Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2010 SESSION

SUBJECT CODE	: FMB 30102
SUBJECT TITLE	: FLUID MECHANICS
LEVEL	: BACHELOR
TIME / DURATION	: 9.00am – 11.00am (2 HOURS)
DATE	: 26 APRIL 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This questions paper consists of TWO (2) sections. Section A and B. Answer ALL questions in section A. For section B, answer THREE (3) questions only.
6. Answer ALL questions in English.
7. Table for specific weight and density of common liquids and gases are appended.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) Determine the mass of an object if it moves 6 ft/s^2 when 40 lb force applied on it

(4 marks)

(b) Prove that the specific weight is equal to density times gravity as below

$\gamma = \rho \times g$

(4 marks)

(c) What velocity will give a mass of 1 slug a kinetic energy of 20 lb.ft?

(4 marks)

(d) A liquid is compressed in a cylinder. The original volume and pressure are 1 liter and 1 MPa, respectively, whereas the final values are 0.995 liter and 2 MPa, respectively. Find the bulk modulus of the liquid.

(8 marks)

Question 2

(a) In the manometer of Figure 1, find P_1 if fluid A is seawater and fluid B is mercury

(8 marks)

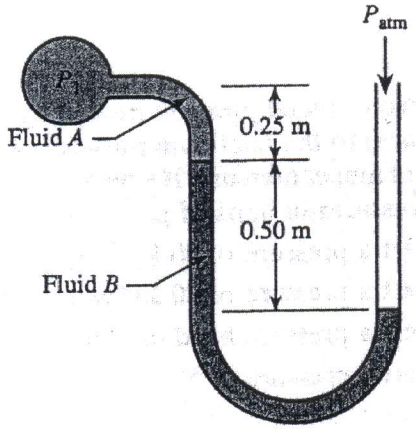

Figure 1

(b) For the differential manometer of Figure 2, find the pressure drop $P_A - P_B$ in the vertical pipeline in which water flows.

(12 marks)

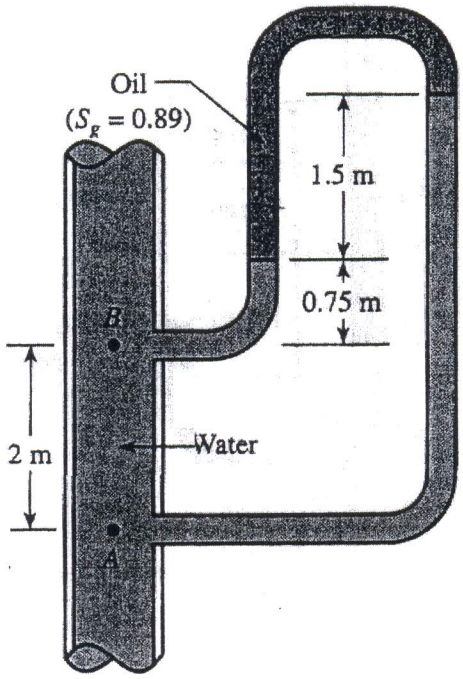

Figure 2

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE questions.
Please use the answer booklet provided.

Question 3

(a) A vertical square gate separates two compartments of a pressurized air tank, as shown in Figure 3. If the gate has a side dimension of 2 ft and is hinged at the top, find the minimum force Q (acting at the gate bottom) required to open the gate.

(10 marks)

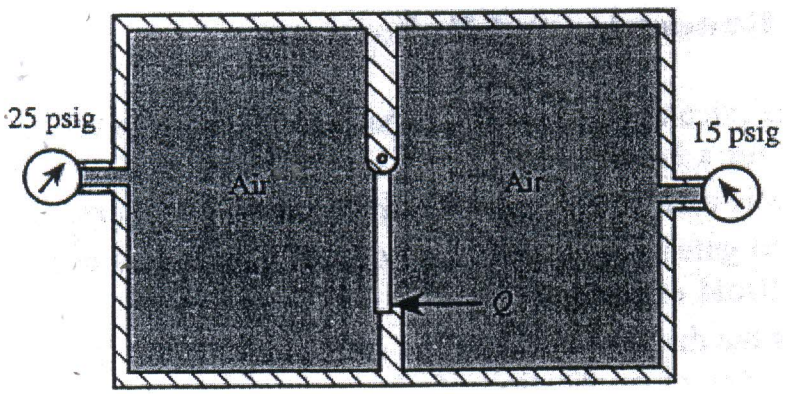

Figure 3

(b) Find the force Q required to hold the rectangular gate of Figure 4. The width of the gate is 3 ft and the right side of the gate is exposed to the atmosphere.

(10 marks)

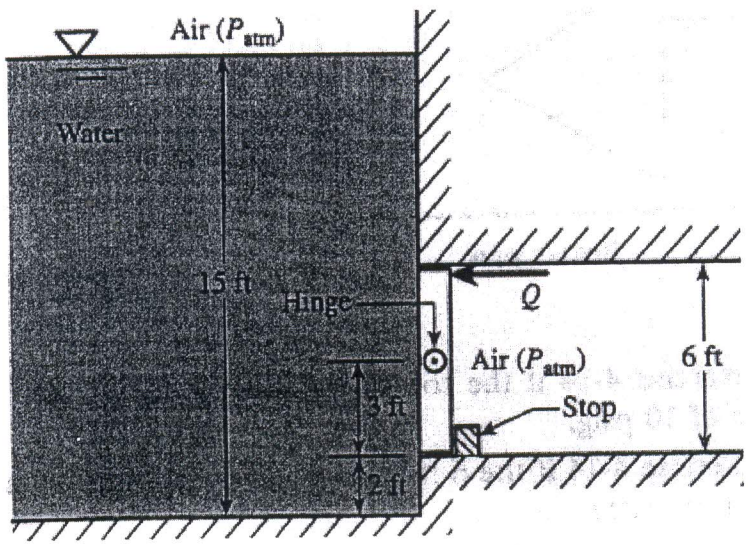

Figure 4

Question 4

(a) Determine the minimum air pressure P_{air} required to keep the 3-ft-diameter circular gate of Figure 5. The gate is a uniform plate weighing 500 lb.

(10 marks)

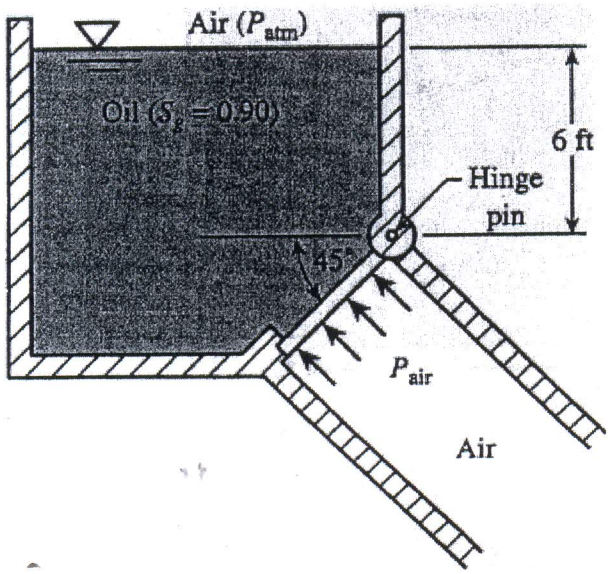

Figure 5

(b) The right side of the open tank of Figure 6 contains a pipe that is closed by a 2 ft diameter circular gate. The gate is hinged via a horizontal pin, as shown. Determine the minimum torque that must be applied to the hinge pin to keep the gate closed. Neglect the weight of the gate that is exposed to the atmosphere on the right side.

(10 marks)

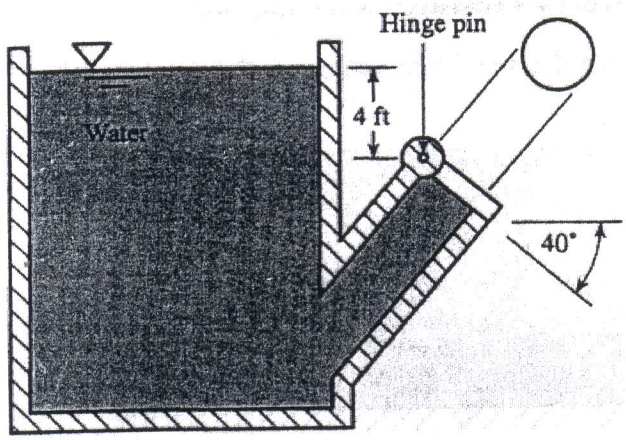

Figure 6

Question 5

(a) Two pipes of 4 in. and 2 in. diameter, respectively, have flow velocities of 30 ft/s and 20 ft/s, respectively. The flows from these two pipes enter a 5 in.-diameter pipe. Determine the velocity and volume flow rate in the large pipe.

(10 marks)

(b) Water enters a cylindrical tank through two pipes at rates of 0.01 m^3/s and 0.02 m^3/s, as shown in Figure 7. If the level in the tank is to remain constant, determine the velocity v_3 of flow leaving the tank through the 200-mm-diameter pipe.

(10 marks)

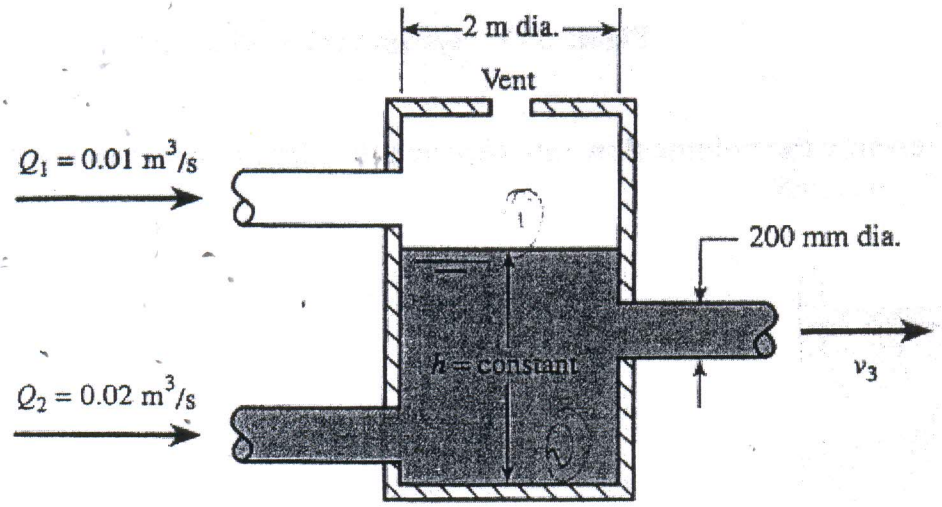

Figure 7

Question 6

(a) For the closed tank of Figure 8, the top is pressurized with air at 15 psig. Find the volume flow rate Q through the circular opening in the side of the tank.

(10 marks)

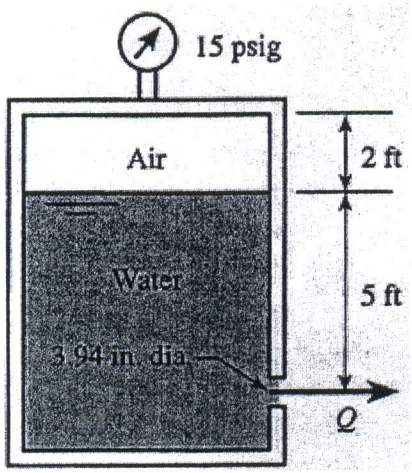

Figure 8

(b) A 25-ft-long garden hose with a 5 in. inside diameter is used to drain a swimming pool, as shown in Figure 9. Determine the volume flow rate when the pool is full as shown.

(10 marks)

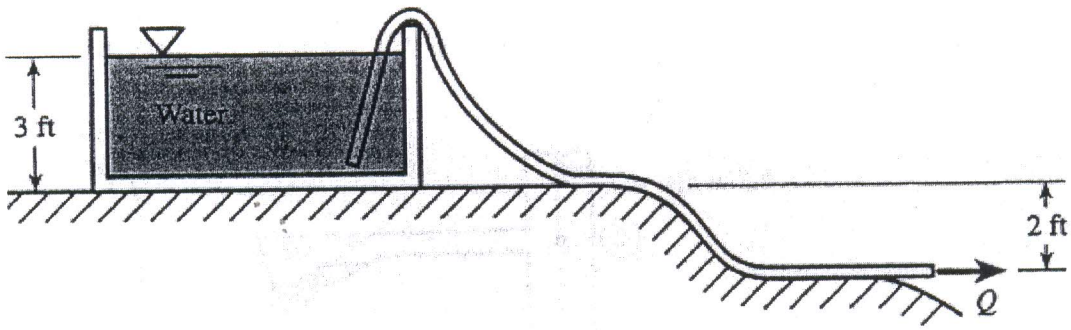

Figure 9

END OF QUESTION

Liquid	Specific Weight γ (lb/ft^3)	Density ρ ($slugs/ft^3$)
Carbon tetrachloride	99.1	3.08
Ethyl alcohol	49.2	1.53
Gasoline	42.2	1.31
Mercury	846	26.3
SAE 30 oil	55.5	1.72
Seawater	64.0	1.99
Water	62.4	1.94

Table 1 Specific weight and density of common liquids. (U.S. Customary units at 68°F.)

Liquid	Specific Weight γ (N/m^3)	Density ρ (kg/m^3)
Carbon tetrachloride	15,600	1,590
Ethyl alcohol	7,730	788
Gasoline	6,630	676
Mercury	133,000	13,600
SAE 30 oil	8,720	889
Seawater	10,050	1,024
Water	9,790	998

Table 2 Specific weight and density of common liquids. (SI units at 20°C.)

Gas	Specific Weight γ (lb/ft^3)	Density ρ ($slugs/ft^3$)
Air	0.0765	0.00238
Helium	0.0104	0.000323
Hydrogen	0.00525	0.000163
Methane	0.0415	0.00129
Nitrogen	0.0728	0.00226
Oxygen	0.0831	0.00258

Table 3 Specific weight and density of common gases. (U.S. Customary units at standard atmospheric pressure and 68°F.)

Gas	Specific Weight γ (N/m^3)	Density ρ (kg/m^3)
Air	12.0	1.23
Helium	1.63	0.166
Hydrogen	0.822	0.0838
Methane	6.54	0.667
Nitrogen	11.4	1.16
Oxygen	13.0	1.33

Table 4 Specific weight and density of common gases. (SI units at standard atmospheric pressure and 20°C.)