POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

CIVIL ENGINEERING DEPARTMENT

FINAL EXAMINATION

JUNE 2012 SESSION

CC501 : HYDRAULICS 2

DATE : 19 NOVEMBER 2012 (MONDAY)
DURATION : 2 HOURS (11.15 AM – 1.15 PM)

This paper consists of **SEVEN (7)** pages including the front page.
Section A : Essay (1 questions – answer ALL)
Section B : Essay (4 questions – answer 3 questions)

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only

SECTION A

ESSAY (25 marks)

Instruction: This section consists of **ONE (1)** essay question. You are required to answer the question.

QUESTION 1

a) A circular water gate of 3m diameter is fixed onto the wall of a pool inclined at 60° to the water surface as shown in Figure 1. Calculate the hydrostatic force on the gate and determine the location of the centre of pressure. **[CLO 1]**

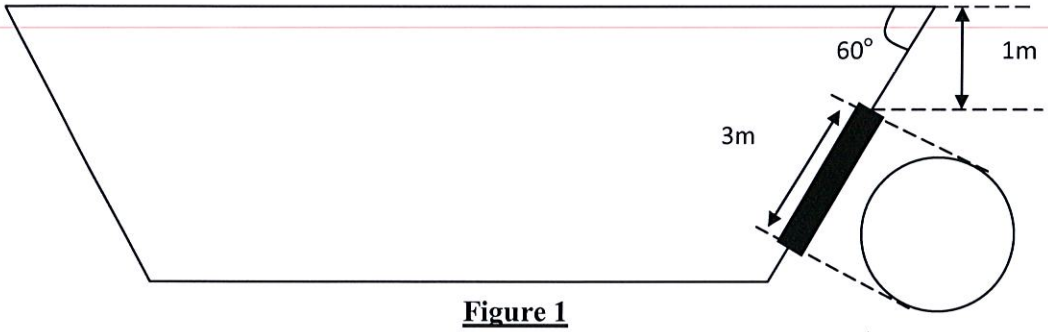

Figure 1

(12 marks)

b) Determine the total pressure per meter length acting on the curved gate AB, which is a quadrant of a cylinder of radius 1 metre as shown in Figure 2. **[CLO1]**

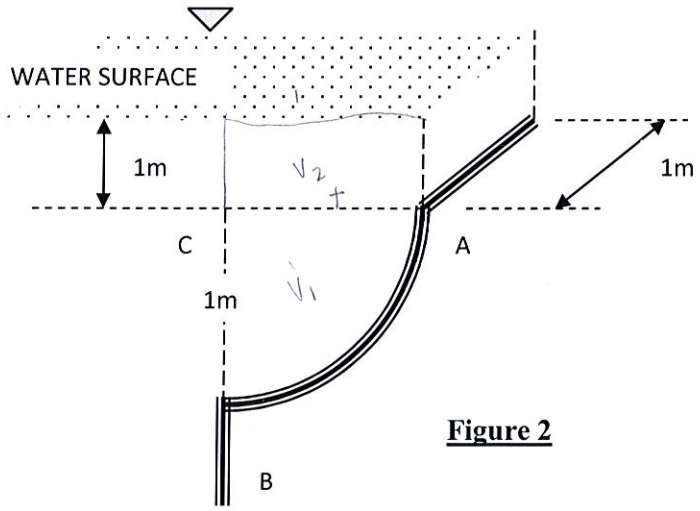

Figure 2

(13 marks)

SECTION B

ESSAY (75 marks)

Instruction: This section consists of **FOUR (4)** essay questions. Answer **THREE (3)** questions only.

QUESTION 1

a) A block of wood floats in water with specific gravity of 0.76. The size of block is 2m wide, 4m long and 1m high. Determine its metacentric height.

[CLO2]

(14 marks)

b) A cylindrical buoy with a diameter of 3 m, depth of 4 m and weighs 150 kN. Show that it cannot float vertically in water.

[CLO2]

(11 marks)

QUESTION 2

A curved pipe was deflected to reduce the pipe diameter from 600mm to 300mm. The deflection of fluid is 60^0. The pressure at the bend = $172kN/m^2$. Based in figure 2 below, calculate :

a) Magnitude of resultant force at the bend **[CLO2]**
(10 Marks)

b) Direction of resultant force **[CLO2]**
(15 Marks)

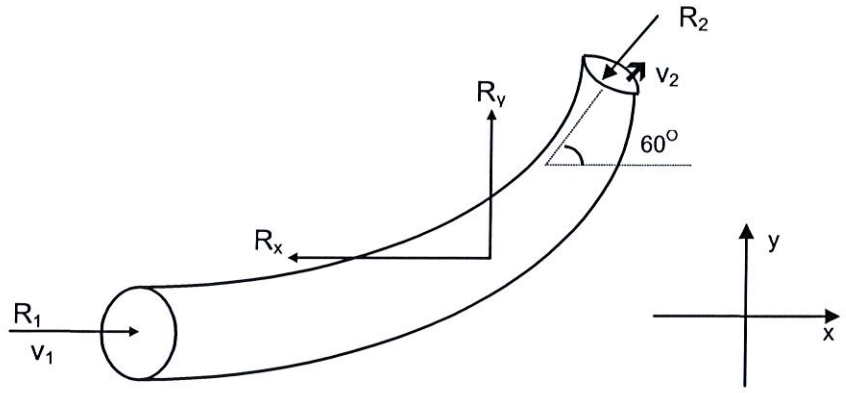

FIGURE 2

QUESTION 3

a. The discharge of water through a rectangular channel with the width of 6 m, is 18 m^3/s when the depth of flow of water is 2 m. Calculate : **[CLO3]**

i. Specific energy of the flowing water
ii. Critical depth
iii. Critical velocity
iv. Value of minimum specific energy

(16 marks)

b. The depth of flow of water, at certain section of a rectangular channel of 5 m width is 0.6 m. The discharge through the channel is 15 m^3/s. If the hydraulic jump takes place on the downstream side, find the depth of flow after the jump.

[CLO3]

(9 marks)

QUESTION 4

A pump is used to pump water as high as 15 m. A pipe will be used is 500 mm diameter and its total length is 2600 m. Friction coefficient of the pipe is 0.0025. Pump features at speeds 720 r.p.m. is as follows:

[CLO3]

Q (l/s)	0	100	200	300	350	400	500
H (m)	17	18	18	16	14	11.5	5
η(%)	0	30	61	82	85	80	47

i. Draw pump characteristic, system characteristic and the pump efficiency graph.

ii. In the graph, state value of flowrate, head and efficiency of pump at that operational point.

iii. Calculate and state power needed by pump at that operational point.

(Note: Neglect energy loss in pump)

(25 Marks)

CIVIL ENGINEERING DEPARTMENT
CC501 –HYDRAULICS 2

A. HYDROSTATIC FORCE

1. $Fx = \rho g A\hat{y}$
2. $Fy = \rho g V$
3. $h_p = \hat{y} + \frac{Igg}{A\hat{y}} . \sin^2\theta$

B. BUOYANCY AND FLOATATION

1. $MG = \frac{w \; x}{W \tan\theta}$
2. $MB = \frac{Igg}{V_s}$

C. MOMENTUM EQUATIONS

1. $F = \rho A V. (V_1 - V_2)$
2. $F = \rho A V^2 kos\theta$
3. $F = \rho A V^2 (1 + kos\theta)$
4. $F = \rho A V^2 \sin\theta$

D. NON-UNIFORM FLOW IN AN OPEN DUCT

1. $E = y + v^2/2g$
2. $yc = (q^2/g)^{1/3}$
3. $Sc = (qn / yc^{5/3})^2$
4. $y_2 = - y_1/2 + (y_1^2/4 + 2 q^2 /g y_1)^{1/2}$
5. $Fr = V / (gy)^{1/2}$
6. $y_1 = y_2/2 \; [\sqrt{}(1 + 8Fr_2^2) -1 \;]$

E. PUMP

1. $Po = \rho g H Q$
2. $Pi = 2\Pi N T$
3. $Hf = f l Q^2 / 3d^5$

4. $Hstm = Hstk + Hf$

5. $$\eta = \frac{Q}{(Q_A/\eta_A)+(Q_B/\eta_B)}$$

6. $$\eta = \frac{H}{(H_A/\eta_A)+(H_B/\eta_B)}$$