



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2014 SESSION

SUBJECT CODE : FMB30103
SUBJECT TITLE : FLUID MECHANICS
LEVEL : BACHELOR
TIME / DURATION : 9.00 AM – 11.30 AM
(2.5 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, EXCLUDING THIS PAGE.

SECTION A(Total:60 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

- (a) A fluid that occupies a volume of 30 L weighs 250 N at a location where the gravitational acceleration is 9.81 m/s^2 , determine the mass of this fluids and its density

(5 marks)

- (b) A 200 L container is filled with 1.5 kg of air at a temperature of 27°C . What is the pressure in the container? Take the gas constant as 0.287 kJ/kg.K

(5 marks)

- (c) Determine the speed of sound in air at 300K and 800K. Also determine the Mach number of an aircraft moving in air at a velocity of 330 m/s for both cases

(10 marks)

Question 2

- (a) A vacuum gage connected to a chamber reads 36 kPa a location where the atmospheric pressure is 92 kPa. Determine the absolute pressure in the chamber

(5 marks)

- (b) A pressure gage connected to a tank reads 500 kPa at a location where the atmospheric pressure is 94 kPa. Determine the absolute pressure in the tank

(5 marks)

- (c) Freshwater and seawater flowing in parallel horizontal pipelines are connected to each other by a double U tube manometer, as shown in Figure 1 below. Determine the pressure different between the two pipelines. Take the density of mercury, seawater and freshwater at that location to be $13\,600\text{ kg/m}^3$, 1035 kg/m^3 and 1000 kg/m^3

(10 marks)

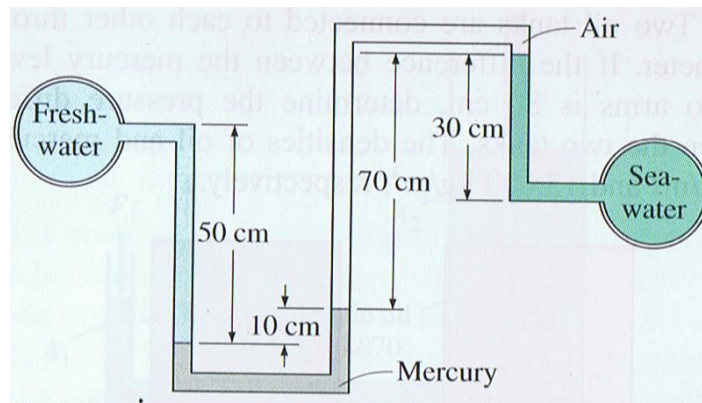


Figure 1: System for Section A, Question 2 (c)

Question 3

- (a) Air whose density is 1.3 kg/m^3 enters the ducts of an air conditioning system at a volume flow rate of $14 \text{ m}^3/\text{min}$. If the diameter of the duct is 40 cm , determine the velocity of the air at the duct inlet and the mass flow rate of air

(10 marks)

- (b) Air enters a nozzle steadily at 3.5 kg/m^3 and 25 m/s and leaves at 0.84 kg/m^3 and 160 m/s . If the inlet area of the nozzle is 60 cm^2 , determine the mass flow rate through the nozzle and the exit area of the nozzle

(10 marks)

SECTION B (Total: 40 marks)**INSTRUCTION: Answer TWO (2) questions only****Please use the answer booklet provided.****Question 4**

- (a) The 500 kg load on the hydraulic lift shown in Figure 2 below is to be raised by pouring oil with density of 820 kg/m^3 into a thin tube. Determine how high h should be in order to begin to raise the weight

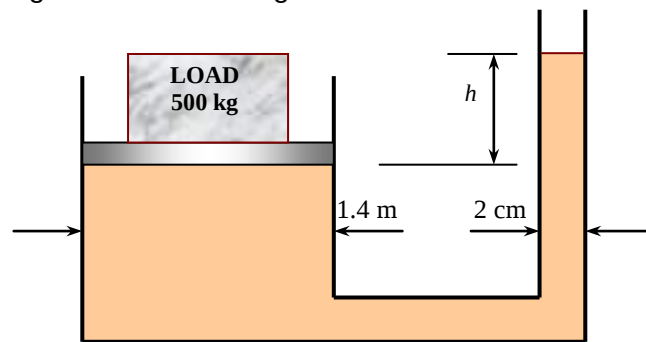


Figure 2: System for Section B, Question 4 (a)

(10 marks)

- (b) A 6 m high, 5 m wide rectangular plate blocks the end of a 5 m deep freshwater channel as shown in Figure 3. The plate is hinged about a horizontal axis along its upper edge through a point A and is restrained from opening by fixed ridge at point B. Determine the force exerted on the plate by the ridge, F_{ridge}

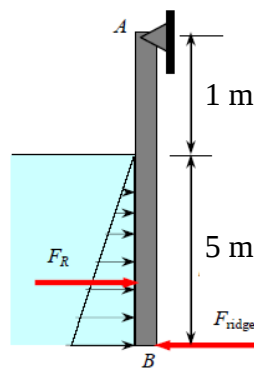


Figure 3: System for Section B, Question 3 (b)

(10 marks)

Question 5

- (a) A Pitot-static probe is used to measure the speed of an aircraft flying at 3500m. If the differential pressure reading is 4 kPa, determine the speed of the aircraft. The density of the atmosphere at an elevation of 3500 m is $\rho = 0.909 \text{ kg/m}^3$
- (5 marks)
- (b) A garden hose attached with a nozzle is used to fill a 50 L bucket. The inner diameter of the hose is 3 cm, and it reduces to 1.2 cm at the nozzle exit. If it takes 1 minutes to filled the bucket with water, determine the volume flow rate (in m^3/s)
- (5marks)
- (c) The water is an 9 m diameter, 4 m high above ground swimming pool is to be emptied by unplugging a 3.5 cm diameter, 27 m long horizontal pipe attached to the bottom of the pool. Determine the maximum discharge rate of water through the pipe. Also, explain why the actual flow rate will be less
- (10 marks)

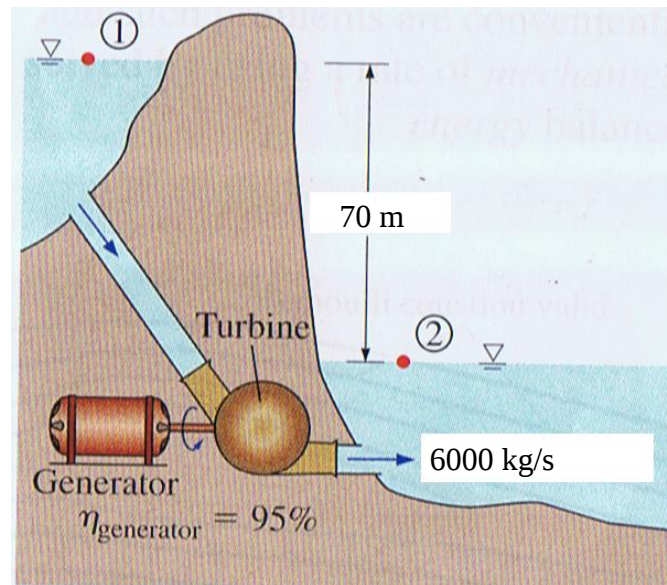
Question 6

Figure 4: System for Section B, Question 6

The water in a large lake is to be used to generate electricity by the installation of a hydraulic turbine-generator. The elevation different between the free surfaces upstream and downstream of the dam is 70 m. Water is to be supplied at a rate of 6000 kg/s as shown in Figure 4.

If the electric power generated is measured to be 3800 kW and the generator efficiency is 95%, determine:

(a) The overall efficiency of turbine-generator

(8 marks)

(b) The mechanical efficiency of the turbine

(6 marks)

(c) The shaft power supplied by the turbine to the generator

(6 marks)

END OF QUESTION