SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI DISEMBER 2014

CC501 : HYDRAULICS 2

TARIKH : 22 APRIL 2015
TEMPOH : 8.30 AM -10.30 AM (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.
Bahagian A: Struktur (10 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Kertas Graf, Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 40 MARKS
BAHAGIAN A : 40 MARKAH

INSTRUCTION:
This section consists of **TEN (10)** short questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **SEPULUH (10)** soalan pendek. Jawab semua soalan.*

CLO1
C1

QUESTION 1

Define the centroid and the center of pressure.

SOALAN 1

Takrifkan sentroid dan pusat tekanan.

[4 marks]
[*4 markah*]

CLO1
C2

QUESTION 2

Figure A2 shows a gate having a quadrant shape of 4m radius and 4m length. Calculate the horizontal force, F_H exerted on the gate.

SOALAN 2

***Rajah A2** menunjukkan pintu air berbentuk suku bulatan berjejari 4m dan 4m panjang. Kirakan daya ufuk, F_H yang bertindak pada pintu air tersebut.*

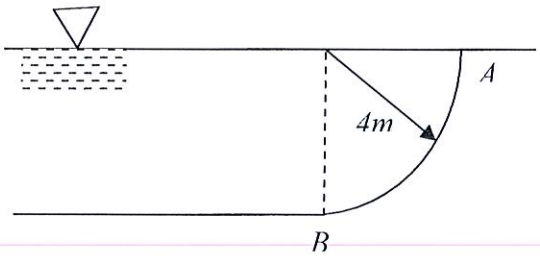


Figure A2 / *Rajah A2*

[4 marks]
[*4 markah*]

CLO 1
C1

QUESTION 3

Define the terms below;

i. Archimedes Principle

ii. Buoyancy Force

SOALAN 3

Takrifkan istilah di bawah ;

i. Prinsip Archimedes

ii. Daya keapungan

[4 marks]
[*4 markah*]

CLO1
C2

QUESTION 4

A wood block with a dimension 30 cm long, 25 cm wide and 20 cm height is floating in water with 20 percent of its volume is above the water surface. The woods is floating in stable equilibrium. Calculate the center of buoyancy, B from the bottom of the wood block.

SOALAN 4

Satu blok kayu dengan dimensi 30 cm panjang, 25 cm lebar dan 20 cm terapung dalam air dengan 20 peratus isipadunya berada di atas permukaan air. Kayu terapung dalam keseimbangan stabil. Kira pusat keapungan, B dari bahagian tapak blok kayu.

[4 marks]
[*4 markah*]

CLO1
C1

QUESTION 5

The momentum equation is widely used in the solution of hydraulic problems. List **FOUR (4)** uses of momentum equation.

SOALAN 5

*Persamaan momentum digunakan secara meluas dalam penyelesaian masalah hidraulik. Senarai **EMPAT (4)** penggunaan persamaan momentum.*

[4 marks]
[*4 markah*]

CLO 1
C2

QUESTION 6

Calculate the force exerted by a jet of water with diameter of 75mm on a stationary flat plate, when the jet strikes the plate normally with velocity of 20m/s.

SOALAN 6

Tentukan daya hentaman jet air berdiameter 75mm ke atas plat tegak yang pegun apabila jet menghentam permukaan secara normal pada halaju 20m/s.

[4 marks]
[*4 markah*]

CLO 2
C1

QUESTION 7

Define the condition of flow based on Froude Number.

SOALAN 7

Takrifkan keadaan aliran berdasarkan Nombor Froude.

[4 marks]
[*4 markah*]

CLO 2
C2

QUESTION 8

The flow rate of water through rectangular channel with dimension of 6 m width is $1.8m^3/s$. Calculate the critical depth (y_c).

SOALAN 8

Kadar aliran air melalui saluran segi empat tepat dengan dimensi 6 m lebar adalah $1.8m^3/s$. Kira ukur dalam genting (yc).

[4 marks]
[*4 markah*]

CLO 2
C1

QUESTION 9

State **TWO (2)** differences between Parallel Pump and Series Pump.

SOALAN 9

*Nyatakan **DUA (2)** perbezaan antara Pam Selari dan Pam Bersiri.*

[4 marks]
[*4 markah*]

CLO 2
C2

QUESTION 10

A pump with an inlet power of 1.46KW has been installed in a system to allow the air to flow at 25m of head. The density and the air flow rate is 1.25kg/m^3 and 3.1m^3/s respectively. Calculate the efficiency of the pump.

SOALAN 10

Sebuah pam dengan kuasa masukan 1.46KW dipasang pada satu sistem untuk mengalirkan udara pada turus 25m. Ketumpatan udara dan kadaralir adalah masing-masing 1.25kg/m^3 dan 3.1m^3/s, kirakan kecekapan pam tersebut.

[4 marks]
[*4 markah*]

SECTION B : 60 MARKS
BAHAGIAN B : 60 MARKAH

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

ARAHAN:
*Bahagian ini mengandungi **EMPAT(4)** soalan berstruktur. Jawab **TIGA (3)** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO1
C3

(a) An inclined rectangular sluice gate AB 1.20m x 5.00m, size as shown in **Figure B1** is installed to control the discharge of water. The end A is hinged. Calculate the hydrostatic force applied on the gate and the location of the center of pressure.

*Satu pintu air AB berbentuk segiempat tepat bersaiz 1.22m x 5.00m dipasang secara condong seperti yang ditunjukkan di dalam **Rajah B1** untuk mengawal aliran air. Hujung pintu A berada dalam keadaan tergantung. Tentukan daya hidrostatik terhadap pintu sluis serta kedudukan pusat tekanan terhadap pintu tersebut.*

[10 marks]
[*10 markah*]

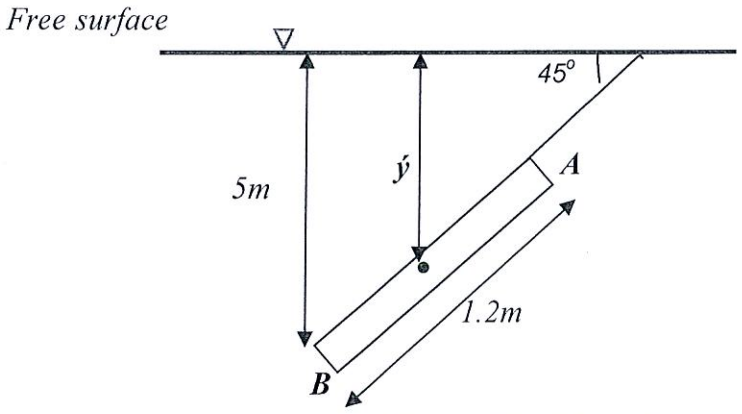


Figure B1 / *Rajah B1*

CLO1
C4

(b) Solid cylinder of 3m diameter has a height of 2m. Determine the location of metacenter of the cylinder when it is floating in water with its axis vertical. The density of the cylinder is 700kg/m^3.

Sebuah silinder padu bergaris pusat 3m dan tinggi 2m. Tentukan kedudukan pusat meta bila silinder tersebut terapung dalam keadaan tegak di dalam air. Ketumpatan silinder tersebut ialah 700kg/m^3.

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

CLO1
C3

(a) A water jet of 150 mm diameter moving at 25 meters per second strikes a stationary plate. Calculate the force exerted on the plate when

(i) the plate position is normal to the jet, and

(ii) the plate makes an angle of 34^{o} to the jet.

Sebuah jet air berdiameter 150 mm dan halaju 25 meter per saat menghentam sebuah plat pegun. Kira daya normal yang dikenakan terhadap plat apabila;

(i) plat dalam kedudukan normal terhadap jet, dan

(ii) plat dalam keadaan bersudut 34^{o} terhadap jet.

[6 marks]
[*6 markah*]

CLO1
C3

(b) A 35mm diameter water jet with a velocity of 28m/s, strikes a flat plate inclined at the angle of 25^{0} to the axis of the jet as shown in **Figure B2**. Calculate the normal force exerted to the plate:

i. When the plate static

ii. When the plate is moving at 4.5m/s in the direction of the jet, and

iii. When the plate is moving at 1m/s parallel to the plate

*Satu jet air yang berdiameter 35mm di hentam oleh pancutan air yang berkelajuan 28m/s pada kedudukan sudut condong 25^{0} seperti yang ditunjukkan dalam **Rajah B2**. Kirakan daya normal yang dikenakan pada plat tersebut jika :*

i. Bila plat dalam keadaan tidak bergerak

ii. Bila plat bergerak pada kelajuan 4.5m/s dalam arah jet air dan

iii. Bila plat bergerak pada kelajuan 1m/s selari dengan kecondongan plat

[14 marks]
[*14 markah*]

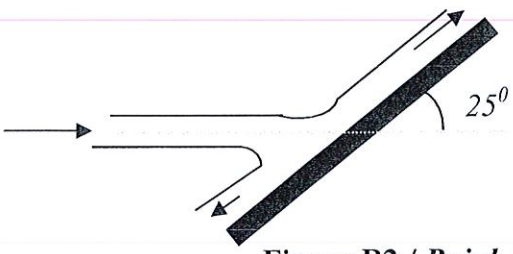


Figure B2 / *Rajah B2*

QUESTION 3
SOALAN 3

CLO2
C3

Water flows in a rectangular channel at a rate of $20m^3/s$, where the hydraulic jump occurred and assume the depth of upstream is 2.5m as shown as **Figure B3** below. Calculate:

i. depth of downstream, y_2 [6 marks]

ii. height of hydraulic jump, Δy [2 marks]

iii. velocity of downstream, v_2 [3 marks]

iv. Froude Number of downstream, Fr_2 [3 marks]

v. energy losses, E_L [3 marks]

vi. power of loss, P_L [3 marks]

*Air mengalir dalam saluran segi empat tepat pada kadar yang $20m^3/s$, di mana lompatan hidraulik berlaku dan menganggap kedalaman hulu adalah 2.5m seperti yang ditunjukkan seperti dalam **Rajah B3** di bawah. Tentukan:*

i. kedalaman di hilir, y_2 *[6 markah]*

ii. ketinggian lompatan hidraulik, Δy *[2 markah]*

iii. halaju di hilir, v_2 *[3 markah]*

iv. Nombor Froude di hilir, Fr_2 *[3 markah]*

v. kehilangan tenaga, E_L *[3 markah]*

vi. kuasa yang terlesap, P_L *[3 markah]*

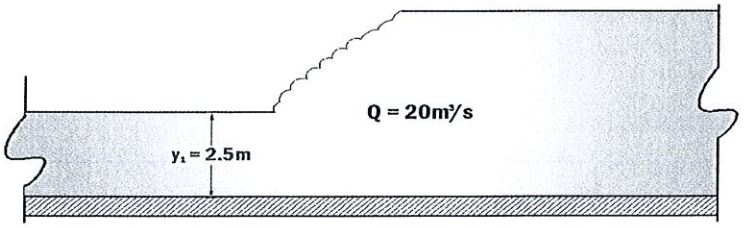


Figure B3 / *Rajah B3*

QUESTION 4
SOALAN 4

CLO2
C4

A centrifugal pump obtains performance as below when operates at the speed of 1500 rpm in a test.

Flow rate, Q (m^3/s)	0.075	0.150	0.200	0.250	0.300
Pump head, H_m (m)	70	68	64	58	49
Inlet power, (kW)	97	127	147	163	170

Pump is required to lift water from one sump to another sump which is located 60m high from sump level using 300mm diameter pipe (f=0.0025) and 120m long.

(i) Draw a graph for pump characteristic

(ii) Determine pump efficiency and flow rate at this speed (neglect minor loses).

Dalam satu ujian pam empar menghasilkan keupayaan seperti dibawah apabila beroperasi dengan kelajuan 1500 rpm.

Kadaralir, Q (m^3/s)	*0.075*	*0.150*	*0.200*	*0.250*	*0.300*
Tinggi Turus, H_m (m)	*70*	*68*	*64*	*58*	*49*
Kuasa Masuk, (kW)	*97*	*127*	*147*	*163*	*170*

Pam diperlukan untuk menghantar air dari satu kebuk ke satu kebuk dimana lokasinya 60m tinggi dari aras kebuk dengan menggunakan paip berdiameter 300mm (f=0.0025) dan 120m panjang.

(i) Plot graf ciri-ciri pam

(ii) Tentukan kecekapan pam dan kadaralir pada halaju tersebut (abaikan kehilangan kecil).

[20 marks]
[*20 markah*]

SOALAN TAMAT

CIVIL ENGINEERING DEPARTMENT
CC501 –HYDRAULICS 2

A. HYDROSTATIC FORCE

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

B. BUOYANCY AND FLOATATION

1. $MG = \_BM - BG$
2. $BM = \frac{I}{V}$

C. MOMENTUM EQUATIONS

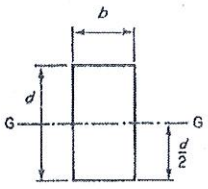
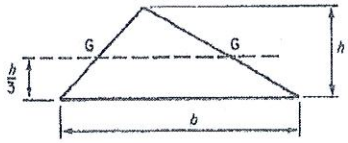
1. $F = \rho A v^2$
2. $F = \rho A(v- u)^2 \text{ kos } \theta$
3. $F = \rho A \left(v - \frac{(u)}{\text{kos}\theta}\right) (v \text{ kos } \theta - u)$
4. $Fx = \rho Q (v_{x1} - v_{x2})$
5. $Fy = \rho Q (v_{y1} - v_{y2})$
6. $\frac{P_1}{\rho g} + \frac{v_1}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2}{2g} + z_2$

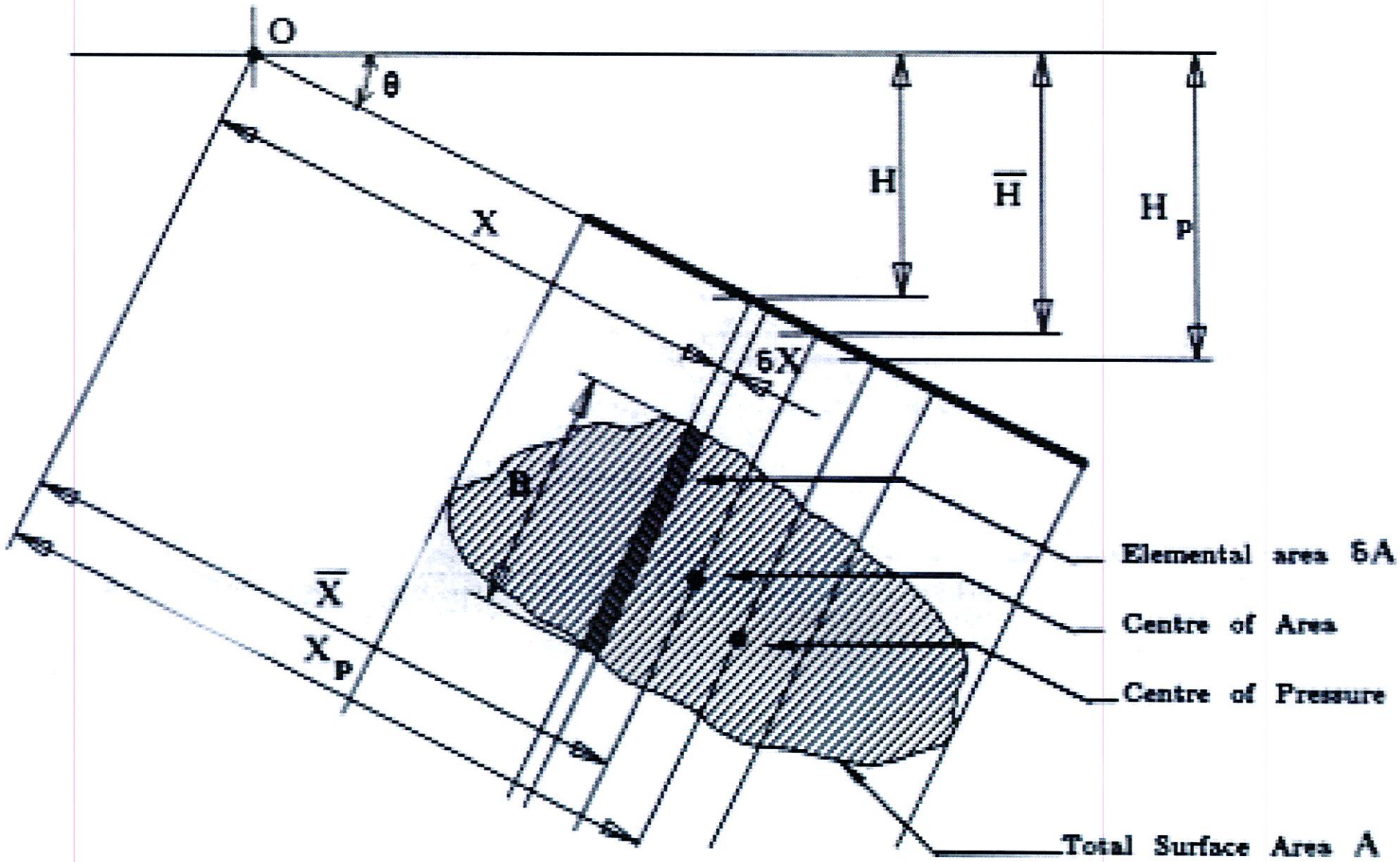
D. NON-UNIFORM FLOW IN AN OPEN DUCT

1. $E = y + v^2/2g$
2. $yc = (q^2/g)^{1/3}$
3. $E \text{ min} = 1.5\ y_c$
4. $Fr = v / (gy)^{1/2}$
5. $Q = A \left(\frac{1}{n}\right) m^{2/3} (i^{1/2})$
6. $y_1 = y_2/2\ [\sqrt{(1 + 8Fr_2^2)} -1]$
7. $P = \rho g Q \Delta E$
8. $\Delta E = \frac{(y_2 - y_1)^3}{4y_2y_1}$

E. PUMP

1. $Po = \rho g H Q$
2. $Pi = 2\Pi N T$
3. $Hf = f L Q^2 / 3D^5$
4. $Hs = Hstk + Hf$
5. $\eta = \dfrac{Q}{(Q_A / \eta_A) + (Q_B / \eta_B)}$
6. $\eta = \dfrac{H}{(H_A / \eta_A) + (H_B / \eta_B)}$
7. $\eta = \dfrac{\text{P output}}{\text{P input}}$

	Area A	Second moment of area I_{GG} about axis GG through the centroid
Rectangle 	bd	$\frac{bd^3}{12}$
Triangle 	$\frac{bh}{2}$	$\frac{bh^3}{36}$
Circle 	πR^2	$\frac{\pi R^4}{4}$


O
θ
H
$\overline{H}$
H_p
X
δX
B
$\overline{X}$
X_p
Elemental area δA
Centre of Area
Centre of Pressure
Total Surface Area A