KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPT.
CE 322: HYDRAULICS
Final Exam
TIME ALLOWED TWO HOURS

Name: _____ Student No. : _____ Mark : /100

Note 1: if any problem requires trial procedure, use only two trials.
Note 2: use the moody diagram only for friction factor calculation whenever is needed.
Note 3: unless stated otherwise, use $v = 1.0 \times 10^{-06}$ m^2/s or $v = 1.0 \times 10^{-05}$ ft^2/s

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PROBLEM #1 (16%): Select the appropriate answer in the following:

- Hazen-Williams equation is more precise than Darcy-Weisbach equation for computation of frictional losses when dealing with less turbulent flow. ---True ---False ----Depends.
- Axial flow pumps offer higher flow than radial flow pumps but with lower pressure ----- true ------ false ------- depends.
- The driving force for open channel flow is ------- gravity ------- pressure ------ momentum ----velocity
- Pumps are connected in parallel to boost 1) pressure 2) flow 3) temperature 4) NPSH

PROBLEM #2 (19%):

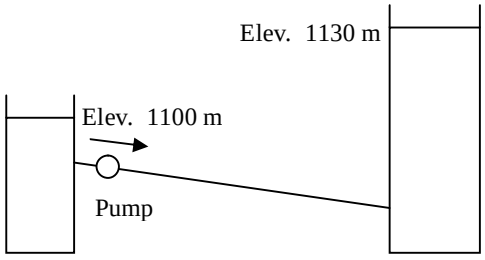
The distance between the inlet (point A) and the outlet (point B) for a pipe is 600 meters. The following pressure values at A and B are given:

P_A = 1152.8 kPa, Z_A = 0.00 m
P_B = 84.3 kPa Z_B = 0.86 m

The pipe diameter is 2.54 cm, Fluid is water at 5 ^{o}C.
If the pipe is smooth, what would be the discharge value needed to reduce the pressure at B (P_B) to zero if the upstream pressure is held without change.

PROBLEM #3 (35%):

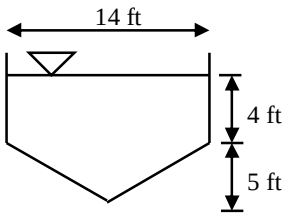
The pipe connecting the two storage tanks shown to the right has the following information:
L = 700 m
C = 110
D = 110 mm, K_{total} = 12



a) Establish the system demand equation for the system.
b) Which model is suitable and most economical if the minimum required discharge is 16 m^3/hr?
c) Find the design head, discharge, NPSH, power and efficiency for the pump you selected.
d) What would be the total head loss in the system at the design discharge.
e) If 30% of the total losses in the system occur between the top of the left storage tank and the pump inlet, investigate the possibility of pump cavitation.
f) What would be the effect of the following assuming that we already selected one of the pumps and installed it in the shown position.
    a. Increasing elevation of the right storage tank on the discharge
    b. Increasing the pipe diameter on the pressure along the pipe.
    c. Reducing elevation of the left storage tank on the discharge.

PROBLEM #4 (30%):

The cross section of an open channel with uniform flow conditions is shown to the right. The following information is given:



1. Channel bottom slope = 0.002
2. Manning roughness coefficient = 0.015

a) Find the critical depth.
b) Classify the channel slope.
c) Find E and Ec.
d) What is the maximum height the channel bottom could be raised without affecting the flow in the channel.