SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

CC501 : HYDRAULICS 2

TARIKH : 27 OKTOBER 2015
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.
Bahagian A: Soalan Pendek (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)

SULIT

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.*

QUESTION 1

CLO1
C1

List **FOUR (4)** principles apply to hydrostatic pressure. → Archimedes, Newton's ~~1st~~ 2nd 3rd

SOALAN 1

*Senaraikan **EMPAT (4)** prinsip yang digunakan untuk menentukan tekanan hidrostatik.*

[4 marks]

[*4 markah*]

CLO1
C2

QUESTION 2

The circular-shape flood gate is hinged along its bottom as shown in **Figure A2**. Determine the horizontal force, F_H at the hinge in order to hold the gate steady.

SOALAN 2

Pintu penebat banjir berbentuk bulatan berengsel di bahagian bawah seperti dalam **Rajah A2**. *Tentukan daya horizontal, F_H untuk memastikan pintu berada dalam keaadan stabil.*

[4 marks]

[*4 markah*]

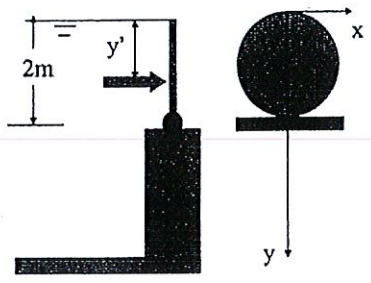


Figure A2 / *Rajah A2*

CLO 1
C1

QUESTION 3

Define the metacentric height of a floating body.

→ distance between meta centre and centre of buoyancy of a floating body

SOALAN 3

Takrifkan ketinggian pusat meta bagi jasad yang terapung.

[4 marks]

[*4 markah*]

CLO1
C2

QUESTION 4

If a piece of irregular shaped metal weighting 300N in air, is completely submerged in water, it weighs 232.5N. Calculate the volume of the metal.

SOALAN 4

Sekeping logam yang berbentuk tidak tetap mempunyai nilai berat di udara 300N tenggelam sepenuhnya di dalam air dengan berat di dalam air 235.5N. Kirakan isipadu logam tersebut.

[4 marks]

[*4 markah*]

CLO1
C1

QUESTION 5

Define Newton's Second Law of motion.

→ External force is required to produce change in momentum

SOALAN 5

Takrifkan Hukum Newton Kedua bagi gerakan.

[4 marks]

[*4 markah*]

CLO 1
C2

QUESTION 6

A jet of water with 8 cm diameter strikes a stationary plate with a certain velocity. The jet is inclined at an angle of 60° with the plate. If the normal force exerted on the plate is 3 kN, determine the velocity of the jet.

SOALAN 6

Satu jet air bergaris pusat 8 cm menghentam plat tetap dengan suatu halaju. Jet air tersebut condong pada sudut 60° dengan plat. Jika daya normal pada plat ialah 3 kN, tentukan halaju jet tersebut.

[4 marks]

[*4 markah*]

CLO 2
C1

QUESTION 7

Identify types of flow based on the condition of critical depth.

→ critical flow
- sub critical
- super critical

SOALAN 7

Kenal pasti jenis aliran dengan berpandukan kepada kedalaman kritikal.

[4 marks]

[*4 markah*]

CLO 2
C2

QUESTION 8

Given the depth of downstream channel $y_2 = 0.45$ m, velocity, $V_2 = 12.2$ m/s. Calculate the upstream Specific Energy, E_1.

$E = y + \frac{V^2}{2g}$

$0.45 + \frac{12.2^2}{2(9.81)}$

SOALAN 8

Diberi, kedalaman saluran di hilir $y_2 = 0.45$ m, halaju, $V_2 = 12.2$ m/s. Tentukan Tenaga Tentu di hulu saliran, E_1.

[4 marks]

[*4 markah*]

CLO 2
C1

QUESTION 9

List **FOUR (4)** cavitation effects on a pump.

→ low pressure at suction pipe
→ Vibration & noise
→ damage to pump components (metal)
→

SOALAN 9

*Senaraikan **EMPAT (4)** kesan kavitasi pada pam.*

[4 marks]

[*4 markah*]

CLO 2
C2

QUESTION 10

A centrifugal pump is required to lift water to a total head of 40 meters at the rate of 50 liter/s. Determine the power required for the pump, if its overall efficiency is 62%.

SOALAN 10

Sebuah pam empar digunakan untuk menyalurkan air pada ketinggian turus 40m dengan kadaralir 50 liter/s. Tentukan kuasa yang diperlukan oleh pam, jika jumlah kecekapan pam ialah 67%.

[4 marks]

[*4 markah*]

$\frac{50\,\text{L}}{\text{min}} \times \frac{1\,\text{m}}{60\,\text{s}}$

$\frac{50\,\text{L}}{60\,\text{s}} \times \frac{60\,\text{s}}{1\,\text{m}}$

$50\,\text{L/m}$

$62 = \frac{1.962 \times 10^{-5}}{P_{in}} \times 100\%$

$P_{in} = \frac{1.962 \times 10^{-5}}{62} \times 100$

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) Calculate the horizontal force (F_H) and vertical force (F_V), given by the fluid with relative density 0.9 to the curved blade as shown in the diagram below. The curved blade radius is 1.4 m and 2.9 m long. The upper edge of the curved blade from the water surface is 2.4 m.

Kirakan daya mendatar (F_H) dan daya menegak (F_V), oleh bendalir dengan ketumpatan bandingan 0.9 terhadap bilah melengkung seperti dalam rajah di bawah. Jejari bilah melengkung ialah 1.4 m dan panjangnya 2.9 m. Jarak hujung atas bilah melengkung ke permukaan air ialah 2.4 m.

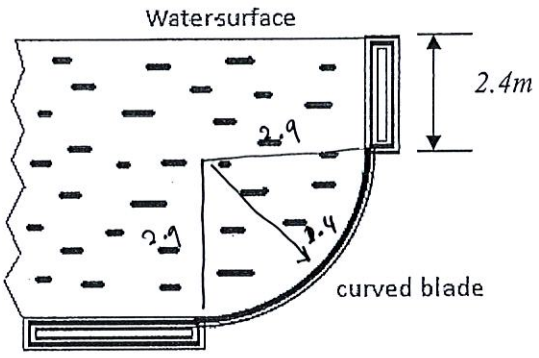


Figure B1 */ Rajah B1*

[10 marks]

[*10 markah*]

CLO1
C3

(b) Calculate the metacentric of a ferry crossing Selat Tebrau. The water density is 1029 kg/m^3. The ferry dimension is 40 m x 15 m x 10 m. The ferry mass is 700 tonnes metric.
Kirakan 'metacentric' sebuah feri yang merentasi Selat Tebrau. Dimensi feri ialah 40 m x 15 m x 10 m. Jisim feri ialah 700 tan metrik.

[10 marks]
[*10 markah*]

$A = 6000\ m^3$

QUESTION 2
SOALAN 2

$\rho g v$

CLO1
C4

A tapering pipe bend, from 500mm to 300mm in diameter, is installed to deviate the flow in a horizontal pipeline as shown in **Figure B2** below. The pressure at the inlet is 120kPa and the rate of flow is 500litres/sec. Determine the magnitude and direction of the resultant force acting on the pipe bend.

*Sebuah liku menirus dari garis pusat 500mm ke 300m, dipasang untuk memesongkan aliran air dalam talian paip mengufuk seperti yang ditunjukkan dalam **Rajah B2** di bawah. Diketahui tekanan pada alur masuk adalah 120kPa dan kadar aliran ialah 500liter/saat. Tentukan magnitud dan arah daya paduan yang bertindak ke atas liku tersebut.*

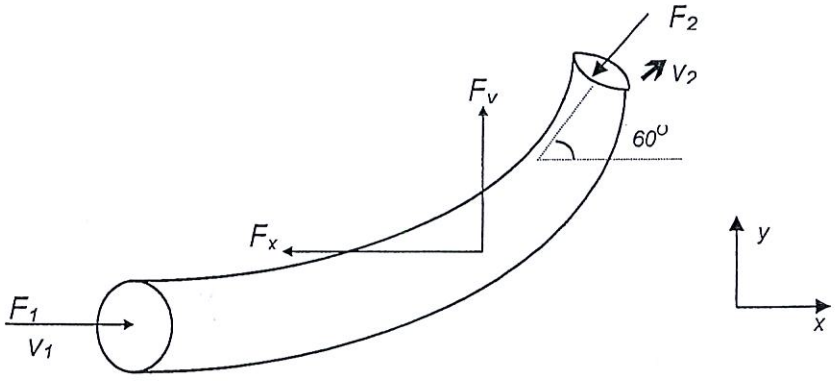


Figure B2/*Rajah B2*

[20 marks]
[*20 markah*]

CLO2
C3

QUESTION 3

SOALAN 3

A rectangular channel carrying supercritical stream is to be provided with a hydraulic jump type energy dissipated. If it is desired to have an energy loss, E_L of 5m in the jump when the inlet Froude Number is 8.5, calculate the sequent depths before jump y_1 and after jump y_2.

Suatu saluran segiempat tepat melesapkan tenaga melalui lompatan hidraulik secara super kritikal. Jika didapati kehilangan tenaga sebanyak 5m semasa lompatan dimana No. Froude sebelum lompatan adalah 8.5, kirakan kedalaman sebelum lompatan y_1 dan selepas lompatan y_2 yang diakibatkan daripada lompatan tersebut.

[20 marks]

[*20 markah*]

QUESTION 4

SOALAN 4

CLO2
C4

In a pump test, centrifugal pump running at 1800 rpm has the following characteristics data as shown in **Table B4** below.

i. Draw the graph of pump characteristics

ii. From the graph determine the head, efficiency and flow rate at optimum point.

iii. Calculate the inlet of power (Pi)

*Dalam satu ujian pam, pam empar yang beroperasi pada kelajuan 1800 rpm menghasilkan data ciri-ciri seperti yang ditunjukkan pada **Jadual B4** di bawah.*

i. lukiskan graf ciri-ciri pam

ii. *Tentukan turus, kecekapan dan kadar alir di titik optimum*

iii. . *Kirakan kuasa masuk pam (Pi)*

Table B4 / *Jadual B4*

Flow rate / *Kadaralir*, Q x 10^{-3} (m^3/s)	Q	36	56	70	83	94
Accelerationpump / *Turus pam*, H (m)	H	26	23.5	21	18.5	16
Efficiency / *Kecekapan*, η (%)	η	47	66	76	81	79
Head Static	Hs					

[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

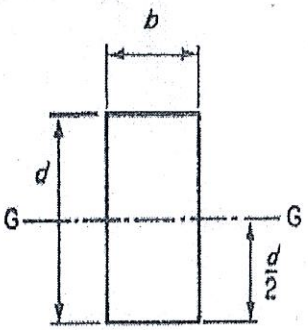
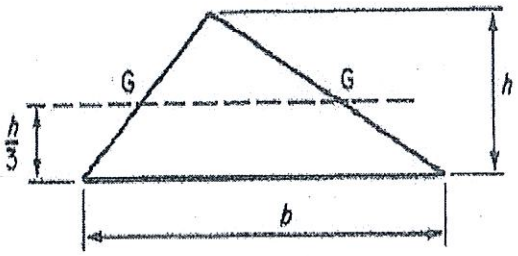
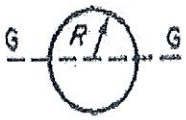
1. $F = \rho A v^2$
2. $F = \rho A(v- u)^2 \text{ kos } \theta$
3. $F = \rho A (v - \frac{(u)}{\text{kos}\theta}) (v \text{ kos } \theta - u)$
4. $Fx = \rho Q (v_{x1} - v_{x2})$
5. $Fy = \rho Q (v_{y1} - v_{y2})$
6. $\frac{P_1}{\rho g} + \frac{v_1}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2}{2g} + z_2$

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. $Q = A \frac{(1)}{n} m^{2/3} (i^{1/2})$
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	$\frac{\pi R^4}{4}$