NATIONAL EXAMINATION - MAY 2012

- 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.

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

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

5. All questions are of equal value.

6. **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.

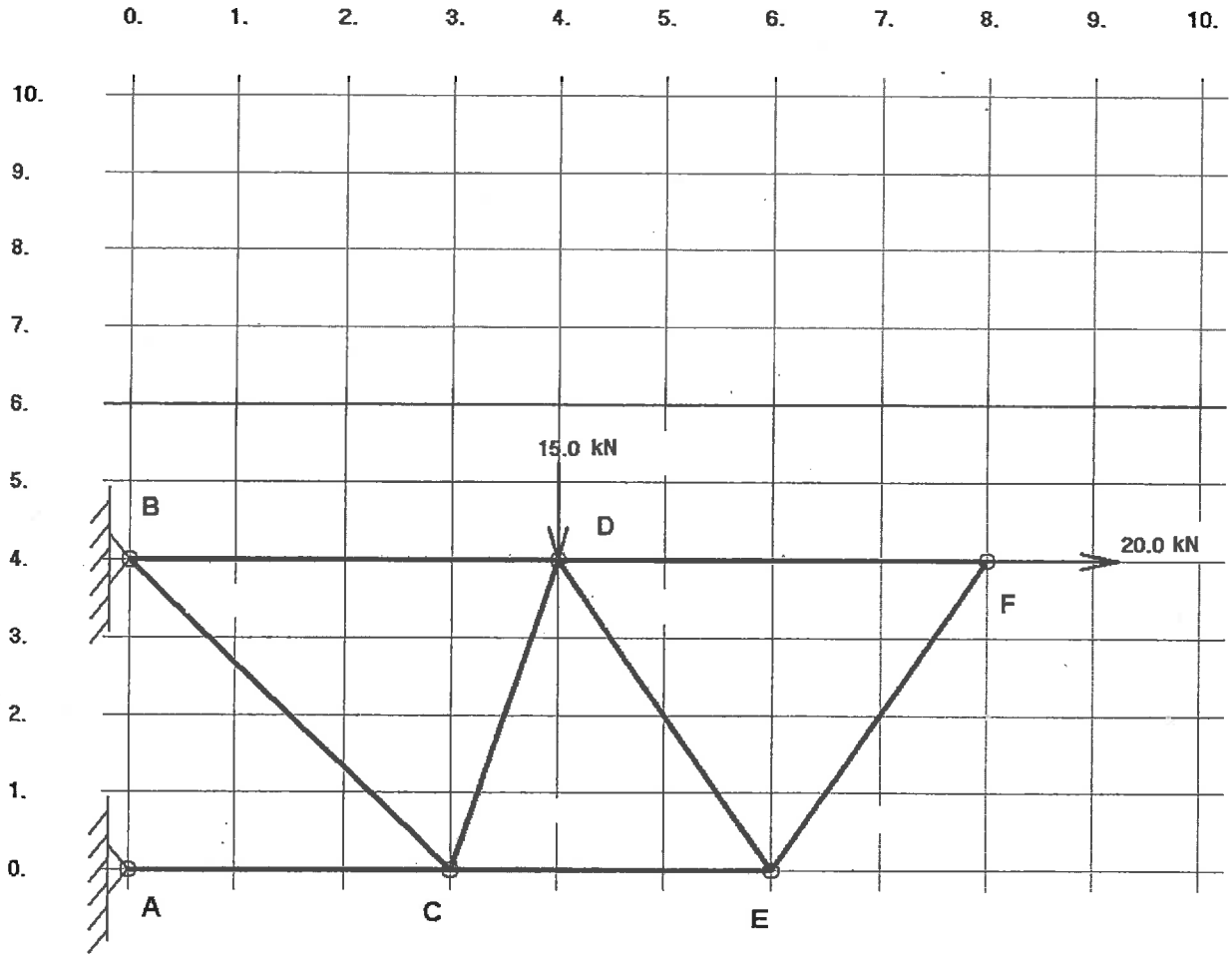

FIGURE 1.

II. (20 Marks Total)

The rod assembly shown is used to support a cylinder which weighs 350 lb_f, as shown in the figure. Using ***cartesian vector methods***, determine the components of the reaction at the ball and socket joint ***A***, the smooth journal bearing ***E***, and the force developed along rod ***CD***. The connections at ***C*** and ***D*** are ball and socket joints. Assume the journal bearing at ***E*** to be frictionless.

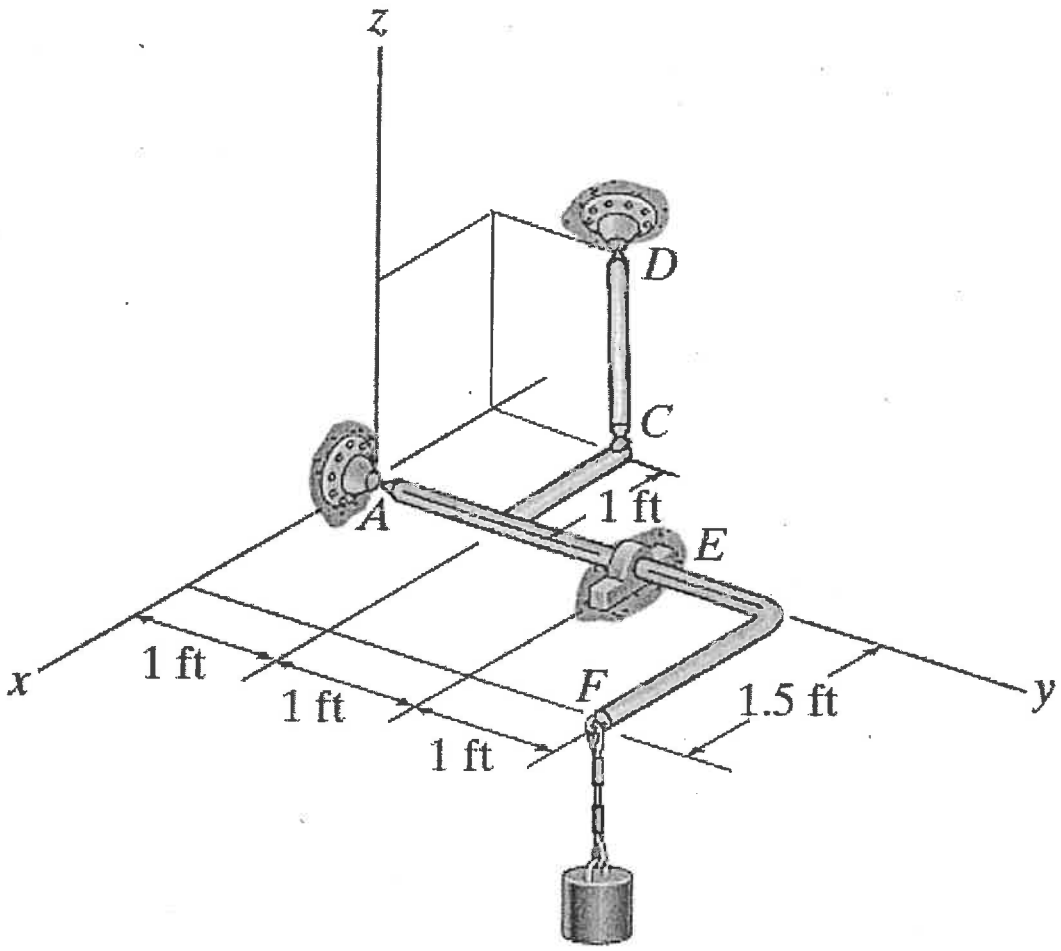

FIGURE 2

III. (20 Marks)

In figure 3 below, block A weighs 25 N and block B weighs 18 N. The coefficient of static friction for all surfaces is $\mu_s = 0.11$. Determine;

a) the value of the force P required for impending motion of block B upward, and
b) the value of the force P required for impending motion of block B downward.

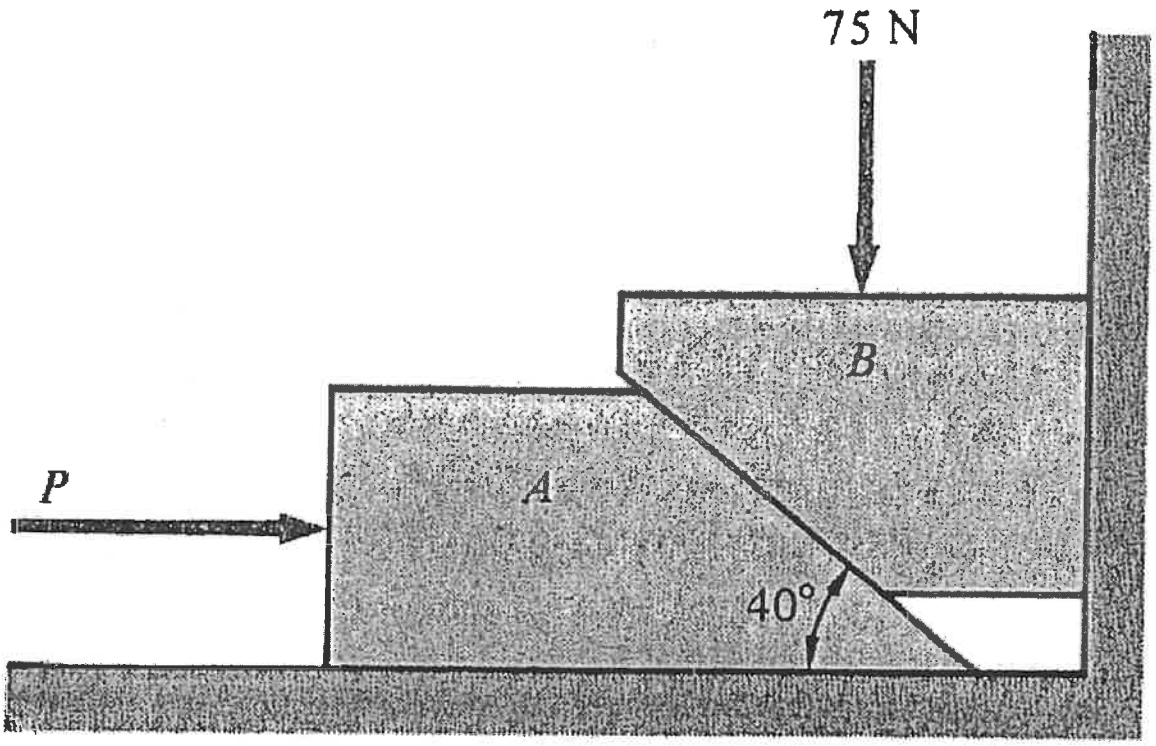

FIGURE 3.

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

IV. (20 Marks)

The 30 kg pendulum has its mass center at G and a radius of gyration about point G of k_G = 300 mm . If it is released from rest when $\theta = 0$ degrees, determine its angular velocity at the instant $\theta = 90$ degrees. Spring AB has a stiffness of $k = 400$ N/m and is unstretched when $\theta = 0$ degrees.

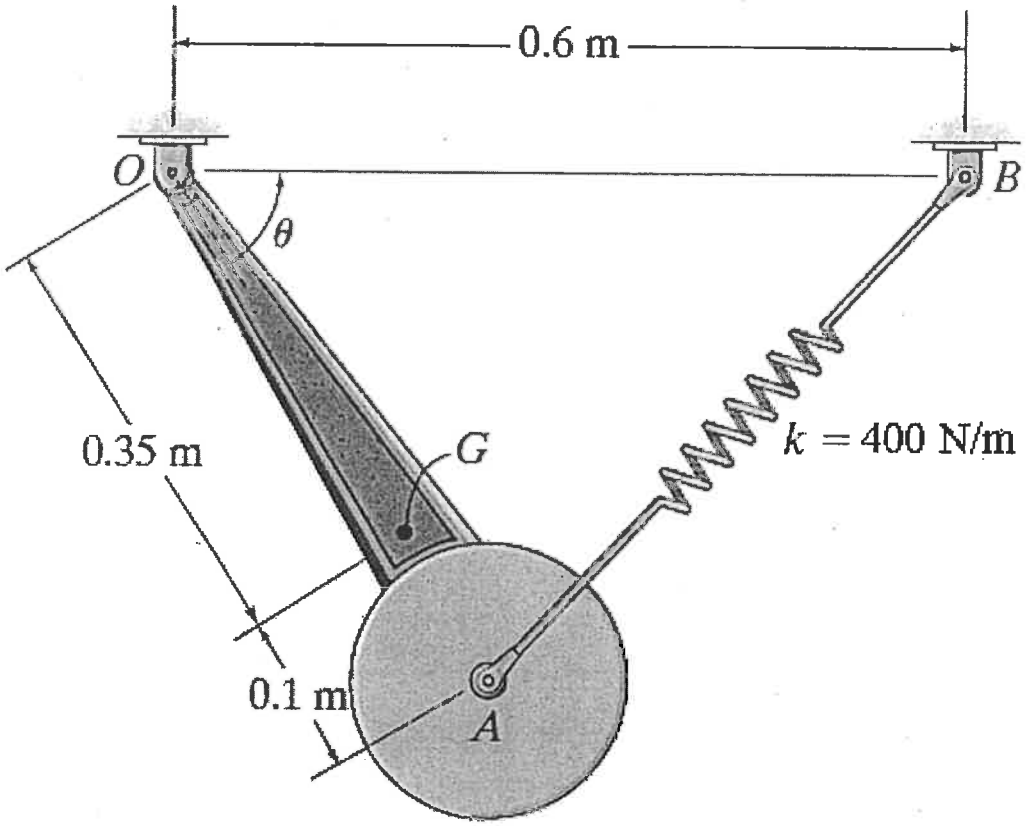

FIGURE 4.

V. (20 marks)

Spheres ***A*** and ***B*** have a mass of 15 kg and 10 kg, respectively. The two spheres approach each other with constant velocity along rectilinear paths, as shown in th the figure. Determine the magnitudes and directions of the velocities of the two spheres just after impact. The coefficient of restitution is assumed to be $e = 0.8$.

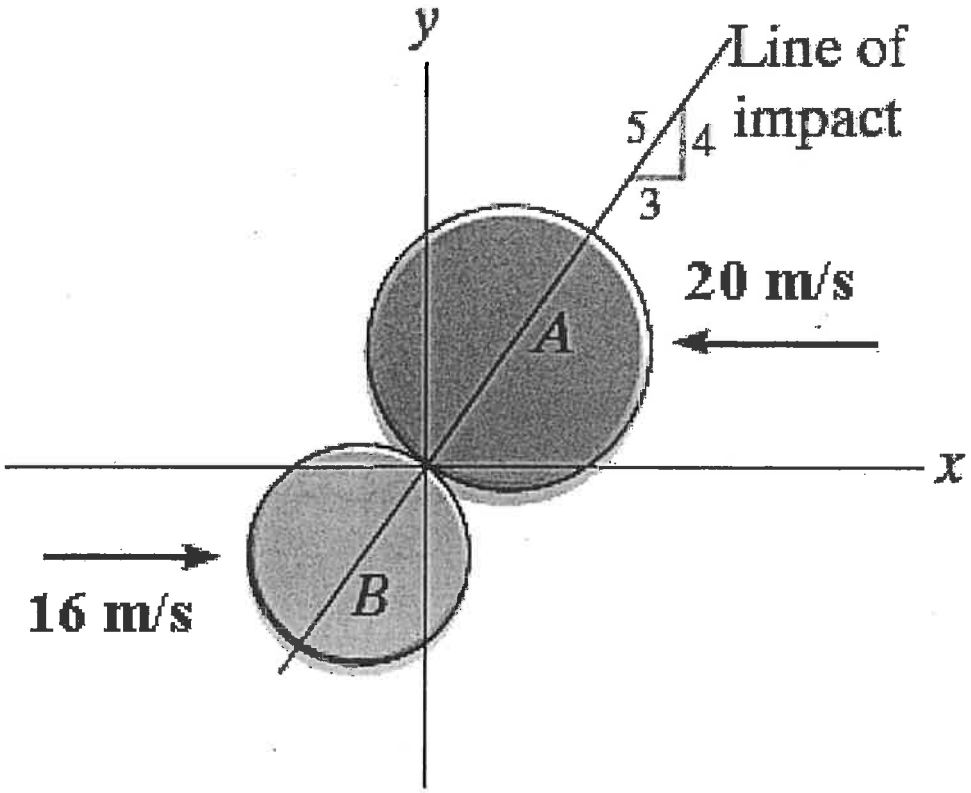

FIGURE 5.

VI. (20 marks)

At the instant shown car ***A*** is travelling with a velocity of 35 m/s and has an acceleration of 2 m/s ^{2} along the highway. At the same instant ***B*** is travelling on the curved on ramp in the direction shown with a speed 20 m/s , which is increasing at a rate of 0.8 m/s ^{2}. Determine the relative velocity and relative acceleration of vehicle ***B*** with respect to vehicle ***A*** at this instant.

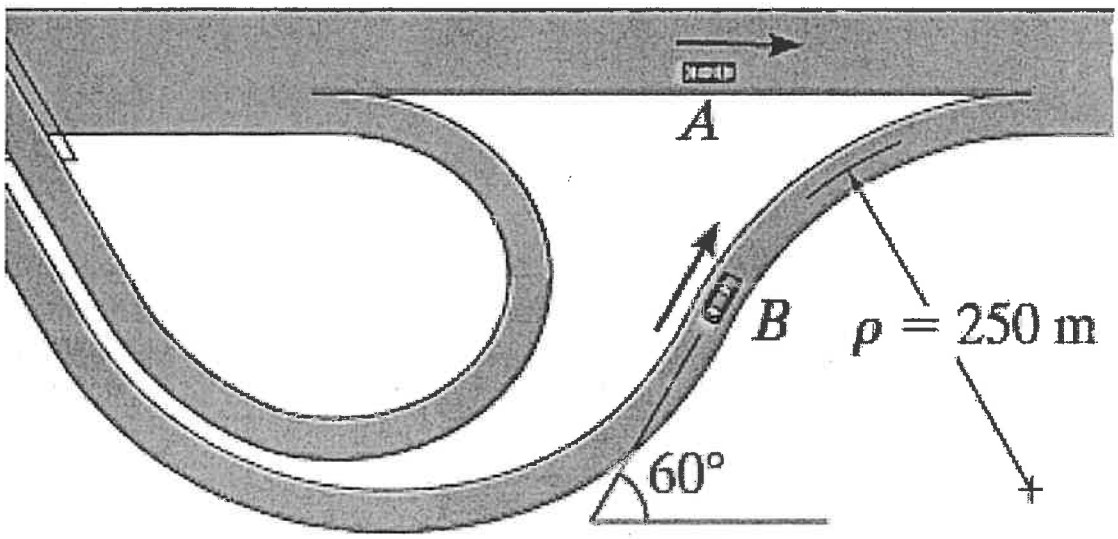

FIGURE 6.