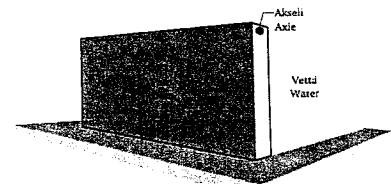


Write CLEARLY in each paper your name, student number, degree programme, the code of the study module, the date of the exam, and the exam you chose.

1. Define the following terms with as few words as possible: a) inertial frame b) tensile stress c) moment of inertia d) free body diagram e) static friction and f) conservative force
2. Answer the following questions shortly but precisely
 - (a) What is Newton's first law?
 - (b) What is Steiner's rule?
 - (c) What is Pascal's law?
3. Let the diameter of a cylinder be D and length L . Let's assume that its mass is distributed in the disc so that the density as a function of radius r is $\rho(r) = \alpha(AD - r^2)$, where α and A are constants. Determine the cylinder's moment of inertia with respect to an axis that goes through the center of the cylinder using the definition of moment of inertia via integration.
4. There are two parallel lanes in a traffic circle and the width of each lane is 3.5 m. To make it on time to the lecture, the lecturer drives on the outer lane of the traffic circle at steady speed of 60 km/h. At this speed the studded winter tires have just enough friction to keep the car in the outer lane in the icy traffic circle. At the outer lane the center of mass of the lecturer's car goes in a circular path whose radius is 13.25 m.

How much slower should the lecturer drive to stay in the road using the inner lane of the traffic circle?

5. Consider a rectangular dam with surface area A . The surface of the lake is level with the dam (see figure).
 - (a) Determine the horizontal force exerted by the water on the dam.
 - (b) Assume that there is a horizontal axle through the upper part of the dam. Determine the torque on the axle.



Problem 5