Mechanical Engineering Department
M201 Hydraulics and Heat Engines
Bylaw:2004

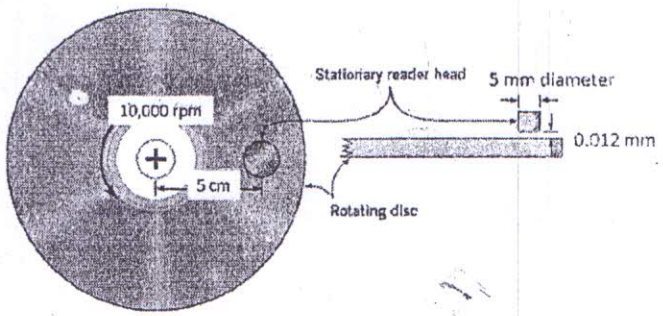
2nd year Electrical Engineering
Time: 3 Hours
Final Exam – May 17th, 2015

Important remarks
- No. of pages: 5
- No. of questions: 5
- Total mark: 50 marks

• يسمح باستخدام جداول شبكات المواسير (مع الطالب)

Question no. 1 (5 marks).

1. In a computer hard drive the disc is to rotate at 10,000 rpm, and the reader head is positioned 0.012 mm above the surface of the disc as shown. Estimate the shearing force on the reader head as a result of the air between the disc and the head. Assume that the disc velocity is the same over the whole area of the head and that the velocity profile in the gap is linear. Take viscosity of air as 1.9×10^{-5} Pa.s. (5 marks)



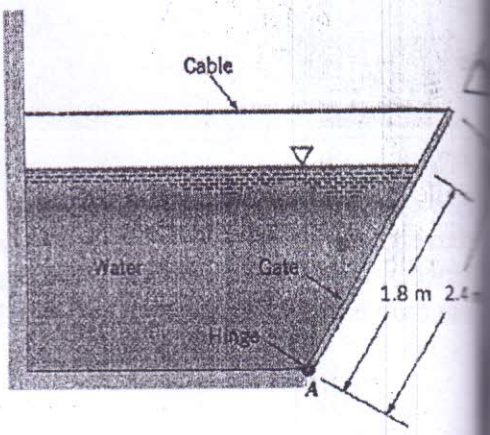
3. Define cavitation and mention where it could happen. Sketch two possible pipe systems where cavitation can happen. (5 marks)

عرف ظاهرة التكهف (cavitation) و أذكر حالتين تؤدي لحدوث هذه الظاهرة في شبكات المواسير. وضح إجابتك بالرسم.

Question no. 2 (10 marks).

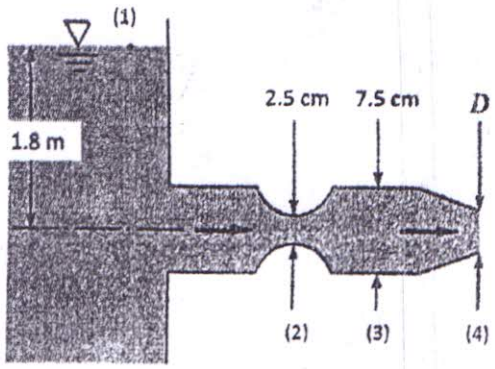
A homogeneous, 1.2 m-wide, 2.4 m-long rectangular gate weighing 400 kg is held in place by a hor flexible cable as shown in the figure. Water acts against the gate, which is hinged at point A. Friction hinge is negligible. Determine the tension in the cable.

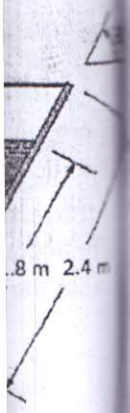
Hint: For a rectangle $I_{xc} = \frac{ba^3}{12}$ where b is the width and a is the height.



estion no. 3 (10 marks).

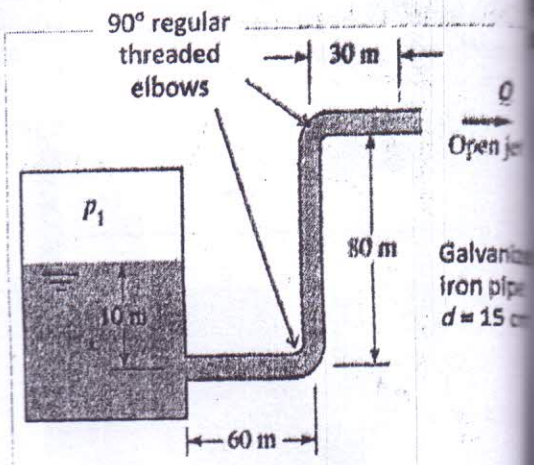
er at 30°C flows from tank shown into the atmosphere. Assuming that water is inviscid, for what nozzle meter D will cavitation begin to occur? To avoid cavitation, should you increase or decrease D from this y a hori cal value? Justify your answer. Water vapor pressure at 30°C is 4.24 kPa (absolute) and atmospheric Friction sure is 101.3 kPa.





Question no. 4 (10 marks)

The pipe flow in the figure is driven by pressurized air in the tank. What gage pressure P_1 is needed to provid water flow rate $Q = 60\ m^3/h$? Include viscous effects. For water ρ=1000 kg/m^3 and $\mu = 0.001$ Pa.s.



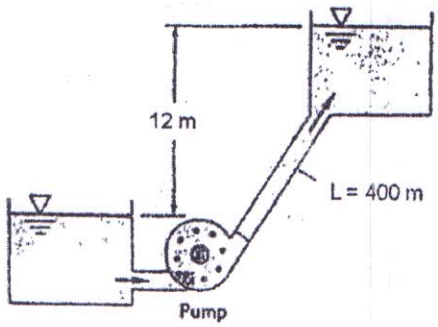
tion no. 5 (10 marks).

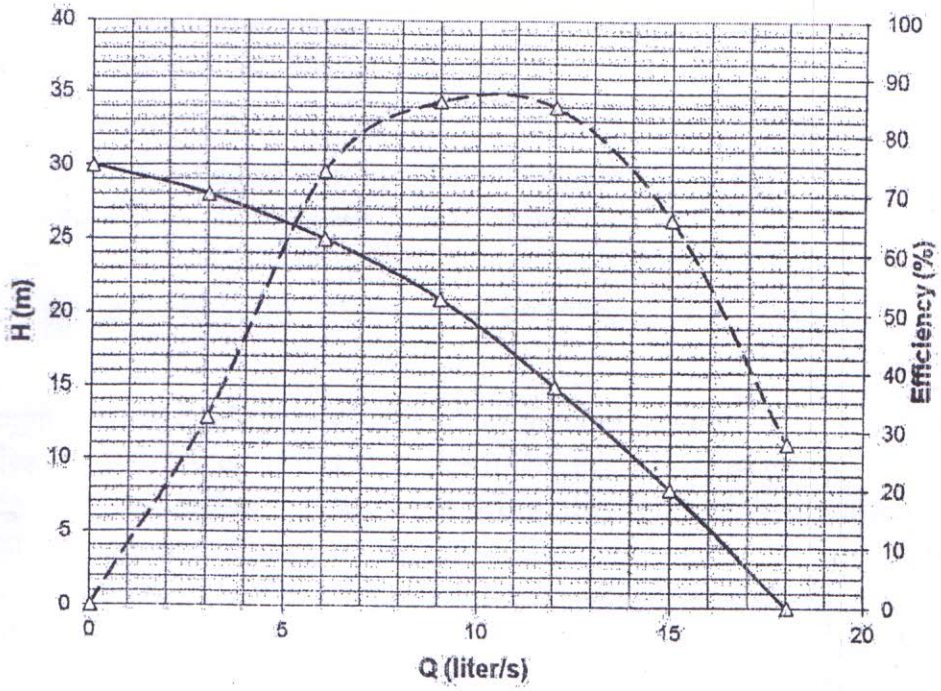
pump having the characteristics below is to be connected to the e system shown with L = 400 m, f = 0.025, D = 0.1 m, and static ad of 12 m.

a) Draw the system curve. (4 marks)

b) Find the flow rate delivered by the pump and the power consumption. (3 marks)

c) If it is desired to reduce this flow rate to 7 Liter/s by installing a valve on the pipe, sketch the new system curve and find the new power consumption. (3 marks)





مع تمنياتي بالتوفيق

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