SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2022/2023

DCC50222 : HYDRAULICS

TARIKH : 15 JUN 2023
MASA : 8.30 PG – 10.30 PG (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Bahagian A: Subjektif (2 soalan)
Bahagian B: Subjektif (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)** subjective questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Describe the centre of gravity and centre of pressure in hydrostatic.

Huraikan pusat graviti dan pusat tekanan dalam hidrostatik.

[4 marks]

[*4 markah*]

CLO1 (b) Identify the vertical force exerted by the fluid on the curved vane BC as shown in Figure A1(b). Given the fluid density of 900 kg/m^3, vane length of 2.0 m and radius of 4.0 m.

Kenal pasti daya menegak yang dikenakan oleh bendalir pada ram melengkung BC seperti ditunjukkan dalam Rajah A1(b). Diberi ketumpatan bendalir 900 kg/m^3, Panjang ram 2.0 m dan jejari 4.0 m.

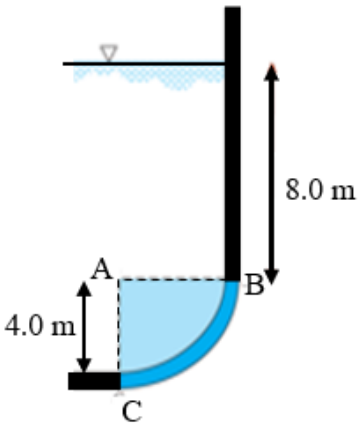


Figure A1(b) / *Rajah A1(b)*

[6 marks]

[*6 markah*]

CLO1 (c) A triangular plate of 1.0 m base and 2.0 m height is immersed in liquid, as shown in Figure A1(c), with specific gravity of 0.8. Calculate the total hydrostatic force on the plate *(F_R)* and location of the centre of pressure *(h_p)*.

Sekeping plat segitiga berukuran 1.0 m pada tapak dan tinggi 2.0 m tenggelam seperti yang ditunjukkan dalam Rajah A1(c) dengan graviti tentu 0.8. Kirakan jumlah daya hidrostatik pada plat (F_R) dan kedudukan pusat tekanan (h_p).

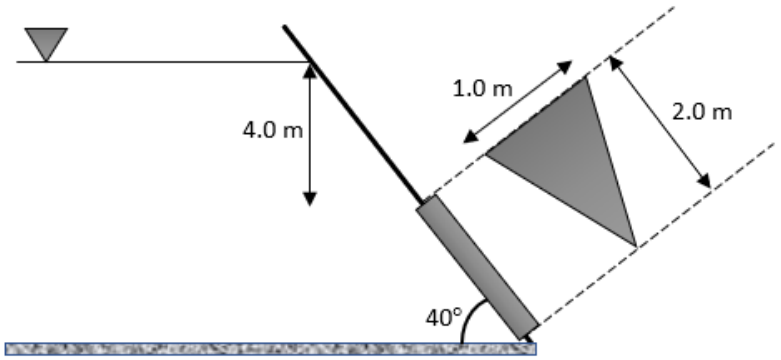


Figure A1(c) / *Rajah A1(c)*

[15 marks]

[*15 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Describe the Archimedes principle for buoyancy force using appropriate diagram.

Huraikan prinsip Archimedes untuk daya apungan menggunakan gambarajah yang sesuai.

[4 marks]

[*4 markah*]

CLO1 (b) A block of wood with specific gravity = 0.7 is partially submerged in water. The dimension of the wood is 50.0 cm x 30.0 cm x 20.0 cm as shown in Figure A2(b). Estimate the height of the block that is above the water.

Sebuah bongkah kayu dengan gravity tentu = 0.7 terendam sebahagian di dalam air. Dimensi kayu ialah 50.0 cm x 30.0 cm x 20.0 cm seperti ditunjukkan dalam Rajah A2(b). Anggarkan ketinggian bongkah kayu yang berada di atas air.

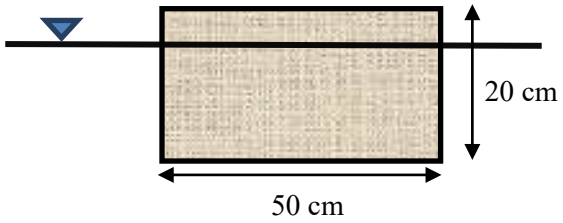


Figure A2(b) / *Rajah A2(b)*

[6 marks]

[*6 markah*]

CLO1 (c) A solid buoy cylinder with a specific gravity of 0.8 is used in seawater with 1.25 specific gravity. The buoy cylinder with a 3.0 m diameter and 3.0 m height is floating upright. Calculate its meta centric height.

Pelampung silinder pepejal dengan graviti tentu 0.8 digunakan dalam air laut dengan graviti tentu 1.25. Pelampung silinder dengan diameter 3.0 m dan ketinggian 3.0 m terapung secara menegak. Kirakan ketinggian pusat meta.

[15 marks]

[*15 markah*]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** subjective questions. Answer **TWO (2)** questions only.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO2 (a) Describe uniform flow and non-uniform flow in an open channel.
Huraikan aliran seragam dan aliran tidak seragan di dalam saluran terbuka.

[4 marks]
[*4 markah*]

CLO2 (b) Water flows through an open rectangular channel with a width base of 6.0 m and a bed slope of 1 in 1000. If the Manning coefficient for the channel is 0.013 and a steady flow depth is 400 cm along the channel, calculate the velocity of flow.
Air mengalir melalui saluran segi empat tepat terbuka dengan lebar 6.0 m dan cerun dasar 1 dalam 1000. Jika pekali Manning untuk saluran itu ialah 0.013 dan kedalaman aliran tetap ialah 400 cm disepanjang saluran, kirakan halaju aliran.

[9 marks]
[*9 markah*]

CLO2 (c) Water flows uniformly through an open trapezium channel at 1.0 m depth. The width base of the channel is 5.0 m and the side slope is 1V:2H on both sides. Calculate the water discharge if a bed slope of channel is 1 in 1000 and the Manning's coefficient, n = 0.045.

Air mengalir secara seragam melalui saluran trapezium terbuka pada kedalaman 1.0 m. Lebar dasar saluran ialah 5.0 m dan kecerunan sisi 1V:2H pada kedua-dua belah. Kirakan kadar alir jika cerun dasar saluran ialah 1 dalam 1000 dan pekali Manning, n = 0.045.

[12 marks]

[*12 markah*]

QUESTION 2

SOALAN 2

CLO2 (a) Describe the wetted perimeter and bed slope.

Huraikan perimeter basah dan kecerunan dasar.

[4 marks]

[*4 markah*]

CLO2 (b) Water flows through half of circular channel with a diameter of 1.5 m. Calculate the bed slope required if the flow rate of water is 0.83 m^3/s and the Manning coefficient of roughness is 0.01.

Air mengalir melalui saluran separuh bulatan yang diameter 1.5 m. Kirakan kecerunan dasar paip pembetung tersebut jika kadar alir air ialah 0.83 m^3/s dan pekali kekasaran Manning ialah 0.01.

[9 marks]

[*9 markah*]

CLO2 (c) A rectangular glazed brick channel has to carry a flow rate of 0.42 m³/s of water. If the bed slope is 0.0005 and the Manning coefficient is 0.013, calculate the most effective cross-section channel.
Sebuah saluran bata kaca berbentuk segiempat tepat perlu membawa kadar alir sebanyak 0.42 m³/s air. Jika kecerunan dasar ialah 0.0005 dan pekali Manning ialah 0.013, kirakan keratan rentas yang paling berkesan bagi saluran tersebut.

[12 marks]
[*12 markah*]

QUESTION 3
SOALAN 3

CLO2 (a) Explain supercritical flow.
Terangkan aliran superkritikal.

[4 marks]
[*4 markah*]

CLO2 (b) Water flows at the rate of 7.3 m^3/s through an open channel of a rectangular section with 3.5 m of width. If a wave occurs at a point where the upstream depth is 500 mm, determine the height of the hydraulic jump.
Air mengalir pada kadar 7.3 m^3/s melalui saluran terbuka keratan segi empat tepat dengan lebar 3.5 m. Jika gelombang berlaku pada titik di mana kedalaman hulu ialah 500 mm, tentukan ketinggian lompatan hidraulik.

[9 marks]
[*9 markah*]

CLO2 (c) Water flowing in an open channel with a flow rate per unit width of 12 m³/s/m and an upstream depth of 1.5 m. If the flow produces a hydraulic jump, calculate the depth after the jump, velocity after the jump and energy loss.
Air yang mengalir dalam saluran terbuka dengan kadar aliran per unit lebar, sebanyak 12 m³/s/m dan kedalaman hulu 1.5 m. Jika aliran menghasilkan lompatan hidraulik, kirakan kedalaman selepas lompatan, halaju selepas lompatan dan kehilangan tenaga.

[12 marks]
[*12 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) With an aid of a diagram, explain specific energy in open channel.
Dengan bantuan gambar rajah, terangkan tenaga tentu dalam saluran terbuka.

[4 marks]
[*4 markah*]

CLO2 (b) A rectangular channel carrying supercritical stream is having an energy loss of 0.8 m in the jump. Calculate the sequent depth before jump and after jump if the inlet Froude Number is 1.78.
Saluran segi empat tepat yang membawa aliran superkritikal mengalami kehilangan tenaga sebanyak 0.8 m dalam lompatan. Kirakan kedalaman urutan sebelum lompatan dan selepas lompatan jika Nombor Froude masuk ialah 1.78.

[9 marks]
[*9 markah*]

CLO2 (c) A rectangular open channel with a width of 5.0 meter is carrying water at 11000 liter/s. If the velocity of the water is 2.4 m/s, calculate specific energy of the flowing water, critical depth, critical velocity and type of flow.
Sebuah saluran terbuka berbentuk segi empat tepat dengan lebar 5.0 meter sedang membawa air pada kadar 11000 liter/s. Jika halaju air ialah 2.4 m/s, kirakan tenaga tentu air yang mengalir, kedalaman kritikal, halaju kritikal dan jenis aliran.

[12 marks]
[*12 markah*]

SOALAN TAMAT

FORMULA DCC50222: HYDRAULICS

HYDROSTATIC FORCE

$$F_R = \rho g h_{cg} A$$

$$h_{cp} = \frac{I_c \sin^2\theta}{A\, h_{cg}} + h_{cg}$$

$$F_H = \rho g h_{cg} A$$

$$F_V = \rho g V$$

$$F_R = \sqrt{(F_H)^2 + (F_V)^2}$$

$$\alpha = \tan^{-1}\left(\frac{F_V}{F_H}\right)$$

$$h_{cp} = \frac{F_1\left(\frac{2}{3}h_1\right) - F_2\left(\frac{2}{3}h_2\right)}{F_R}$$

$$F_1 = \frac{1}{2}(\rho_1 g h_1) h_1 L$$

$$F_2 = (\rho_1 g h_1) h_2 L$$

$$F_3 = \frac{1}{2}(\rho_2 g h_2) h_2 L$$

$$F_R = F_1 + F_2 + F_3$$

$$F_R = F_1 - F_2$$

$$h_{cp} = \frac{2}{3}H$$

$$h_{cp} = \frac{F_1\left(\frac{2}{3}h_1\right) + F_2\left(\frac{h_2}{2} + h_1\right) + F_3\left(\frac{2}{3}h_2 + h_1\right)}{F_R}$$

BUOYANCY AND FLOATATION

$$W = \rho_b g V_b$$

$$F_B = \rho_f g V_d$$

$$BG = OG - OB$$

$$BM = \frac{I_C}{V_d}$$

$$GM = BM - BG$$

UNIFORM OPEN CHANNEL

$$v = \frac{R^{\left(\frac{2}{3}\right)} S_o^{\left(\frac{1}{2}\right)}}{n}$$

$$Q = \frac{A R^{\left(\frac{2}{3}\right)} S_O^{\left(\frac{1}{2}\right)}}{n}$$

$$R = \frac{A}{P}$$

Best hydraulics cross section

Rectangular

$$b = 2y$$

Trapezoidal

$$b + 2zd = 2d\sqrt{1 + z^2}$$

NON-UNIFORM OPEN CHANNEL

$$Q = Av$$

$$E = y + \left[\frac{v^2}{2g}\right]$$

$$E = y + \left[\frac{Q^2}{2gA^2}\right]$$

$$F_r = \frac{v}{\sqrt{gy}}$$

$$y_1 = \frac{y_2}{2}\left[\sqrt{1 + (8{Fr_2}^2)} - 1\right]$$

$$y_2 = \frac{y_1}{2}\left[\sqrt{1 + (8{Fr_1}^2)} - 1\right]$$

$$\Delta y = y_2 - y_1$$

$$v_c = \sqrt{g\, y_c}$$

$$y_c = \left[\frac{Q^2}{b^2 g}\right]^{\frac{1}{3}}$$

$$y_c = \left[\frac{q^2}{g}\right]^{\frac{1}{3}}$$

$$E_{min} = \frac{3}{2} y_c$$

$$E_L = \frac{(y_2 - y_1)^3}{4 y_2 y_1}$$

$$P = \rho Q g E_L$$

Table A1: *Geometric Properties of Plane Surface*

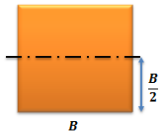
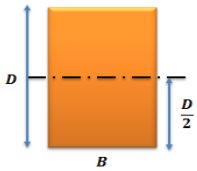
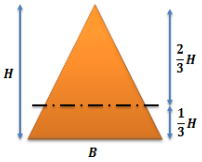
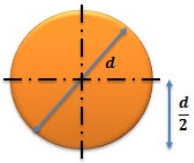
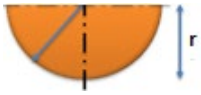
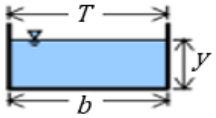
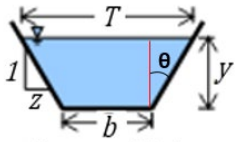
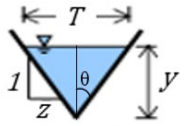
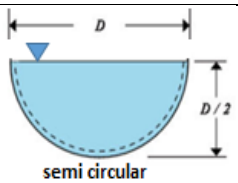
	Square	Rectangle	Triangle	Circle	Semi-circle
Shape					
Area	$A = B^2$	$A = BD$	$A = \frac{1}{2} BH$	$A = \frac{\pi d^2}{4}$	$A = \frac{\pi r^2}{2}$
I_c	$I_c = \frac{B^4}{12}$	$I_c = \frac{BD^3}{12}$	$I_c = \frac{BH^3}{36}$	$I_c = \frac{\pi d^4}{64}$	$I_c = 0.1102 r^4$

Table A2: *Geometry of open channel section*

Section	Area, A (m^2)	Wetted Perimeter, P (m)	Top Width (m)
 Rectangular	$A = by$	$P = b + 2y$	$T = b$
 Trapezoidal	$A = by + zy^2$ $A = by + y^2 \tan\theta$	$P = b + 2y\sqrt{1+z^2}$ $P = b + \frac{2y}{\cos\theta}$	$T = b + 2zy$ $T = b + 2y\tan\theta$
 Triangular	$A = zy^2$ $A = y^2 \tan\theta$	$P = 2zy$ $P = \frac{2y}{\cos\theta}$	$T = 2zy$ $T = 2y\tan\theta$
 semi circular	$A = \frac{\pi r^2}{2}$ $A = \frac{\pi D}{8}$	$P = \pi r$ $P = \frac{\pi D}{2}$	$T = D$