SULIT

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2019

DCB3102: HYDRAULICS

TARIKH : 07 NOVEMBER 2019
MASA : 2.30 PETANG - 4.30 PETANG (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (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
C1

(a) Define ideal fluid and real fluid

Takrifkan bendalir unggul dan bendalir sebenar.

[5 marks]
[*5 markah*]

CLO1
C2

(b) Explain the following properties of liquid and its SI unit:

Terangkan sifat-sifat cecair berikut dan berikan unit SI masing-masing:

i. Density
Ketumpatan

ii. Specific weight
Berat tentu

iii. Specific gravity
Graviti tentu

iv. Specific volume
Isipadu tentu

[8 marks]
[*8 markah*]

CLO1
C3

(c) The pressure is generally represented in the following terms: Atmospheric pressure, Gauge pressure and Absolute pressure.

Tekanan umumnya diwakili oleh istilah berikut: Tekanan atmosfera, Tekanan tolok dan Tekanan mutlak

i. Sketch a diagram showing the relationship between atmospheric pressures, gauge pressure and absolute pressure

Lakarkan rajah yang menunjukkan hubungan tekanan atmosfera, tekanan tolok dan tekanan mutlak

[4 marks]
[*4 markah*]

ii. Referring to question c(i) above, interpret the pressures and its formula.
Merujuk kepada soalan c(i) di atas, jelaskan tekanan-tekanan tersebut dan formula berkaitan.

[8 marks]
[*8 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) Define open channel with the aid of a diagram.

Takrifkan saluran terbuka dengan bantuan rajah.

[5 marks]
[*5 markah*]

CLO1
C2

(b) Describe the following types of flow:

Huraikan jenis-jenis aliran berikut:

i. Steady flow

Aliran mantap

ii. Uniform flow

Aliran seragam

iii. Laminar flow

Aliran laminar

iv. Turbulent flow

Aliran turbulen

[8 marks]
[*8 markah*]

CLO1
C3

(c) Bernoulli's equation expresses conservation of energy for flowing fluids such as water. The equation used relates the energy of the fluid in terms of its elevation, pressure, and velocity and relies on the principles outlined by the law of conservation of energy.

Persamaan Bernoulli menunjukkan keabadian tenaga untuk bendalir yang mengalir seperti air. Persamaan yang digunakan mengaitkan tenaga bendalir dari segi ketinggian, tekanan, dan halaju dan bergantung kepada prinsip yang digariskan oleh hukum keabadian tenaga.

i. Sketch the Bernoulli's Theorem concept in fluid flowing in a pipe.

Lakarkan konsep Teorem Bernoulli di dalam aliran air dalam sebuah paip.

[4 marks]
[*4 markah*]

ii. Relate the **THREE (3)** types of energy in Bernoulli's Theorem with its formula.

*Kaitkan **TIGA (3)** jenis tenaga di dalam Teorem Bernoulli beserta formula.*

[8 marks]
[*8 markah*]

SECTION B: 50 MARKS
BAHAGIAN B: 50 MARKAH

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

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

QUESTION 1
SOALAN 1

CLO2
C2

(a) Calculate the specific gravity of a fluid having viscosity of 6 x 10^{-3} Ns/m^2 and kinematic viscosity 0.035 x 10^{-4} m^2/s.

Kirakan nilai graviti tentu suatu bendalir yang mempunyai kelikatan 6 x 10^{-3} Ns/m^2 dan kelikatan dinamik 0.035 x 10^{-4} m^2/s.

[5 marks]
[*5 markah*]

CLO2
C3

(b) Specific gravity of 5 x 10^{-3} m^3 petrol is 0.7. Calculate the following fluid properties:

Graviti tentu bagi 5 x 10^{-3} m^3 petrol ialah 0.7. Kirakan ciri-ciri bendalir seperti berikut:

i. Density
Ketumpatan

ii. Mass
Jisim

iii. Specific Weight
Berat tentu

iv. Specific volume
Isipadu tentu

[8 marks]
[*8 markah*]

CLO2
C3

(c) A U-tube differential manometer with mercury as the gauge liquid is connected to two pipes at A and B as shown in **Diagram B1 (c)** below. Pipe A contains oil of specific gravity 0.92 and pipe B is carrying liquid X with specific gravity 1.5. If the pressure at point A is 125 kN/m^2 , calculate:

*Sebuah manometer tiub U dengan merkuri sebagai cecair tolok, disambungkan kepada dua paip A dan B seperti ditunjukkan dalam **Rajah B1 (c)**. Paip A mengandungi minyak dengan graviti tentu 0.92 dan paip B membawa cecair X dengan graviti tentu 1.5. Jika tekanan pada titik A ialah 125 kN/m^2, kirakan:*

i. Density of oil and liquid X

Ketumpatan minyak dan cecair X.

[4 marks]
[*4 markah*]

ii. Pressure at point B.

Tekanan pada titik B.

[8 marks]
[*8 markah*

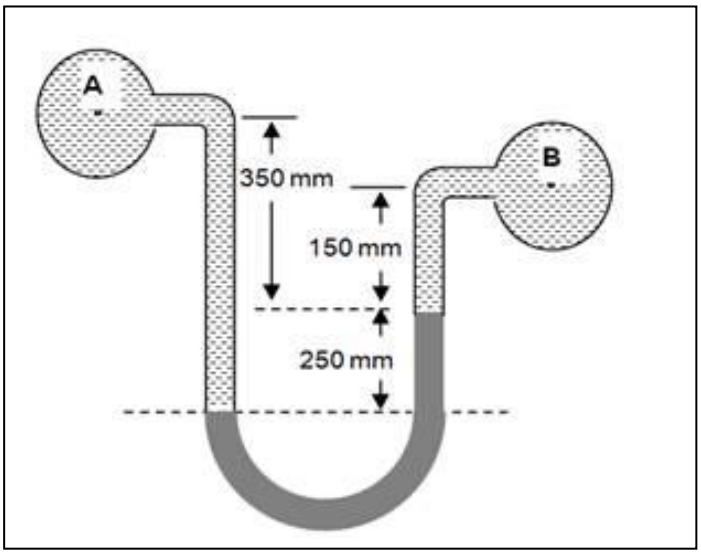

Diagram B1 (c)/ *Rajah B1 (c)*

QUESTION 2
SOALAN 2

CLO2
C2

(a) The diameter of the pipe at section 1 and 2 are 15 cm and 20 cm respectively. Calculate the velocity at section 2 if the velocity of water at section 1 is 4 m/s.

Diameter paip pada seksyen 1 dan 2 ialah 15 cm dan 20 cm masing-masing. Kirakan halaju di seksyen 2 jika halaju air di seksyen 1 ialah 4 m/s.

[5 marks]
[*5 markah*]

CLO2
C3

(b) A horizontal conical water pipe as shown in **Figure B2 (b)** below has a diameter of 1.2 m at section 1 and 0.6 m at section 2. The pressure head at the larger end is 15m of water and at the smaller end is 12 m of water. Calculate the velocity at section 1.

*Sebuah paip mendatar berbentuk kon seperti ditunjukkan dalam **Rajah B2 (b)** di bawah, mempunyai diameter 1.2 m pada seksyen 1 dan 0.6 m pada seksyen 2. Turus tekanan pada hujung besar ialah 15 m air dan pada hujung yang kecil 12 m air. Kirakan halaju pada seksyen 1.*

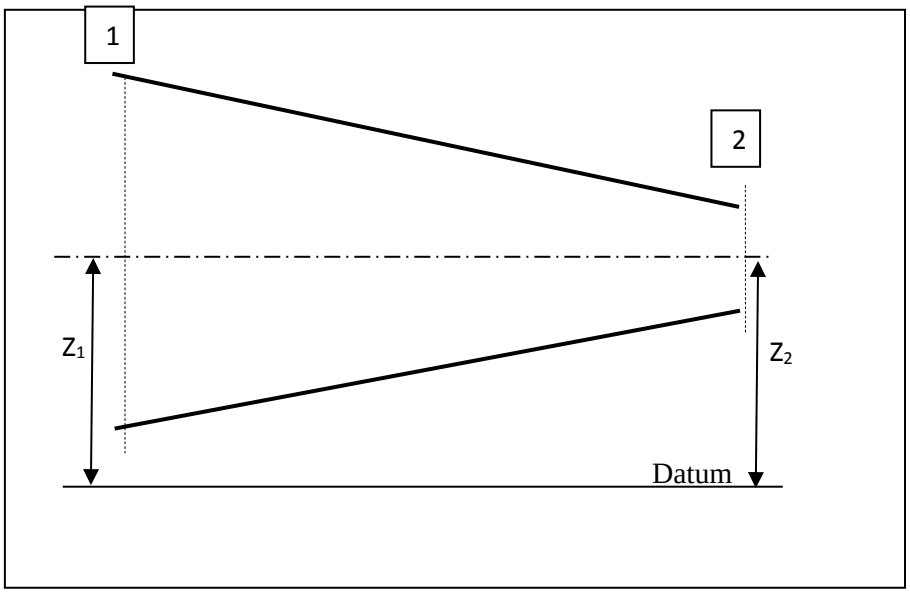

Figure B2 (b) / Rajah B2 (b)

[8 marks]
[*8 markah*]

CLO2
C3

(c) Water flows through a pipe at the rate of 1.1 m^3/s as shown in **Figure B2 (c)**. The diameter of pipe at section 1 and 2 is 200 mm and 400 mm respectively. Pressure of water at section 2 is 1 x 10^6 Pa and its velocity is 8.46 m/s. Calculate:

*Air mengalir melalui sebuah paip pada kadar alir 1.1 m^3/s seperti ditunjukkan dalam **Rajah B2 (c)**. Diameter paip pada bahagian 1 dan 2 ialah 200 mm 400 mm masing-masing. Tekanan air pada bahagian 2 adalah 1 x 10^6 Pa dan halajunya ialah 8.46 m/s. Kirakan:*

i. Head loss due to sudden enlargement.

Kehilangan turus disebabkan pembesaran tiba-tiba.

[4 marks]
[*4 markah*]

ii. Water pressure at section 1

Tekanan air di bahagian 1.

[8 marks]
[*8 markah*]

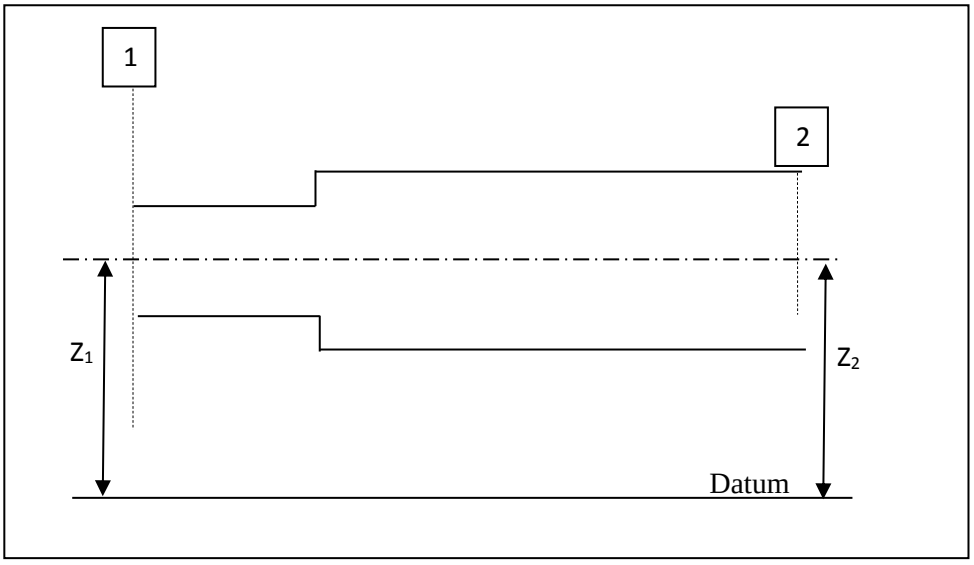

Figure B2 (c) / Rajah B2 (c)

CLO2
C2

QUESTION 3
SOALAN 3

(a) Water flows through a conical pipeline having cross sectional area of 0.13 m^2 at section A and 0.018 m^2 at section A. If the velocity of flow at section B is 10 m/s, calculate the kinetic heads at section A.

Air mengalir melalui paip kon yang mempunyai luas keratan rentas 0.13 m^2 di bahagian A dan 0.018 m^2 di bahagian B. Jika halaju aliran pada bahagian B ialah 10 m/s, kirakan turus kinetik pada bahagian A.

[5 marks]
[*5 markah*]

CLO2
C3

(b) Oil is pumped in a 300 mm diameter and 2000 m long pipe at the rate of 0.15 m^3/s. Given density of oil is 900 kg/m^3. Calculate the head loss in friction if kinematic viscosity is 22 x 10^{-4} m^2/s.

Minyak dipam ke dalam paip berdiameter 300 mm yang panjangnya 2000 m pada kadar 0.15 m^3/s. Diberi ketumpatan minyak ialah 900 kg/m^3. Kirakan turus kehilangan disebabkan geseran jika kelikatan kinematik ialah 22 x 10^{-4} m^2/s.

[8 marks]
[*8 markah*]

CLO2
C3

(c) The cross sectional area of a horizontal pipe increases suddenly from 7.855 x 10^{-3} m^2 to 0.031 m^2. If the flowrate of water through the pipe is 0.1 m^3/s, calculate:

Luas keratan rentas sebuah paip mendatar meningkat secara mendadak dari 7.855 x 10^{-3} m^2 kepada 0.031 m^2. Jika kadar aliran air melalui paip ialah 0.1 m^3/s, hitung:

i. The loss of head due to sudden enlargement.

Kehilangan turus disebabkan pembesaran mendadak.

[4 marks]
[*4 markah*]

ii. The difference of pressure between two sections of the pipeline.

Perbezaan tekanan antara dua bahagian paip tersebut.

[8 marks]
[*8 markah*]

QUESTION 4
SOALAN 4

CLO2 C2 (a) The weight of 3 m^3 petrol is 21 N. Calculate specific weight and its density.

Berat bagi 3 m^3 petrol ialah 21 N. Kirakan nilai berat tentu dan ketumpatannya.

[5 marks]
[*5 markah*]

CLO2 C3 (b) The side slope of a trapezoidal channel is 2 horizontal to 3 vertical in which the width of the channel is 5 m and height of free surface of water above the bed is 4 m. If the flow rate through the channel is 25 m^3/s, calculate the bed slope. Take Chezy constant as C=60.

Cerun sisi saluran trapezoid adalah 2 mendatar kepada 3 menegak di mana lebar saluran adalah 5 m dan ketinggian permukaan air dari dasar ialah 4 m. Jika kadar aliran melalui saluran adalah 25 m^3/s, hitung cerun dasar. Ambil pemalar Chezy sebagai C = 60.

[8 marks]
[*8 markah*]

CLO2 C3 (c) A rectangular open channel 4 m wide have the depth of water as 1.2 m. Calculate:

Sebuah saluran terbuka segiempat tepat 4 m lebar mempunyai kedalaman air 1.2 m. Kirakan:

i. The flow rate using Chezy formula if given bed slope 0.0009 and C = 60. *Kadaralir menggunakan formula Chezy jika diberi cerun dasar 0.0009 dan C=60.*

[4 marks]
[*4 markah*]

(ii) The bed slope of channel if the value of n in Manning's formula is 0.012 and the flowrate is given as 2.5 m^3/s.

Cerun dasar saluran jika nilai pekali n di dalam formula Manning ialah 0.012 dan kadaralir diberi sebagai 2.5 m^3/s.

[8 marks]
[*8 markah*]

SOALAN TAMAT

Hydraulic Formula

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

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

$V_s = \frac{1}{\rho}$

$S = \frac{\gamma_{fluid}}{\gamma_{water}}$ or $\frac{\rho_{fluid}}{\rho_{water}}$

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

$P = F/A$

$P = \rho gh$

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

$Q = A \times V$

$A_1V_1 = A_2V_2$

$E = \left(z + \frac{V^2}{2g} + \frac{P}{\gamma} \right)$

$H = \left(z + \frac{V^2}{2g} + \frac{P}{\gamma} \right)$

$\frac{P}{\gamma} + \frac{V^2}{2g} + z = \text{constant}$

$$z_1 + \frac{V_1^2}{2g} + \frac{P_1}{w} = z_2 + \frac{V_2^2}{2g} + \frac{P_2}{w}$$

$\frac{v_1^2}{2g} - \frac{v_2^2}{2g} - h_L = \frac{P_2}{\rho g} - \frac{P_1}{\rho g}$

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

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

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

$Q = a_d x \frac{a_1 a_2 \sqrt{2gh}}{\sqrt{a_1^2 - a_2^2}} = \frac{a_1 a_2 \sqrt{2gh}}{\sqrt{a_1^2 - a_2^2}}$

$h = \left(\frac{p_1}{w} - \frac{p_2}{w} \right) + (z_1 - z_2)$

$c_v = \frac{\nu}{V} = \frac{\nu}{\sqrt{2gh}}$

$c_c = \frac{a_c}{a}$

$c_d = \frac{Q_a}{Q_t} = \frac{Q_a}{a \times \sqrt{2gh}}$

$c_d = c_v \times c_c$

$Re = \frac{\rho d V}{\mu}$ or $\frac{Vd}{\nu}$

$\Delta P_L = 4f \frac{L}{D} \frac{\rho V^2}{2}$

$h_f = \frac{4fLv^2}{2gd}$

$h_f = \frac{fLQ^2}{3d^5}$

$$f = \frac{16}{Re}$$

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

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

$$h_L = K\frac{v^2}{2g}$$

$$h_L = \frac{v^2}{2g}$$

$$h_L = 0.5\ \frac{v^2}{2g}$$

$$h_L = \frac{(v_1 - v_2)^2}{2g}$$

$$\frac{l}{d^5} = \frac{l}{d_1^5} + \frac{l}{d_2^5} + \frac{l}{d_3^5}.$$

$$\frac{P_1}{\omega} + \frac{V_1}{2g} + z_1 = \frac{P_2}{\omega} + \frac{V_2}{2g} + z_2$$
+ inlet loss
+ friction loss
+ outlet loss

$$P = B + 2D$$

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

$$V = C\sqrt{(R_h i)}$$

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

$$Q = \frac{1}{n}AR_h^{2/3}i^{1/2}$$

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

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

$$A = by$$
$$P = b + 2y$$

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

$$A = y(b + y/\tan\theta)$$
$$P = b + 2y/\sin\theta$$

$$A = (b + zd)\,d$$
$$P = b + 2y\sqrt{1 + z^2}$$