

SULIT



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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022 / 2023

DCB20062: FLUID MECHANICS

TARIKH : 28 DISEMBER 2022

MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Bahagian A: Esei (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)** essay questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan esei. Jawab SEMUA soalan.

QUESTION 1***SOALAN 1***

- | | | |
|-------------|--|-----------------------------------|
| CLO 1
C2 | <p>(a) Explain the difference between liquid and gas.</p> <p><i>Terangkan perbezaan antara cecair dan gas.</i></p> | <p>[5 marks]
[5 markah]</p> |
| CLO 1
C2 | <p>(b) The characteristics of a continuous fluid which are independent from the motion of the fluid is called basic properties of the fluid. Discuss the properties of the basic fluid.</p> <p><i>Ciri-ciri bendalir selanjar yang bebas daripada pergerakan bendalir dipanggil sifat asas bendalir itu. Bincangkan sifat bendalir asas tersebut</i></p> | <p>[10 Marks]
[10 markah]</p> |
| CLO 1
C3 | <p>(c) Explain FIVE (5) types of fluid.</p> <p><i>Terangkan LIMA (5) jenis bendalir.</i></p> | <p>[10 marks]
[10 markah]</p> |

QUESTION 2

SOALAN 2

- CLO 1
C2
- (a) Describe the concept of pressure head.
Huraikan konsep tekanan turus.
- [5 marks]
[5 markah]
- CLO 1
C2
- (b) Describe **TWO (2)** types of the simple manometers used to measure pressure (with a diagram).
*Huraikan **DUA (2)** jenis alat manometer ringkas yang digunakan untuk mengukur tekanan (beserta gambarajah).*
- [10 marks]
[10 markah]
- CLO 1
C3
- (c) Referring to Figure A2(c), complete the figure and show the derivation of the formula to obtain the pressure difference at A and B ($P_A - P_B$).
Merujuk kepada Rajah A2(c), lengkapkan gambarajah dan tunjukkan terbitan formula untuk mendapatkan perbezaan tekanan di A dan B ($P_A - P_B$).

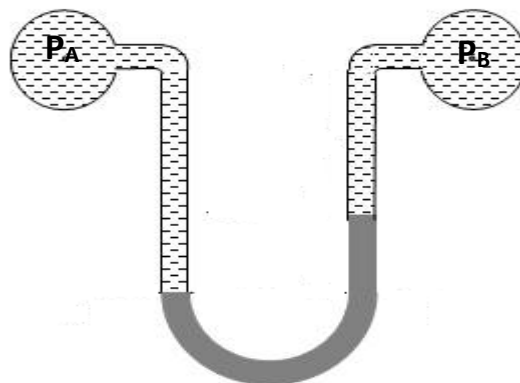


Figure A2(c) / Rajah A2(c)

[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**

- CLO 2
C2 (a) The diameter of a pipe is 380mm respectively. If the velocity of water flowing through the pipe at the section is 4m/s, identify the discharge through the pipe.

Diameter sebatang paip ialah 380mm setiap satu. Sekiranya halaju yang mengalir melalui paip pada bahagian tersebut adalah 4m/s, kenalpasti kadar alir yang mengalir melalui paip tersebut.

[5 marks]

[5 markah]

- CLO 2
C3 (b) A pipe (1) with 450mm diameter branches into two pipes (2 & 3) with diameter of 300mm and 200mm respectively. If the discharge in pipe 1 are $0.477\text{m}^3/\text{s}$ and average velocity in pipe 2 are 2.5m/, calculate the velocity in pipe 3.

Satu paip (1) dengan diameter 450mm berpecah kepada dua cabang (2 & 3) dengan diameter 300mm dan 200mm setiap satu. Sekiranya kadar alir pada paip 1 adalah $0.477\text{m}^3/\text{s}$ dan halaju purata paip 2 adalah 2.5m/s, kirakan halaju paip 3.

[8 marks]

[8 markah]

CLO 2
C3

- (c) A horizontal venturimeter with inlet diameter 200mm and throat diameter 100mm is used to measure the flow of water. The pressure at inlet is 0.18N/mm^2 and the vacuum pressure at the throat is 280mm of mercury. Calculate the rate of flow. The value of coefficient of discharge, c_d may be taken as 0.98.

Satu meter venturi mendatar mempunyai diameter salur masuk adalah 200mm and diameter salur leher 100mm digunakan untuk mengukur aliran bendalir. Diberikan tekanan pada salur masuk adalah 0.18N/mm^2 dan tekanan vakum pada salur leher adalah 280mm merkuri. Kirakan kadar aliran bendalir di dalam meter venturi tersebut. Ambil pekali kadaralir, c_d sebagai 0.98.

[12 marks]

[12 markah]

QUESTION 2**SOALAN 2**CLO 2
C2

- (a) A lubricating oil flows in a 250 mm diameter pipe at 1 m/s. Identify the types of flow that occur. Assume $\mu = 0.15\text{Ns/m}^2$ and $\rho = 1300\text{kg/m}^3$.

Minyak pelincir mengalir dalam paip berdiameter 250 mm pada 1 m/s. Kenal pasti jenis aliran yang berlaku. Andaikan $\mu = 0.15\text{Ns/m}^2$ dan $\rho = 1300\text{kg/m}^3$.

[5

marks]

[5 markah]

CLO 2
C3

- (b) Water flows at a velocity of 2.8 m/s in a pipe with a diameter of 350 mm and a length of 75 m. Calculate the head lost due to friction using the Darcy-Weishbach formula. Given the kinematic viscosity of water as $0.012 \times 10^{-4}\text{m}^2/\text{s}$.

Air mengalir pada halaju 2.8 m/s dalam paip berdiameter 350 mm dan panjang 75 m. Kira kehilangan kepala akibat geseran menggunakan formula Darcy-Weishbach. Diberi kelikatan kinematik air sebagai $0.012 \times 10^{-4} \text{m}^2/\text{s}$.

[8 marks]

[8 markah]

CLO 2
C3

- (c) Referring to figure B2(c), the inlet and outlet pipes are connected to the tank. Determine the flow rate for the flow system. ($f = 0.01$).

Merujuk kepada rajah B2(c), bahagian masuk dan keluar paip telah dihubungkan ke tangki. Tentukan kadar alir bagi sistem aliran tersebut. ($f = 0.01$)

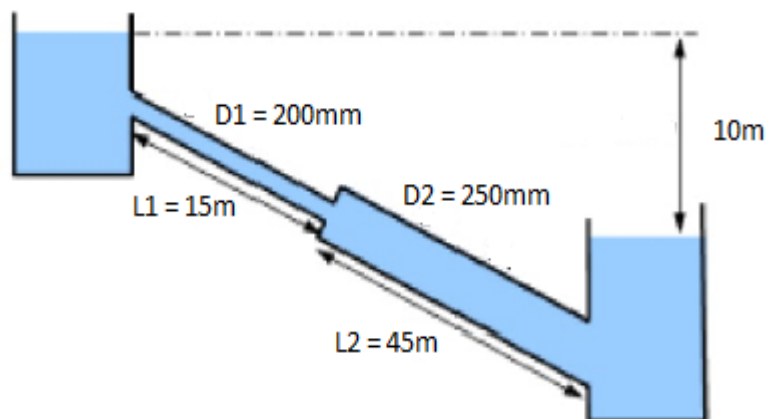


Figure B2(c) / Rajah B2(c)

[12 marks]

[12 markah]

QUESTION 3

SOALAN 3

CLO2
C2

- (a) In an open channel flow of width is 3 m, 1.5 m depth as shown in Figure B3(a), and the bed slope 1:5000, identify the hydraulics radius.

Pada aliran terbuka dengan kelebaran 3 m, kedalaman 1.5 m seperti Rajah B3(a) dan nisbah cerun lantai 1:5000, kenalpasti jejari hidraulik pada saluran terbuka.

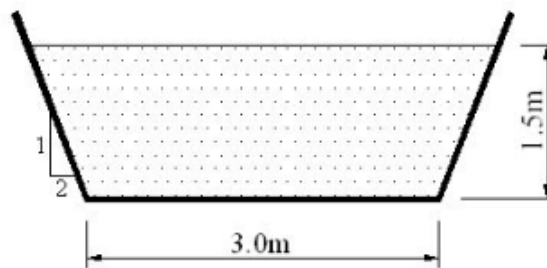


Figure B3(a) / Rajah B3(a)

[5 marks]
[5 markah]CLO2
C3

- (b) The water is flowing through the rectangular channel of 2.5 m width. The depth of water in the channel is 4 m, and the channel is running full. Calculate the velocity of water through the channel. Assume Chezy constant $C = 60$ and bed slope 1:2000.

Air mengalir melalui saluran segiempat tepat dengan kelebaran 2.5 m. Kedalaman air pada saluran itu adalah 4 m dan aliran air pada saluran sedang mengalir penuh. Kirakan halaju air yang melalui saluran. Andaikan pekali Chezy, $C = 60$ dan nilai cerun dasar 1:2000.

[8 marks]
[8 markah]

CLO2
C3

- (c) The water flows fully through a rectangular channel of 60 cm wide and 20 cm deep. The channel is having bed slope as 1 in 2000. Take Chezy's constant $C = 60$. Calculate the:

Aliran air yang penuh melalui saluran segi empat tepat dengan ukuran 60 cm lebar dan 20 cm dalam. Saluran ini mempunyai cerun dasar dengan nisbah 1 dalam 2000. Ambil pemalar Chezy $C = 60$. Kirakan:

- (i) hydraulic mean depth
kedalaman min hidraulik [4 marks]
[4 markah]
- (ii) flow rate of water
kadar aliran air [8 marks]
[8 markah]

QUESTION 4**SOALAN 4**CLO 2
C2

- (a) The area of the triangular section is 66.67 m^2 and the wetted perimeter of the section is 24.03 m. Identify the value of the manning's roughness coefficient if the bed slope of the channel section is 1 in 500 and the discharge through the channel is $117.61 \text{ m}^3/\text{s}$.

Luas bahagian segi tiga ialah 66.67 m^2 dan perimeter basah bagi bahagian itu ialah 24.03 m. Kenal pasti nilai kekasaran manning co efficient jika cerun dasar bahagian saluran ialah 1 dalam 500 dan luahan melalui saluran ialah $117.61 \text{ m}^3/\text{s}$.

[5 marks]

[5 markah]

- CLO 2
C3
- (b) Calculate the bed slope of a rectangular channel of 6 m width when the depth of water is 2.0 m and the flow rate is $2 \text{ m}^3/\text{s}$. Take Chezy constant, $C = 50$.

Kirakan cerun dasar bagi saluran segi empat tepat dengan kelebaran 6 m, kedalaman air adalah 2.0 m dan kadar alir ialah $2 \text{ m}^3/\text{s}$. Ambil pekali Chezy, $C = 50$.

[8 marks]

[8 markah]

- CLO 2
C3
- (c) Water flows through a pipe of 15 cm diameter with a velocity of 5 m/s. The length of the pipe is 300 m. Calculate:

Air mengalir melalui paip berdiameter 15 cm dengan halaju 5 m/s. Panjang paip adalah 300 m. Kirakan:

- (i) the loss of the head at the inlet and the exit of the pipe.
kehilangan turus pada aliran masuk dan keluar

[6 marks]

[6 markah]

- (ii) the total loss of the head. Take $f = 0.001$.
jumlah kehilangan turus. Ambil $f = 0.001$

[6 marks]

[6 markah]

Notes

The assessment items for this course have covered elements of the Dublin Problem: DP1, DP2, DP4 and DPB5 as mentioned in FEIST.

SOALAN TAMAT

FLUID MECHANICS FORMULA

$$\rho = \frac{m}{v}$$

$$Y = \rho g = \frac{W}{V}$$

$$S = \frac{Y_{\text{fluid}}}{Y_{\text{water}}} \text{ or } \frac{\rho_{\text{fluid}}}{\rho_{\text{water}}}$$

$$\nu = \frac{\mu}{\rho}$$

$$P = \frac{F}{A} \text{ or } P = \rho gh$$

$$Q_{\text{in}} = Q_{\text{out}} \text{ or } Q_1 = Q_2$$

$$Q = A \times V \text{ or } A_1 V_1 = A_2 V_2$$

$$Z_1 + \frac{V_1^2}{2g} + \frac{P_1}{w} = Z_2 + \frac{V_2^2}{2g} + \frac{P_2}{w}$$

$$\frac{V_1^2}{2g} + \frac{V_2^2}{2g} - hL = \frac{P_2}{\rho g} - \frac{P_1}{\rho g}$$

$$S_m > S; h = y \left(\frac{S_m}{S} - 1 \right)$$

$$S_m < S; h = y \left(1 - \frac{S_m}{S} \right)$$

$$Q_{\text{act}} = C_d \times \frac{a_1 a_2 \sqrt{2gh}}{\sqrt{a_1^2 - a_2^2}} = \frac{C_d a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \sqrt{2gh}$$

$$h = \left(\frac{P_1}{w} - \frac{P_2}{w} \right) + (Z_1 - Z_2)$$

$$Re = \frac{\rho dV}{\mu} \text{ or } \frac{dV}{\nu}$$

$$f = \frac{16}{Re} \text{ or } \frac{0.079}{Re^{1/4}}$$

$$P_1 - P_2 = \frac{32\mu VL}{d^2}$$

$$h_f = \frac{4fLV^2}{2gD} \text{ or } h_f = \frac{fLQ^2}{3d^5}$$

$$f = \frac{16}{Re} \text{ or } \frac{0.079}{Re^{1/4}}$$

$$P_1 - P_2 = \frac{32\mu VL}{d^2}$$

$$hL = K \frac{V^2}{2g} \text{ or } \frac{V^2}{2g} \text{ or } 0.5 \frac{V^2}{2g} \text{ or } \frac{(V_1 - V_2)^2}{2g}$$

$$\frac{P_1}{\omega} + \frac{V_1}{2g} + Z_1 = \frac{P_2}{\omega} + \frac{V_2}{2g} + Z_2 + \text{inlet loss} + \text{friction}$$

loss + outlet loss

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

$$A = by$$

$$P = b + 2y$$

$$A = (b + zy)y$$

$$P = b + 2y \sqrt{1 + Z^2}$$

$$A = r^2(\theta - \sin \theta \cos \theta)$$

$$P = 2r \theta$$

$$A = (y \tan \theta)y$$

$$P = 2 \left(\frac{y}{y \cos \theta} \right)$$

$$V = C \times \sqrt{(R_h S)}$$

$$Q = \frac{A_s^{1/2} R^{2/3}}{n}$$

$$Q = \frac{1}{n} A R_h^{2/3} S^{1/2}$$

$$Q = A \times C \times \sqrt{(R_h S)}$$