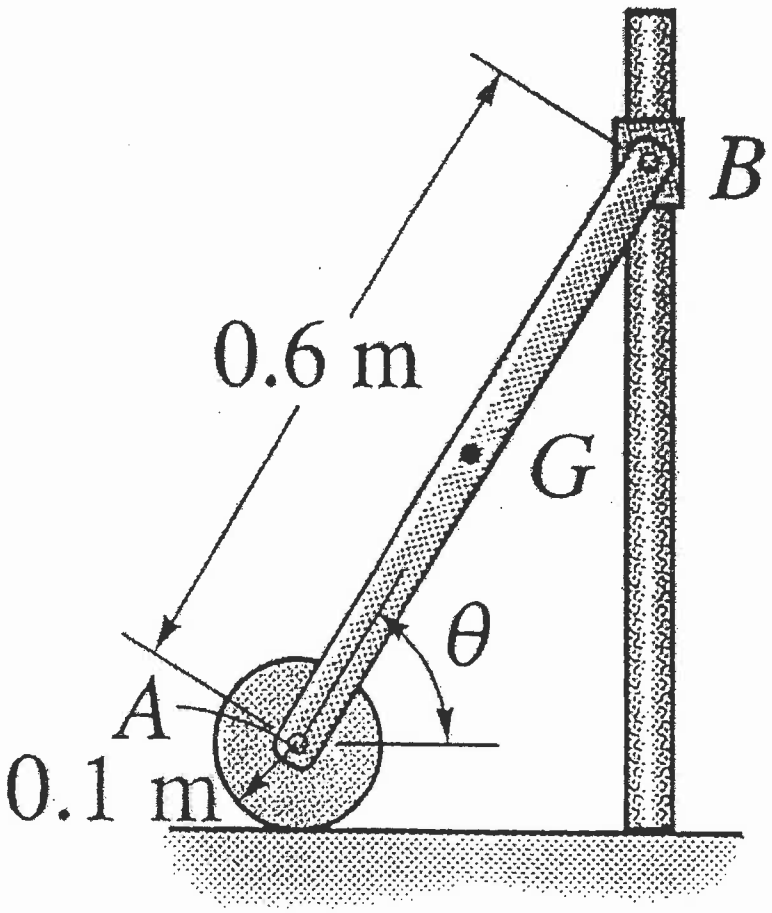

FIGURE 5.

VI. (20 Marks)

A ball which has a mass of 2 kg and negligible size has an initial velocity of 10 m/s at point ***A***, in the figure shown. If the inclined surface from ***A*** to ***B*** has negligible friction, determine;

a) the horizontal distance ***d***, that is the distance from point ***C*** to ***D***, where the ball hits the horizontal surface.

b) the velocity at which the ball strikes the surface at point ***D***.

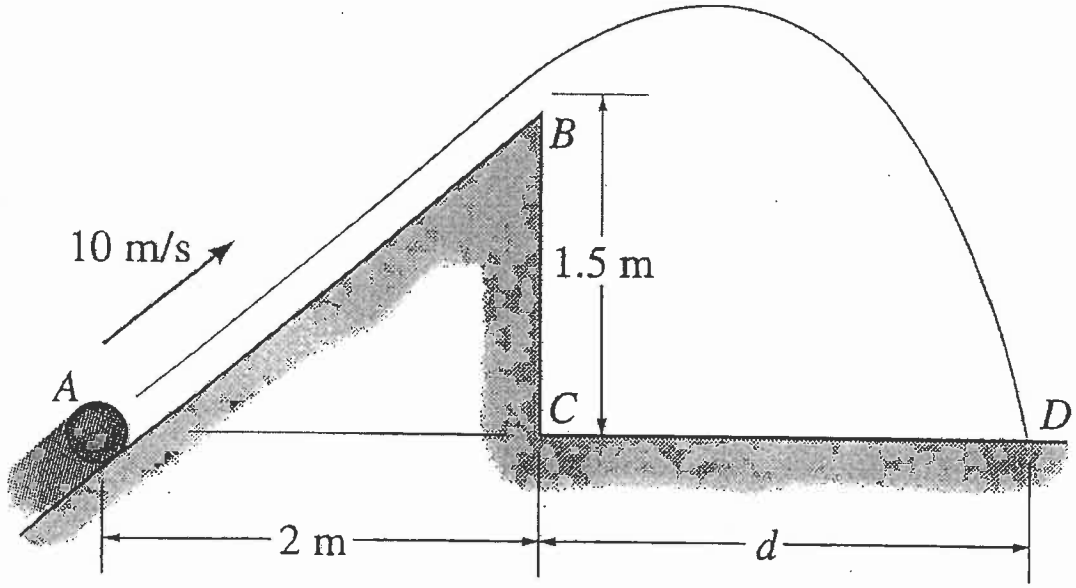

FIGURE 6.