南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

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Course Name： MAE 203B **Dept.：** Department of Mechanics and Aerospace Engineering

Exam Duration： 2 hours **Exam Paper Setter：** Yuan Hongyan

This exam paper contains ___6___questions and the score is __100__ in total. (Please hand in your exam paper, answer sheet, and your scrap paper to the proctor when the exam ends.)

Notes:

- Read each question carefully.
- g=10m/s^2.
- Draw the free body diagram when necessary.
- Provide details involving the ways of solving problems.

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1. The 0.4-kg pin P is constrained to move in the smooth curved slot, which is defined by the lemniscate r = (0.6 cos 2θ) m. Its motion is controlled by the rotation of the slotted arm OA, which has a constant clockwise angular velocity of $\dot{\theta}$ = -3 rad/s. Determine the force arm OA exerts on the pin P when θ = 0° . Motion is in the vertical plane. (20')

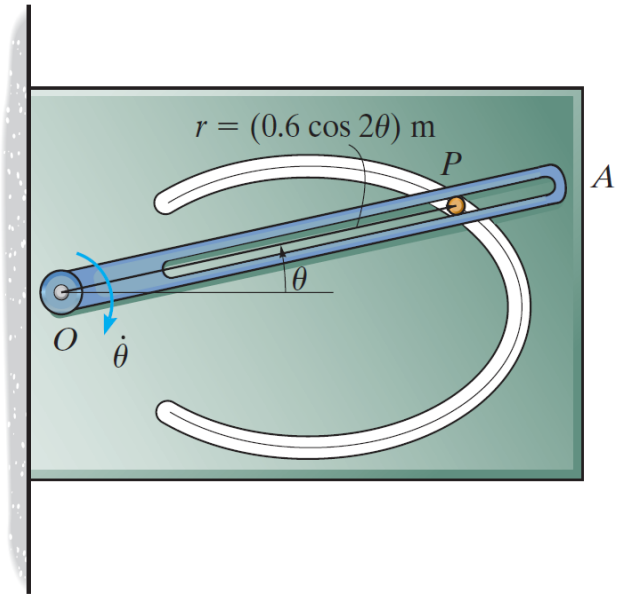

Figure 1

2. **The two blocks shown start from rest. The horizontal plane and the pulley are frictionless, and the pulley is assumed to be of negligible mass. Determine the acceleration of each block and the tension in each cord. (15')**

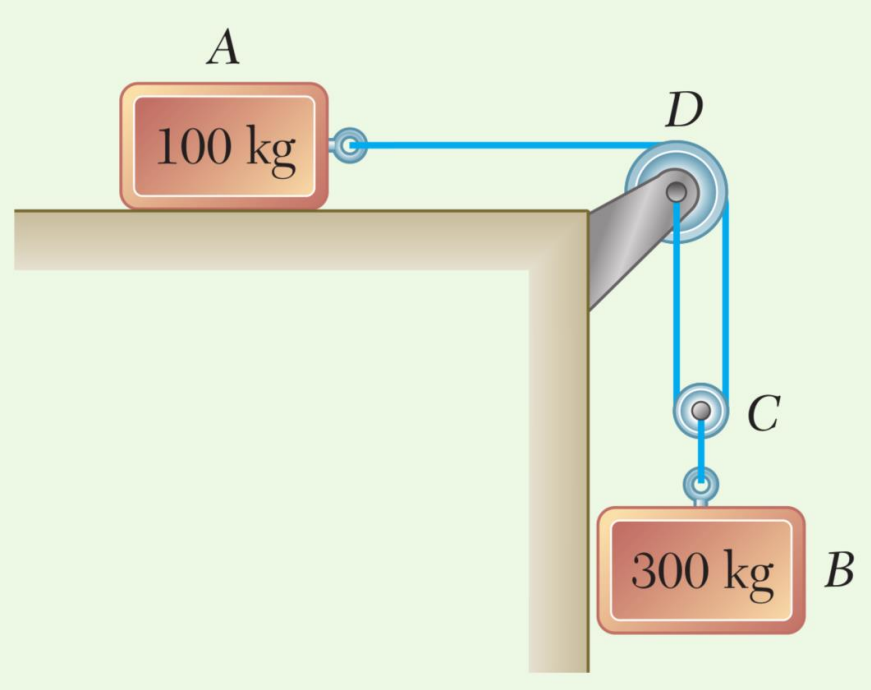

Figure 2

3. **The collar C moves downward with an acceleration of 1 m/s^2. At the instant shown, it has a speed of 3 m/s which gives links CB and AB an angular velocity $\omega_{AB} = \omega_{CB} = 10$ rad/s. Determine the angular accelerations of CB and AB at this instant. (15')**

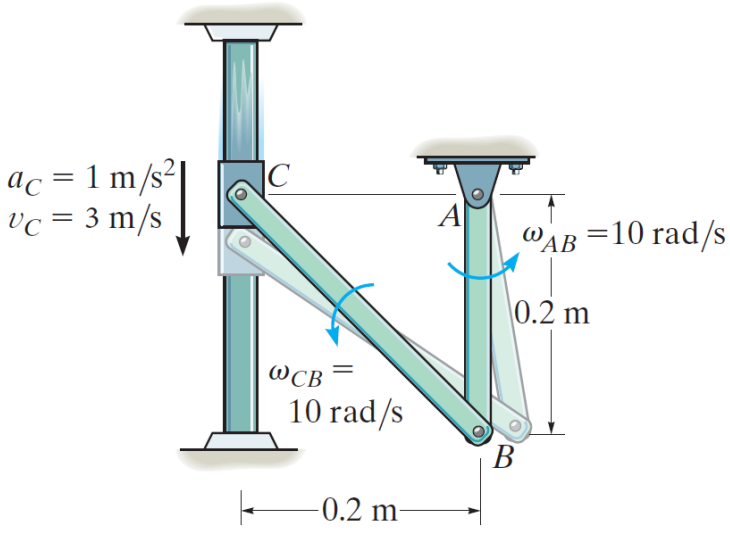

Figure 3

4. **A cord is wrapped around a homogeneous disk with a radius of r = 0.5 m and a mass of m =15 kg. If the cord is pulled upward with a force T of magnitude 180 N, determine (a) the acceleration of the center of the disk, (b) the angular acceleration of the disk, (c) the acceleration of the cord. (20')**

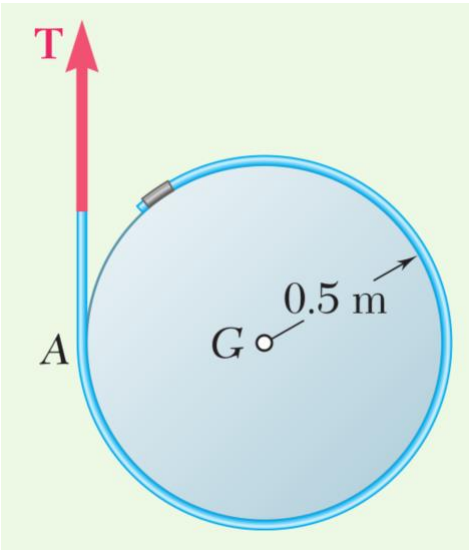

Figure 4

5. **Each of the two slender rods shown is 0.75 m long and has a mass of 6 kg. If the system is released from rest with β = 60°, determine (a) the angular velocity of rod AB when β = 20°, (b) the velocity of point D at the same instant. (15')**

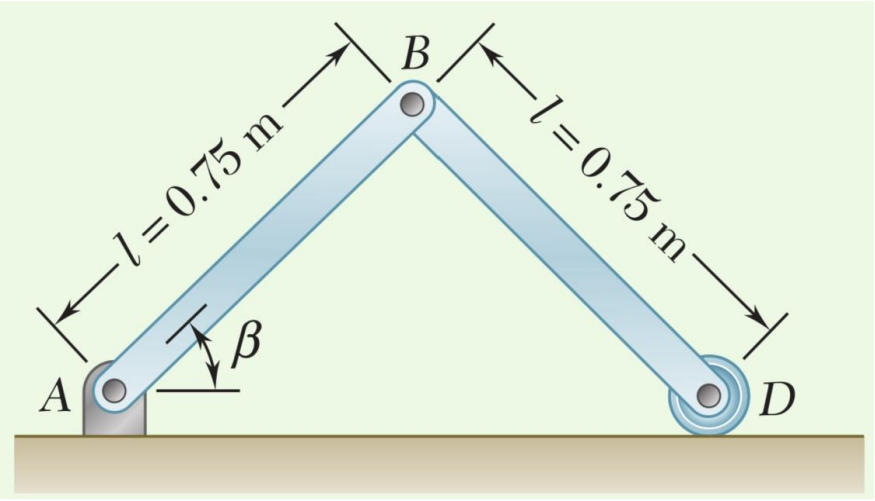

Figure 5

6. The double pulley consists of two wheels which are attached to one another and turn at the same rate. The pulley has a mass of 15 kg and a radius of gyration of k_O = 110 mm. If the block at A has a mass of 40 kg, determine the speed of the block in 3 s after a constant force of 4 kN is applied to the rope wrapped around the inner hub of the pulley. The block is originally at rest. (15')

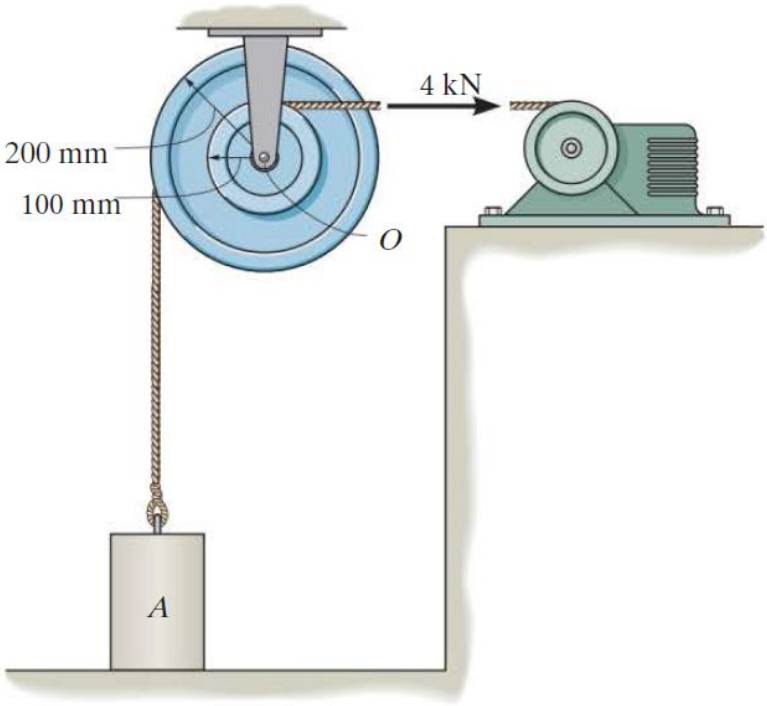

Figure 6