

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 **DUA BELAS (12)** 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)

SULIT

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 A1(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 A1(b) dengan berat tentu 10 kN/m^3 . Kirakan jumlah daya hidraulik pada plat (F) dan kedalaman pusat tekanan (h_p).

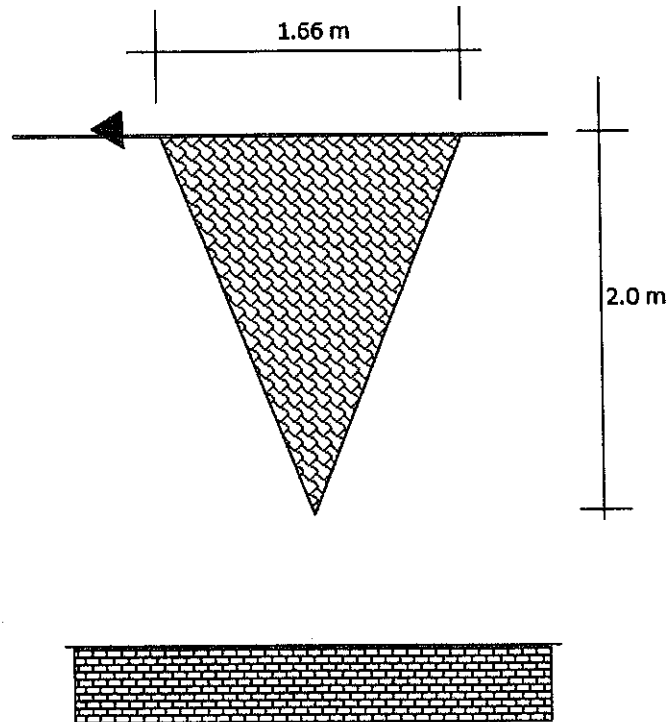


Figure A1 (b) / Rajah A1 (b)

[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 A1(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 A1(c). Diberi ketumpatan bendalir 800 kg/m^3 , panjang ram 6.7 m dan jejari 15 m .

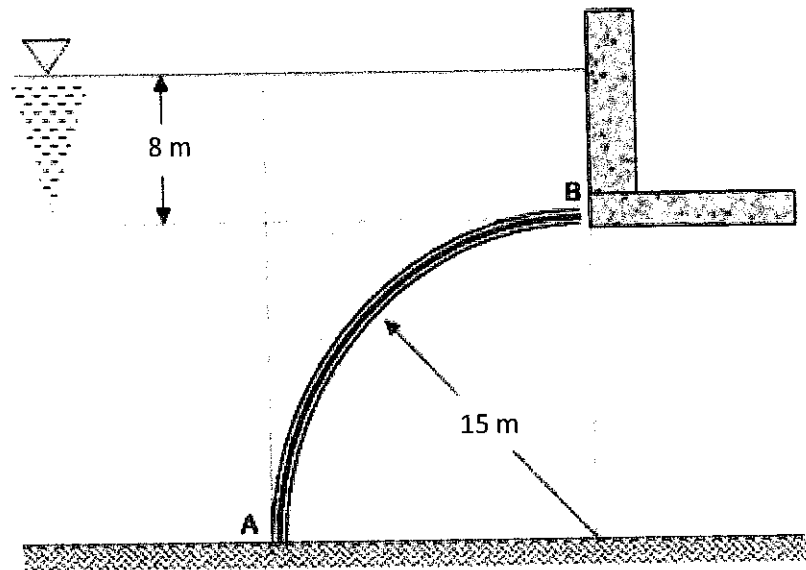


Figure A1 (c) / Rajah A1 (c)

[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 $10 \text{ m}^3/\text{s}$, 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 $10 \text{ m}^3/\text{s}$, 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 B1(c).

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 kadar alir dalam m^3/s seperti Rajah B1(c).

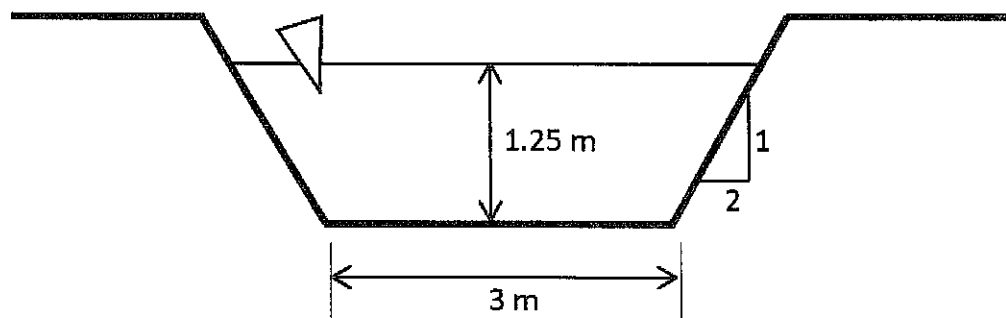


Figure B1(c) / Rajah B1(c)

[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 $20 \text{ m}^3/\text{s}$. 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 berlapis simen selebar 6 m membawa air pada kadar $20 \text{ m}^3/\text{s}$. 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 $20 \text{ m}^3/\text{s}$ 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 $20 \text{ m}^3/\text{s}$ 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 $35 \text{ m}^3/\text{s}$. Given that width of channel and depth of water are 12 m and 1.2 m. Determine:

Kadar alir bagi air yang melalui saliran segiempat tepat terbuka adalah $35 \text{ m}^3/\text{s}$.

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 $21 \text{ m}^3/\text{s}$.
Given that Manning's roughness coefficient is 0.012. Determine:

Sebuah saluran segiempat tepat terbuka dengan lebar 7 m mengalirkan air pada kadar alir $21 \text{ m}^3/\text{s}$. 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
- $13.5 \text{ m}^3/\text{s}$
- . 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 $13.5 \text{ m}^3/\text{s}$. 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 $1 \text{ m}^3/\text{s}$ 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 $1 \text{ m}^3/\text{s}$ 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.

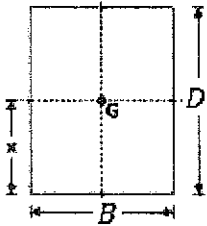
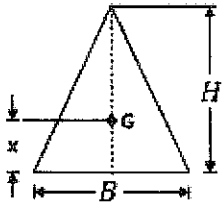
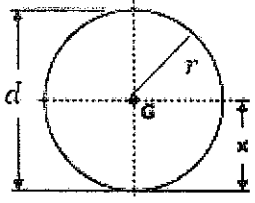
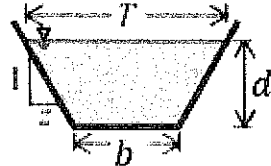
SOALAN TAMAT

FORMULA

DCC50222- HYDRAULICS

1. $F_R = \rho g h_{cg} A$	12. $F_{r1} = \frac{v_1}{\sqrt{(gy_1)}}$
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. $W = \rho_b x g x V_b$	17. $y_1 = \frac{y_2}{2} \left[\sqrt{1 + (8Fr_2^2)} - 1 \right]$
7. $F_B = \rho_f x g x V_d$	18. $y_2 = \frac{y_1}{2} \left[\sqrt{1 + (8Fr_1^2)} - 1 \right]$
8. $BM = \frac{I_c}{V_d}$	19. $E_L = \frac{(y_2 - y_1)^3}{4y_2 y_1}$
9. $m = \left[\frac{A}{P} \right]$	20. $P = \rho Q g E_L$
10. $Q = \frac{Am(\frac{2}{3})_t(\frac{1}{2})}{n}$	
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	$\frac{\pi d^4}{64}$ @ $\frac{\pi r^4}{4}$	$\frac{1}{2} \theta d$
 Trapezoidal	-	$d(b + zd)$	-	$b + 2d\sqrt{1 + z^2}$

