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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FMD20202**
SUBJECT TITLE	:	**FLUID MECHANICS**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**2.00 pm – 4.00 pm (2 HOURS)**
DATE	:	**10 JANUARY 2015**

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 question paper consists of TWO (2) sections. Section A and B. Answer ALL questions in Section A. For Section B, answer TWO (2) questions only.**
6. **Answer all questions in English.**

THERE ARE 6 PAGES OF QUESTIONS AND 2 PAGES OF APPENDICES, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

(a) Define 'fluid mechanics'.

(4 marks)

(b) Differentiate between 'fluid statics' and 'fluid dynamics'.

(4 marks)

(c) Name FIVE (5) applications of fluid mechanics.

(4 marks)

(d) Briefly explain the term 'Bulk Modulus'.

(4 marks)

(e) State 'Pascal's law'.

(4 marks)

(f) Explain the different between 'gage pressure' and 'absolute pressure'.

(4 marks)

(g) Define the term 'viscosity'.

(4 marks)

Question 2

A rigid cylinder of 0.1 m diameter contains SAE 30 oil, as shown in *Figure 1* below. If a pressure of 1×10^6 N/m² is applied, calculate the distance of the piston move downward?

(12 marks)

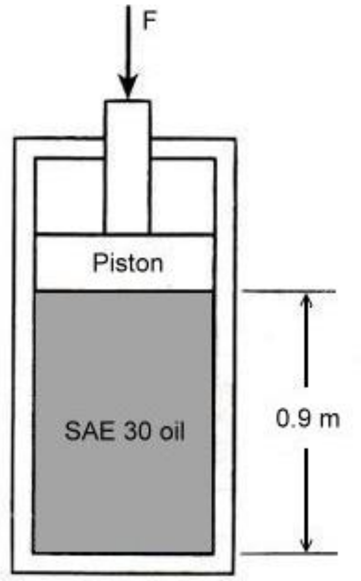


Figure 1

Question 3

(a) For a tank containing **ethyl alcohol** under air pressure, as shown in *Figure 2*, find the pressure at the bottom of the tank, P_{bottom} (kPa).

(10 Marks)

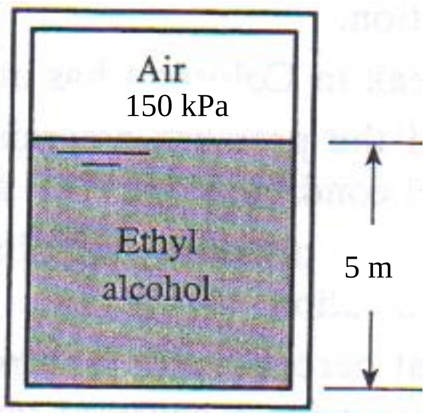


Figure 2

(b) In the manometer of *Figure 3*, fluid A is water and fluid B is mercury. What is the absolute pressure P_1 (kPa)?

(10 Marks)

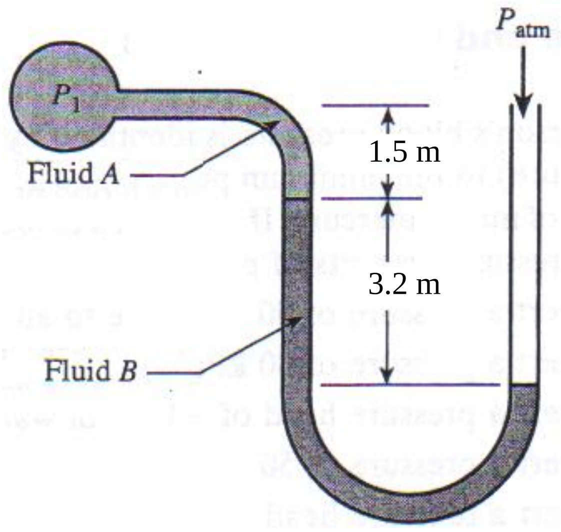


Figure 3

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 4

A spherical buoy is anchored to a reverbed with a cable as shown in *Figure 4*. This buoy is designed to float so that it can be seen above the river's water surface. At times, however the water level rises such that the buoy is completely submerged.
If the buoy has a diameter 1.0 m and a material density of 750 kg/m^3:

(a) Calculate the weight, W (N) of the buoy.

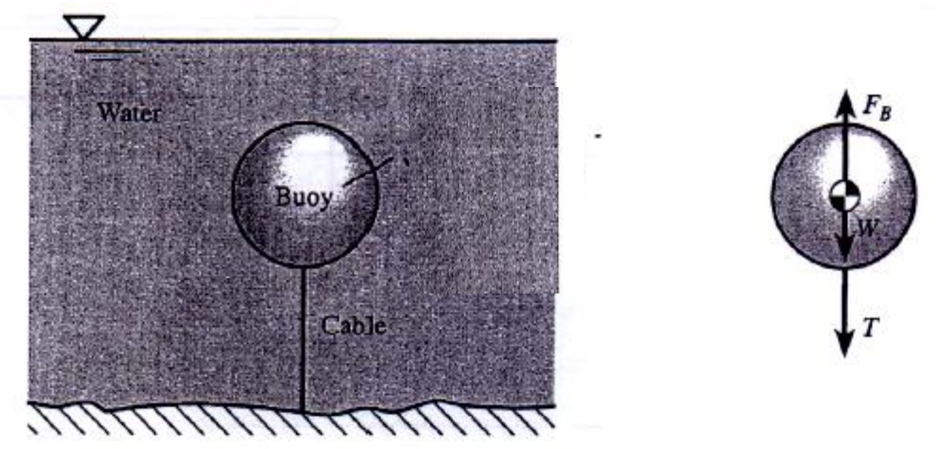
(6 Marks)

(b) Find the buoyancy force, F_B (N).

(7 Marks)

(c) Use the free body diagram (FBD) to find the tension in the cable, T (N)

(7 Marks)



(a) Buoy completely submerged (b) FBD of buoy

Figure 4

Question 5

For the system gate of *Figure 5*, the height of the triangular gate is 0.866 m. Calculate the;

(i) Resultant force, F_R (N)

(10 Marks)

(ii) Point of application, h_{cp} (m)

(10 Marks)

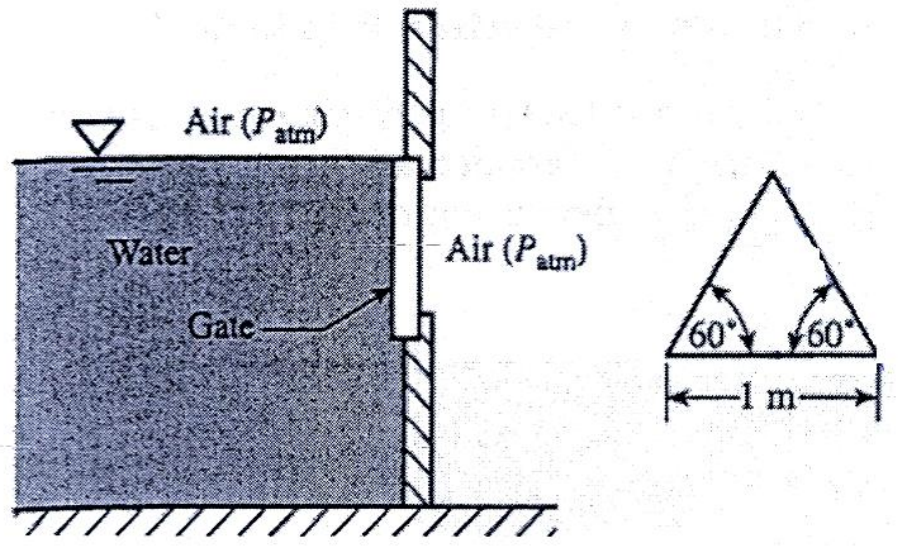


Figure 5

Question 6

For the system of *Figure 6*, h = 40 m and the diameter of the side opening is 0.008 m. If the liquid is water, find the:

i. Jet velocity, v_2 in m/s

(10 Marks)

ii. Volume flow rate, Q in m^3/s

(10 Marks)

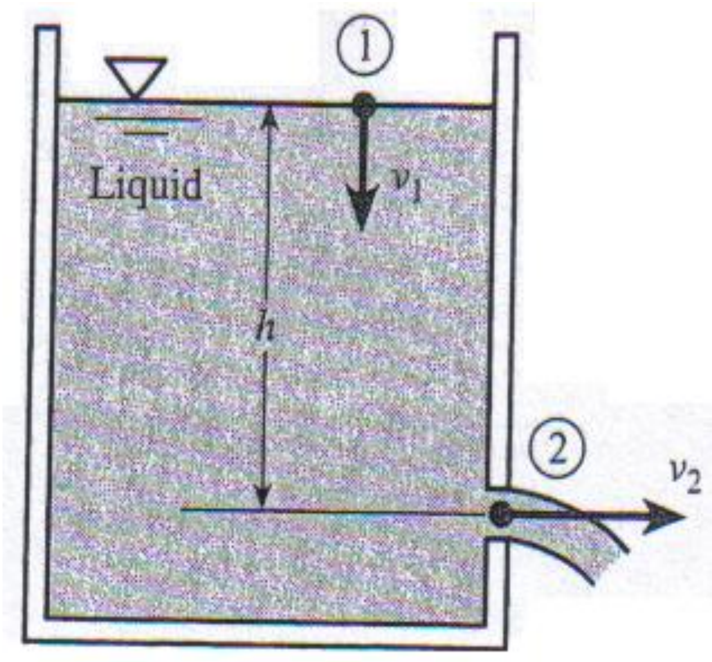


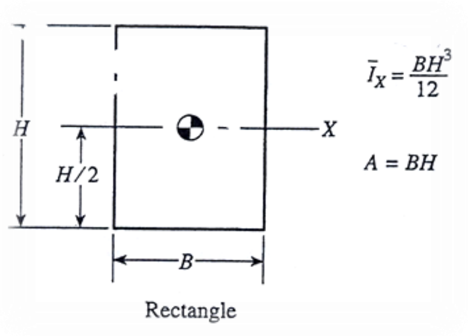
Figure 6

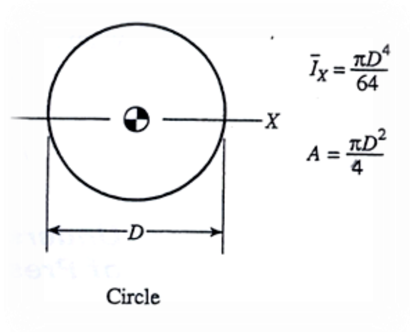
END OF QUESTION

APPENDICES: FORMULAE AND TABLES

$Sg = \dfrac{\gamma}{\gamma_{water\ at\ 4°C}}$	$\gamma_{water\ at\ 4°C} = 9810\ N/m^3$	$\beta = \dfrac{-\Delta P}{\Delta V / V}$
$V_{cylinder} = \pi r^2 h$	$W = mg$	$g = 9.82\ m/s^2$
$p_{abs} = p_{gage} + p_{atm}$	$p_{atm} = 101\ kPa$	$V_{sphere} = \dfrac{4}{3}\pi r^3$
$p = \gamma h$	$F = pA = \gamma h A$	$F_B = \gamma_{fluid} \times V_{Body}$
$h_{cp} = \dfrac{\bar{I}_X}{\bar{h}A} + \bar{h}$	$v = \sqrt{2gh}$	$Q = VA$

Table 1: List of Formulae.





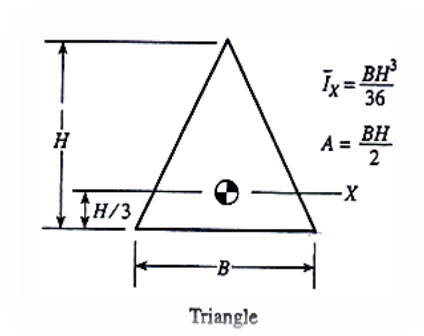


Table 2: Properties of some common plane areas.

Liquid	Specific weight (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 3: Specific weight and density of common liquids. (SI units at 20°C)

Gas	Specific weight (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 atmospheric pressure and 20°C)

Liquid	Bulk Modulus ( ) (*MPa*)
Carbon tetrachloride	1,130
Ethyl alcohol	1,060
Gasoline	1,300
Mercury	28,500
SAE 30 oil	1,500
Seawater	2,340
Water	2,150

Table 5: Typical bulk modulus values of common liquids