NATIONAL EXAMINATION - MAY 2019

04-BS-3 STATICS AND DYNAMICS

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 is provided 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. **The 8½"×11" sheet of self-prepared notes MUST be submitted along with the examination paper and the answer booklet.**

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

I. The pipe assembly supports a 300 kN load at ***D***, as shown in figure 1. A pin at ***A*** and a cable ***BC*** supports the pipe assembly. Using ***cartesian vector methods***, determine the ***x, y, z*** components of reaction forces and moments at the pin ***A*** and the tension in cable ***BC***.

NOTE: Neglect the weight of the pipe assembly.

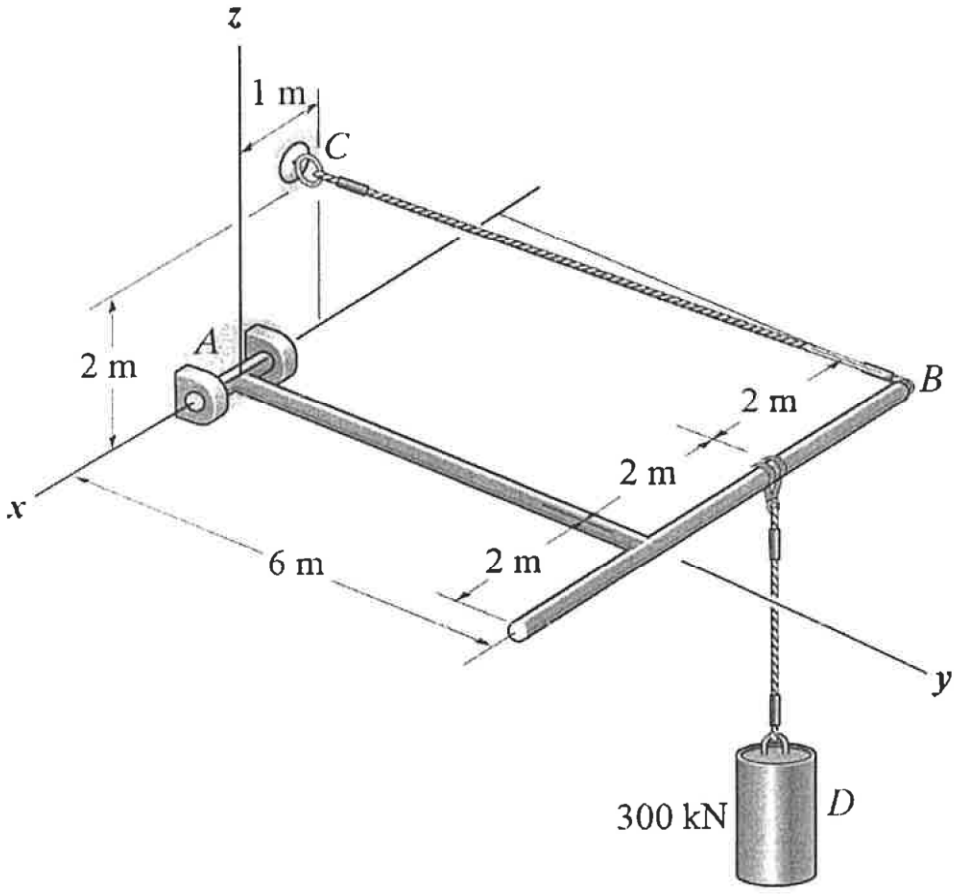

FIGURE 1.

II Determine the magnitude and sense of the forces in all of the members for the structure shown in figure 2.

NOTE: Each division on the grid shown represents 1 metre.

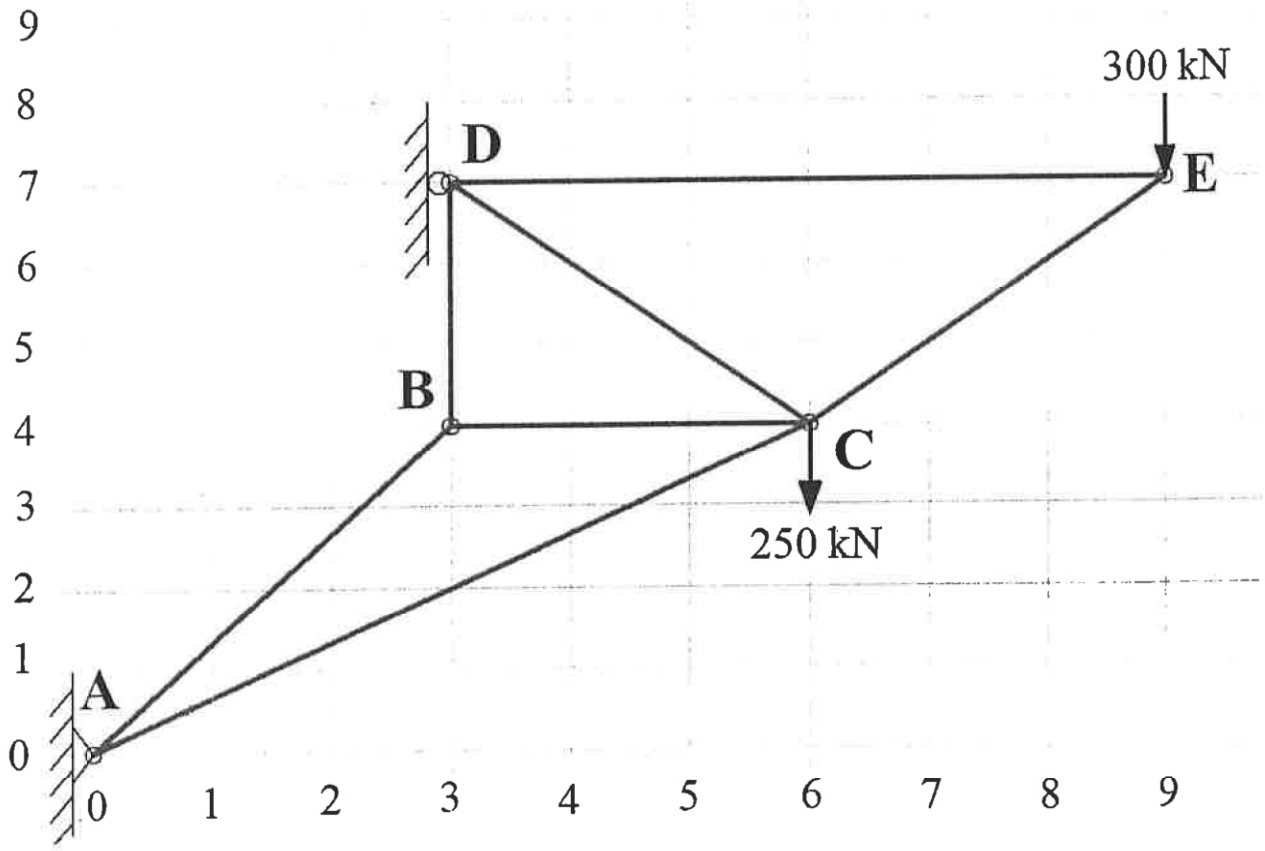

FIGURE 2.

III. Block A has a weight of 100 N and rests on a surface for which $\mu_s = 0.25$. If the coefficient of static friction between the cord and the fixed peg at C is $\mu_s = 0.3$, determine the greatest weight of the suspended cylinder B that will not cause motion. Clearly state all initial assumptions and verify their validity.

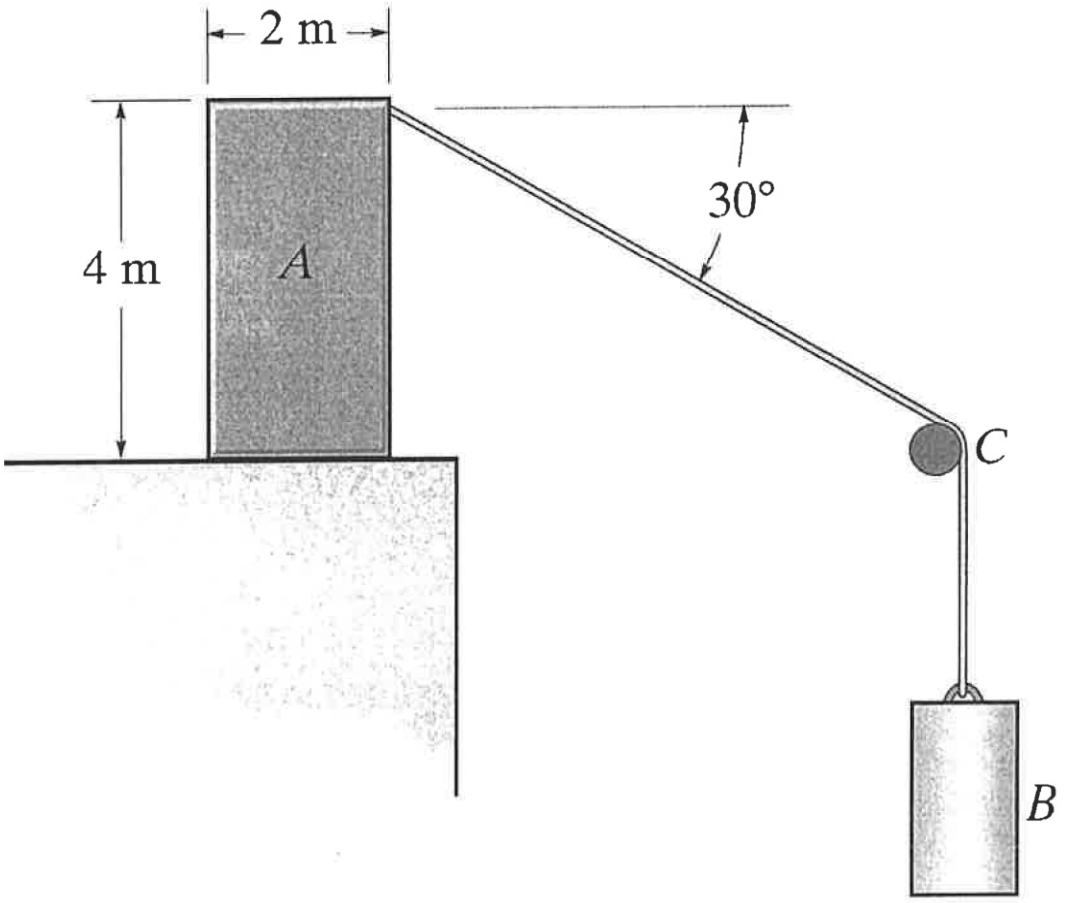

FIGURE 3.

PART B - DYNAMICS

(ANSWER ANY 2 0F THE 3 QUESTIONS)

IV. The pendulum in figure 4 has a total mass of 30 kg. The pendulum has its mass center at ***G*** and a radius of gyration about point ***G*** of $k_G = 300$ mm. The spring ***AB*** has a stiffness of $k = 320$ N/m and is unstretched when $\theta = 0°$. If the pendulum is released from rest when $\theta = 0°$, determine its angular velocity at the instant $\theta = 90°$. Neglect the mass of the spring.

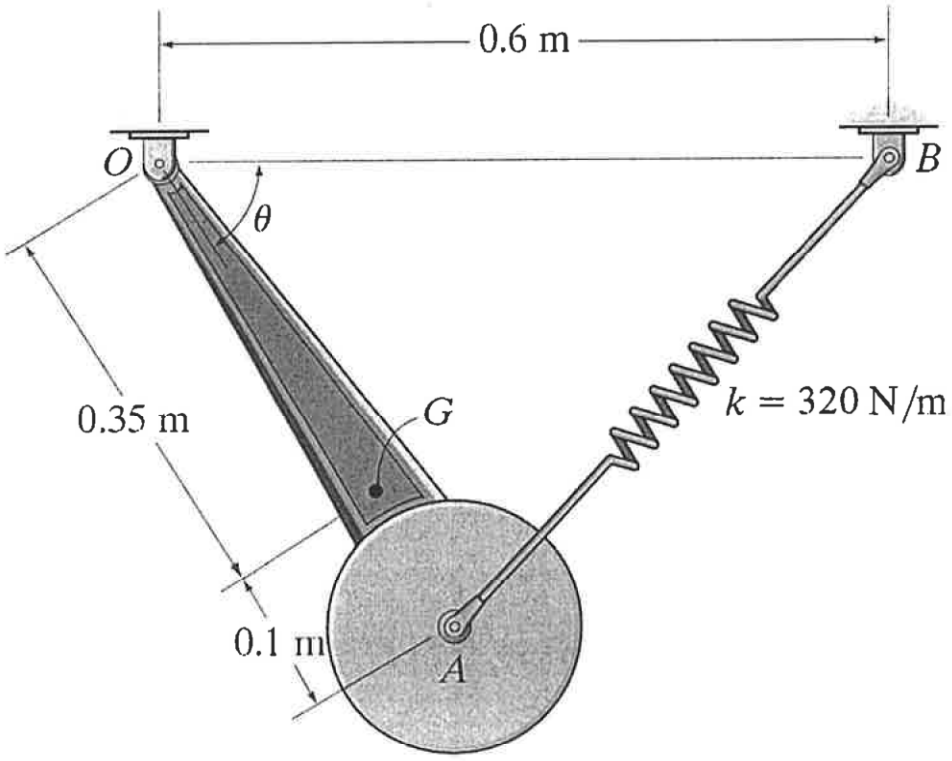

FIGURE 4

V. A ball which has a mass of 0.5-kg is thrown toward the wall with an initial velocity $v_A = 12$ m/s, as shown in figure 5.

Determine

(a) the velocity at which it strikes the wall at ***B***,

(b) the velocity at which it rebounds from the wall if the coefficient of restitution $e = 0.5$,

(c) the distance s from the wall to where it strikes the ground at ***C***.

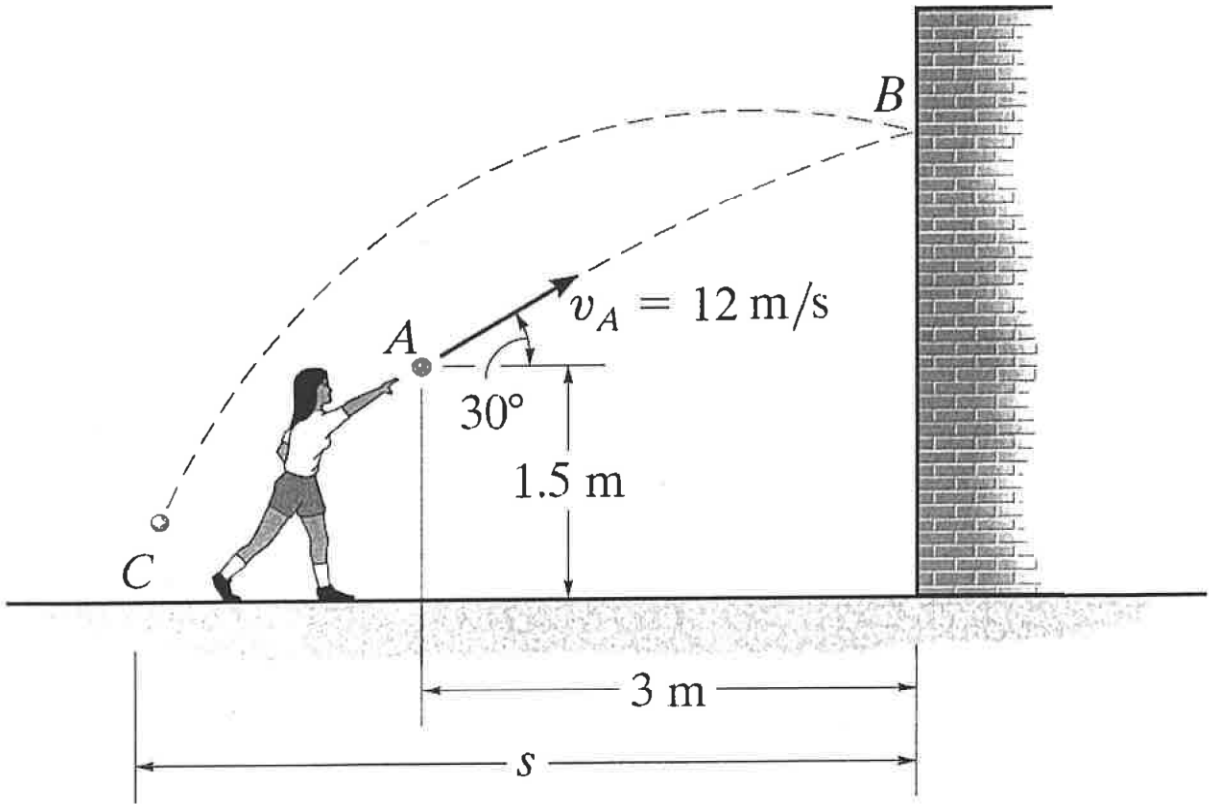

FIGURE 5.

VI. At the instant shown, the slider block ***B*** is traveling to the right with the velocity and acceleration shown. Determine the angular acceleration of the wheel ***C*** at this instant.

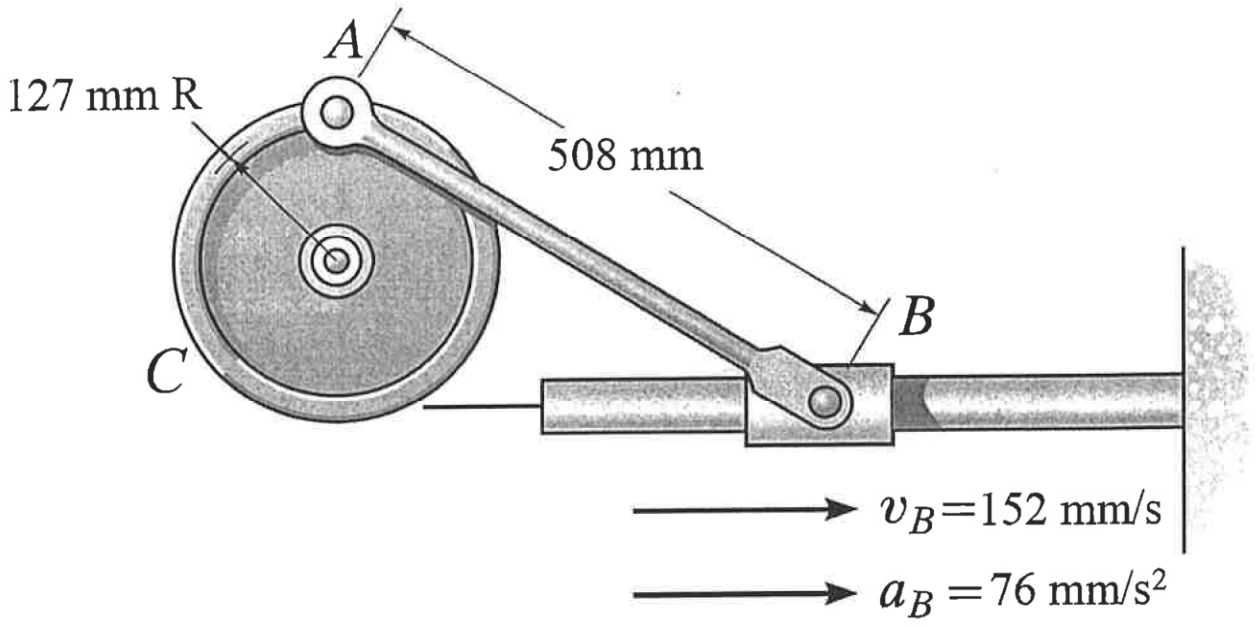

FIGURE 6.