SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DCC50222 : HYDRAULICS

TARIKH : 21 DISEMBER 2022
MASA : 02.30 PETANG - 04.30 PETANG (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.

Bahagian A: Struktur (2 soalan)
Bahagian B: Esei (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** structured questions. Answer **ALL** questions.
ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1 C2

(a) When a surface is submerged in a fluid, forces developed on the surface due to the fluid. Illustrate the position of hydrostatic force (F), centroid of object (G) and centre of pressure (P) acting on a plane surface submerged in a fluid.
Apabila permukaan terendam dalam bendalir, daya muncul pada permukaan disebabkan oleh bendalir tersebut. Lakarkan kedudukan daya hidrostatik (F), titik tengah objek (G) dan pusat tekanan (P) yang bertindak pada permukaan satah yang tenggelam di dalam bendalir tersebut.

[5 marks]
[*5 markah*]

CLO1 C3

(b) A triangular plate of 1.66 m base and 2.0 m height is immersed vertically in liquid as shown in Figure 1 (b) with specific weight of 10 kN/m^3. Calculate the total hydraulic force on the plate (F) and the depth of centre of pressure (h_p).
Sekeping plat segitiga berukuran 1.66 m pada tapak dan tinggi 2.0 m, tenggelam secara menegak di dalam cecair seperti yang ditunjukkan dalam Rajah 1 (b) dengan berat tentu 10 kN/m^3. Kirakan jumlah daya hidraulik pada plat (F) dan kedalaman pusat tekanan (h_p).

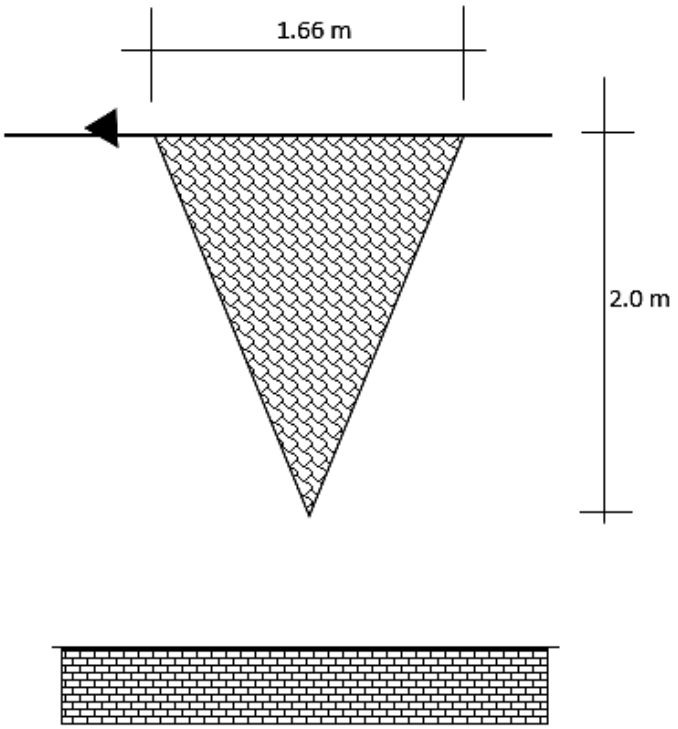


Figure 1 (b) / *Rajah 1 (b)*

[10 marks]

[*10 markah*]

CLO1
C3

(c) Calculate the horizontal and vertical force exerted by the fluid on the curved vane AB as shown in Figure 1 (c). Given the fluid density 800 kg/m^3, vane length 6.7 m and radius 15 m.

Kira daya mengufuk dan menegak yang dikenakan oleh bendalir pada ram melengkung AB seperti ditunjukkan dalam Rajah 1(c). Diberi ketumpatan bendalir 800 kg/m^3, panjang ram 6.7 m dan jejari 15 m.

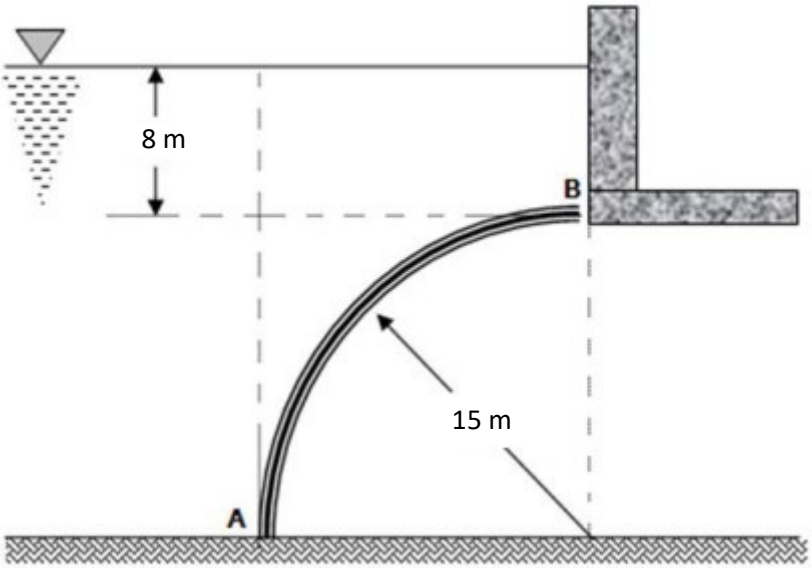


Figure 1 (c) / *Rajah 1 (c)*

[10 marks]
[10 *markah*]

QUESTION 2
SOALAN 2

CLO1
C2

(a) There are 3 types of equilibrium of floating bodies namely stable, unstable and neutral. Describe **TWO (2)** of them with a related diagram.

*Terdapat 3 jenis keseimbangan jasad terapung iaitu stabil, tidak stabil dan neutral. Huraikan **DUA (2)** daripadanya beserta gambarajah yang berkaitan.*

[5 marks]
[5 *markah*]

CLO1
C3

(b) A wooden block of length 3.0 m, width 1.25 m, depth 0.75 m and its float-water specific weight is 6.4 $\frac{kN}{m^3}$. Calculate:

i. Volume of water displaced (m^3), V_d
ii. Position of center of Buoyancy (m), OB

Bongkah kayu dengan panjang 3.0 m, lebar 1.25 m, dalam 0.75 m dan berat tentu 6.4 $\frac{kN}{m^3}$. Kirakan:

i. Isipadu air yang disesarkan (m^3), V_d
ii. Kedudukan pusat keapungan (m), OB

[10 marks]
[*10 markah*]

CLO1
C3

(c) A pontoon has mass of 70 tones and size of 8 m width, 20 m long and 3 m height. The pontoon is in the sea with a density of 1025 kg/m^3. Calculate metacentric if the pontoon is loaded with 1000 kg gravel stone.
Satu ponton mempunyai jisim 70 tan dan bersaiz 8 m lebar, 20 m panjang dan 3 m tinggi. Ponton tersebut berada di atas laut yang mempunyai ketumpatan 1025 kg/m^3. Kirakan pusat meta ponton apabila dibebani 1000 kg batu kerikil.

[10 marks]
[*10 markah*]

SECTION B : 50 MARKS

BAHAGIAN B : 50 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** essay questions. Answer **TWO (2)** questions only.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan esei. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2
C2

(a) Explain uniform flow in open channel.

Terangkan aliran seragam di dalam saluran terbuka.

[5 marks]

[*5 markah*]

CLO2
C3

(b) A trapezoidal channel carry water at a rate equal to 10 m^3/s, Manning's coefficient, n is 0.01 and bed slope is 0.0035. The side slope of this channel Z is 2:1. Determine the width (B) of this channel if the allowable velocity of flow is 2.5 m/s.

Saluran trapezoid membawa air pada kadar yang sama dengan 10 m^3/s, pekali Manning, n ialah 0.01 dan kecerunan dasar ialah 0.0035. Cerun sisi saluran Z ini ialah 2:1. Tentukan lebar dasar (B) saluran ini jika halaju aliran yang dibenarkan ialah 2.5 m/s.

[10 marks]

[*10 markah*]

CLO2
C3

(c) An open trapezium channel with side slope 1:2, bottom slope 1:4000 and the depth is 1.25 m. Using Manning coefficient, n = 0.025, calculate discharge in m^3/s as shown in Figure C1.

Sebuah saluran terbuka berbentuk trapezium mempunyai kecerunan sisi 1:2, cerun dasar saluran ini ialah 1:4000 dan kedalaman air ialah 1.25 m. Dengan menggunakan pekali Manning, n= 0.025, kirakan kadaralir dalam m^3/s seperti rajah C1.

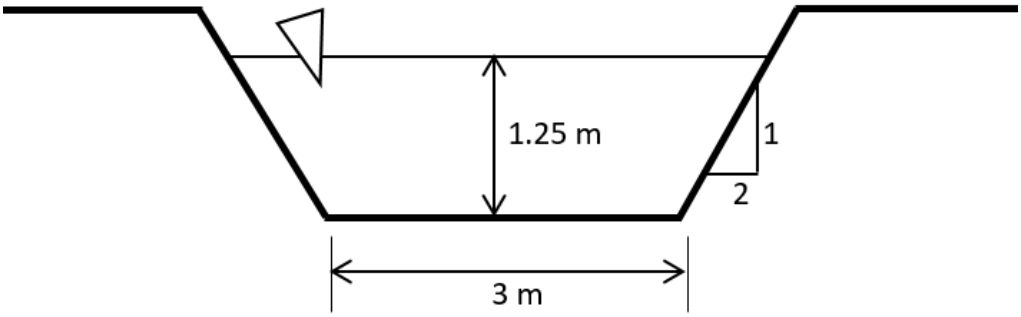


Figure C1 / *Rajah C1*

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

CLO2
C2

(a) Explain hydraulic gradient.
Terangkan kecerunan hidraulik.

[5 marks]
[*5 markah*]

CLO2 C3

(b) A cement-lined rectangular channel 6 m wide carries water at the rate of 20 m^3/s. Calculate the value of Manning's coefficient, if the slope required to maintain a depth of 1.5 m is 1/625.

Saluran segi empat tepat berlapik simen selebar 6 m membawa air pada kadar 30 m^3/s. Kira nilai pekali Manning, jika keperluan cerun untuk mengekalkan kedalaman 1.5m ialah 1/625.

[10 marks]

[*10 markah*]

CLO2 C3

(c) A trapezoidal channel is required to flow the water of 20 m^3/s at the minimum cross section. Determine the best cross section for the channel if the base gradient is 1: 1200. Take the side gradient is 2 verticals: 3 horizontal and n = 0.014.

Satu saluran trapezoid dikehendaki mengalirkan air sebanyak 20 m^3/s pada keratan rentas paling minimum. Tentukan keratan rentas terbaik untuk saluran berkenaan jika kecerunan dasar ialah 1: 1200. Ambil kecerunan sisi ialah 2 menegak : 3 mengufuk dan n = 0.014.

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO2 C2

(a) With the aid of a diagram sketch, describe the definition of specific energy.

Dengan bantuan lakaran gambarajah, terangkan definisi bagi tenaga tentu.

[5 marks]

[*5 markah*]

CLO2
C3

(b) A flow rate of water through an open rectangular channel is 35 m^3/s. Given that width of channel and depth of water are 12 m and 1.2 m. Determine:
Kadaralir bagi air yang melalui saliran segiempat tepat terbuka adalah 35 m^3/s. Diberikan lebar saliran dan kedalaman air adalah 12 m dan 1.2 m Tentukan:

(i) Specific energy
Tenaga tentu

(ii) Froude number
Nombor Froud

(iii) Types of flow
Jenis aliran

[10 marks]
[*10 markah*]

CLO2
C3

(c) An open rectangular channel with 7 m wide flowing water at rate of 21 m^3/s. Given that Manning's roughness coefficient is 0.012. Determine:
Sebuah saliran segiempat tepat terbuka dengan lebar 7 m mengalirkan air pada kadaralir 21 m^3/s. Diberikan pekali kekasaran Manning adalah 0.012. Tentukan:

(i) Critical depth
Kedalaman kritikal

(ii) Critical velocity
Halaju kritikal

(iii) Minimum specific energy
Tenaga tentu minima

(iv) Hydraulic gradient
Kecerunan hidraulik

[10 marks]
[*10 markah*]

QUESTION 4
SOALAN 4

CLO2 C2 (a) Describe **FIVE (5)** uses of hydraulic jump.

*Huraikan **LIMA (5)** kegunaan lompatan hidraulik.*

[5 marks]
[*5 markah*]

CLO2 C3 (b) A hydraulic jump occurs in a 3.2 m wide rectangular channel, flow depth before the jumps 0.72 m. Discharge in the channel is 13.5 m^3/s. Determine:
Lompatan hidraulik berlaku dalam saluran segi empat tepat selebar 3.2 m, kedalaman aliran sebelum lompatan 0.72 m. Kadar alir dalam saluran ialah 13.5 m^3/s. Tentukan:

(i) Flow depth after the jump
Kedalaman aliran selepas lompatan
(ii) Type of jump
Jenis lompatan
(iii) Energy loss and power due to jump
Kehilangan tenaga dan kuasa berdasarkan lompatan

[10 marks]
[*10 markah*]

CLO2
C3

(c) Water flows at the rate of 1 m^3/s along a channel of rectangular section of 1.6 m width. If a standing wave occurs at a point where upstream depth is 250 mm. Calculate:

Air mengalir pada kadar 1 m^3/s di sepanjang saluran keratan segi empat tepat dengan lebar 1.6 m. Jika ombak berlaku pada titik di mana kedalaman hulu 250 mm. Kirakan:

(i) The increase value in water level after the hydraulic jump.
Nilai peningkatan aras air selepas lompatan hidraulik

(ii) Loss head of water
Kehilangan turus air

[10 marks]
[*10 markah*]

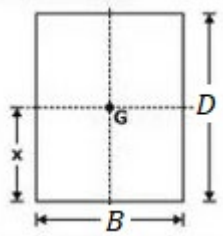
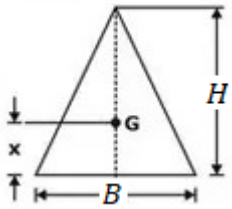
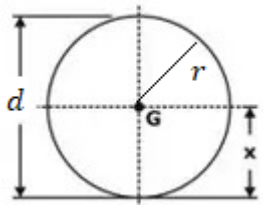
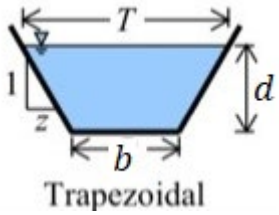
Notes
Assessment items for this course have covered elements of the Dublin Problem: DP1, DP2 and DP3 as mention in FEIST.

SOALAN TAMAT

FORMULA DCC50222 : HYDRAULICS

1. $F_R = \rho g h_{cg} A$	12. $F_{r1} = \frac{v_1}{\sqrt{(g y_1)}}$
2. $h_{cp} = \frac{I_c \sin^2\theta}{A\, h_{cg}} + h_{cg}$	13. $v_c = \sqrt{g\ y_c}$
3. $F_V = \rho g V$	14. $E_{min} = \frac{3}{2}\ y_c$
4. $F_R = \sqrt{(F_H)^2 + (F_V)^2}$	15. $E = y + \left[\frac{Q^2}{2gA^2}\right]$
5. $tan\ \alpha = \frac{F_V}{F_H}$	16. $y_c = \left[\frac{Q^2}{b^2 g}\right]^{\frac{1}{3}}$
6. $W = \rho_b\ xg\ x\ V_b$	17. $y_1 = \frac{y_2}{2}\left[\sqrt{1 + (8{Fr_2}^2)} - 1\right]$
7. $F_B = \rho_f\ xg\ x\ V_d$	18. $y_2 = \frac{y_1}{2}\left[\sqrt{1 + (8{Fr_1}^2)} - 1\right]$
8. $BM = \frac{I_C}{V_d}$	19. $E_L = \frac{(y_2 - y_1)^3}{4 y_2 y_1}$
9. $m = \left[\frac{A}{P}\right]$	20. $P = \rho Q g E_L$
10. $Q = \frac{Am^{\left(\frac{2}{3}\right)} i^{\left(\frac{1}{2}\right)}}{n}$	
11. $b + 2zd = 2d\sqrt{1 + z^2}$	

Geometric Properties of Plane Surface & Open Channel Flow Section

Plane surface	C.G from the base	Area,A	Moment of Inertia about an axis passing through C.G and parallel to base (I_c)	Wetted perimeter, P
Rectangle 	$x = \frac{D}{2}$	BD	$\frac{BD^3}{12}$	$b + 2d$
Triangle 	$x = \frac{H}{3}$	$\frac{1}{2}BH$	$\frac{BH^3}{36}$	$2 \times \frac{d}{\cos\theta}$
Circle 	$x = \frac{d}{2}$	$\frac{\pi d^2}{4}$ @ πr^2	$\frac{\pi d^4}{64}$ @ $\frac{\pi r^2}{4}$	½ θd
 Trapezoidal	-	$d(b + zd)$	-	$b + 2d\sqrt{1 + z^2}$