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 2014 SESSION

SUBJECT CODE	:	**NMB 21203**
SUBJECT TITLE	:	**FLUID MECHANICS 1**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**(3 HOURS)**
DATE	:	

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 paper consists of SEVEN (7) questions. Answer any FIVE (5) questions only.**
6. **Answer all questions in English.**

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FIVE (5) questions only.
Please use the answer booklet provided.

Question 1

A crane is used to lower weighs into the seawater (density of 1025 kg/m^3) for an underwater construction project. Determine the tension in the rope of the crane due to a rectangular 0.6 m x 0.6 m x 4 m concrete block (density of 2500 kg/m^3) when it is:

(a) Suspended in the air (10 marks)

(b) Completely immersed in water (10 marks)

Question 2

A 6 m high, 5 m wide rectangular plate blocks the end of a 5 m deep freshwater channel as shown in Figure 1. 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:

(a) The average pressure at the centroid, P_{ave} (4 marks)

(b) The resultant force on the wall, F_r (4 marks)

(c) The center of pressure, y_p (4 marks)

(d) The force exerted on the plate by the ridge, F_{ridge} (8 marks)

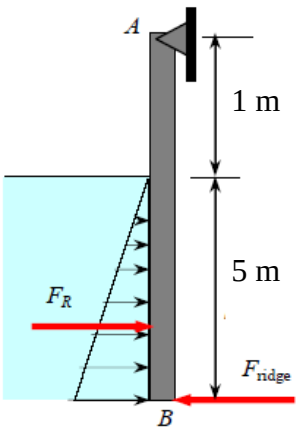

Figure 1: System for Question 1 [Yunus Cengel, 2014]

Question 3

The pressure of water flowing through a pipe is measured by arrangement shown in Figure 2 below. For the values given, calculate the pressure in the pipe. Take the standard density of water to be ρ_w = 1000 kg/m^3. (20 marks)

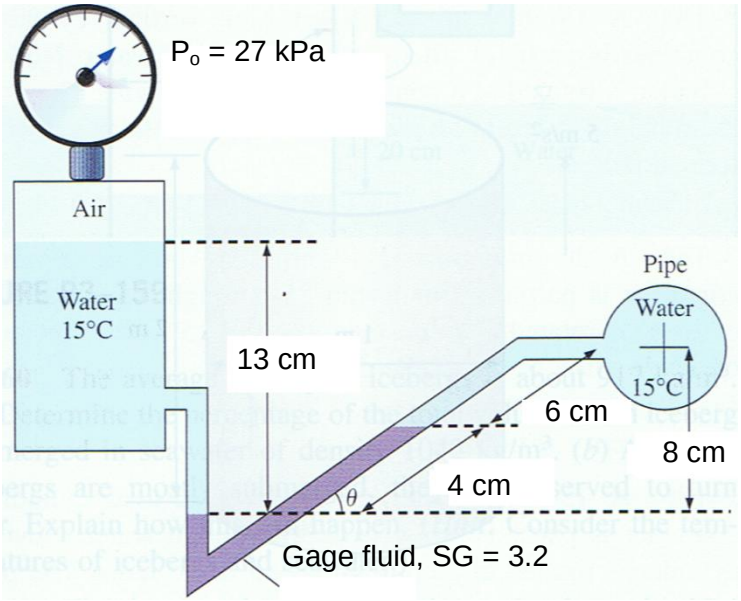

Figure 2: System for Question 3 [Yunus Cengel, 2014]

Question 4

The water in a large lake is to be used to generate electricity by the installation of hydraulic turbine-generator. The elevation difference between the free surface upstream and downstream of the dam is 70 m as shown in Figure 3 below. Water is to be supplied at a rate of 6000 kg/s. If the electric power generator efficiency is 95 percent, determine:

(a) The overall efficiency of the turbine-generator (8 marks)

(b) The mechanical efficiency of the turbine, and (6 marks)

(c) The shaft power supplied by the turbine to the generator (6 marks)

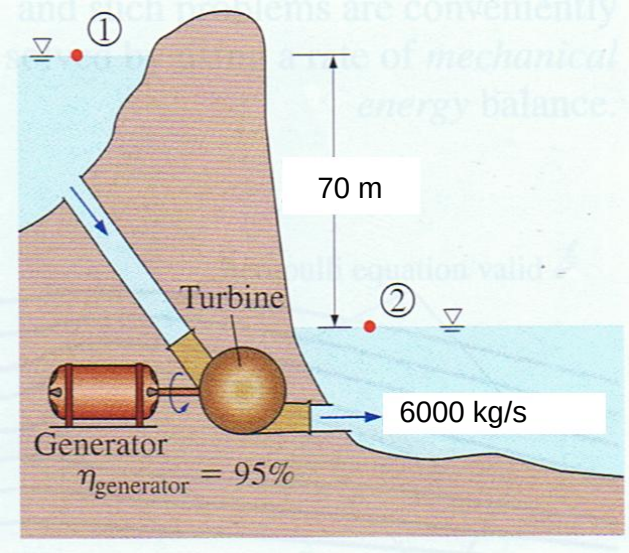

Figure 3: System for Question 4 [Yunus Cengel, 2014]

Question 5

A hurricane is a tropical storm formed over the ocean by low atmospheric pressures. As a hurricane approaches land, inordinate ocean swells (very high tides) accompany the hurricane. A class 5 hurricane features winds in excess of **300 km/h**, although the wind velocity at the center "eye" is very low.

Figure 4 shows a hurricane hovering over the ocean swell. The atmospheric pressure 320 km from the eye is 762 mmHg (at point 1), and the wind are calm. The atmospheric pressure at the eye of the storm is 560 mmHg. Estimate:

(a) the ocean swell at the hurricane at point 3, (h_3) and (10 marks)

(b) at point 2 (h_2), where the wind velocity is 300 km/h. (10 marks)

Take the density of seawater and mercury as 1025 kg/m^3 and 13 600 kg/m^3, respectively, and the density of air at normal sea level pressure as 1.2 kg/m^3

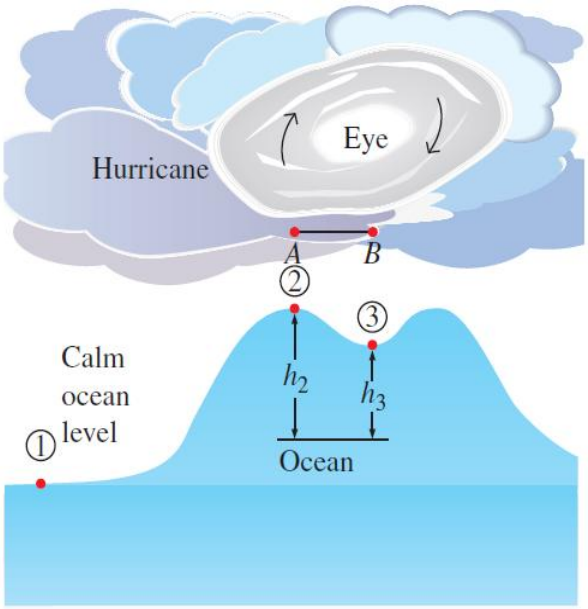

Figure 4: System for Section B, Question 5 [Yunus Cengel, 2014]

Question 6

A reducing elbow is used to deflect water flow at a rate of 18 kg/s in a horizontal pipe upward 40^o while accelerating as shown in Figure 5. The elbow discharge water into the atmosphere. The cross sectional area of the elbow is 120 cm^2 at the inlet and 10 cm^2 at the outlet. The elevation difference between the centers of the outlet and the inlet is 50 cm. The weight of the elbow and the water in it is considered to be negligible. If the density of water is 1000 kg/m^3 and momentum-flux correction factor is 1.03, determine:

(a) The velocity of water at the inlet and outlet (5 marks)

(b) The gage pressure at the center of the inlet of the elbow and (7 marks)

(c) The anchoring force needed to hold the elbow in place (8 marks)

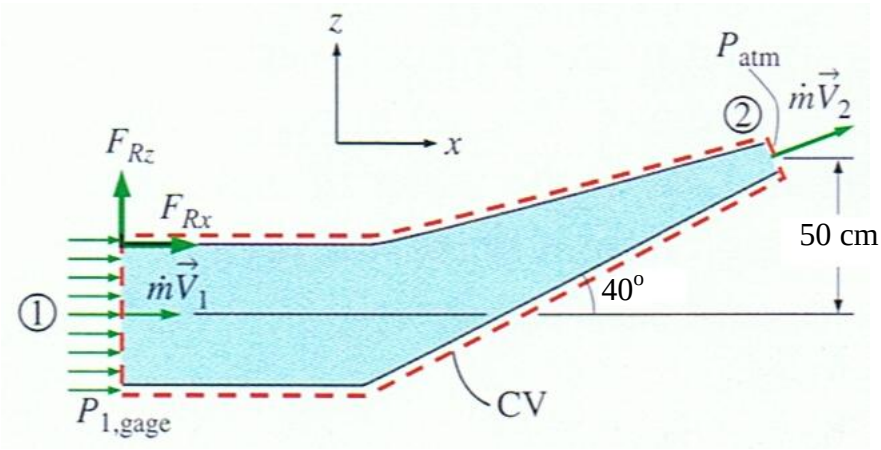

Figure 5: System for Question 6 [Yunus Cengel, 2014]

Question 7

Water at 5^{o}C (ρ = 1000 kg/m^{3} and μ = 1.519 x 10^{-3} kg/m.s) is flowing steadily through a 0.4 cm diameter 10 m long horizontal pipe at an average velocity of 0.8 m/s as shown in Figure 6. Determine:

(a) The Reynolds Number, Re (3 marks)

(b) The friction factor (3 marks)

(c) The head loss (3 marks)

(d) The pressure drop (4 marks)

(e) The volume flow rate (4 marks)

(f) The pumping power required to overcome this pressure drop (3 marks)

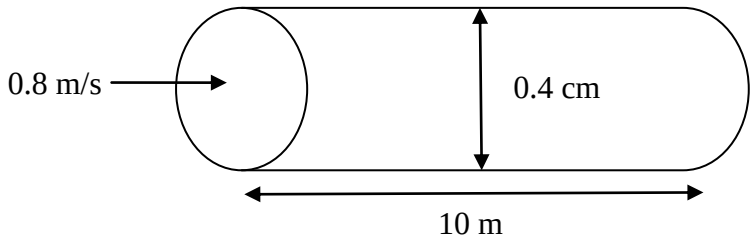

Figure 6: System for Question 7

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