SULIT

POLITEKNIK MALAYSIA

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2018

DCB3102 : HYDRAULICS

TARIKH : 29 OKTOBER 2018
MASA : 11.15 PAGI – 1.15 PETANG (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : **Hydraulic 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 struktur. Jawab **SEMUA** soalan*

QUESTION 1
SOALAN 1

CLO1
C1

(a) List **TWO (2)** physical characteristics of liquid.
*Senaraikan **DUA (2)** ciri fizikal bagi cecair.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Describe **FOUR (4)** categories in classification of fluid.
*Jelaskan **EMPAT (4)** kategori dalam klasifikasi bendalir.*

[8 marks]
[*8 markah*]

CLO1
C3

(c) Pressure measuring instruments are classified based on construction and working principles. Interpret the differences of **FOUR (4)** basic types of pressure measuring instruments as below:
*Alat pengukur tekanan dikategorikan berdasarkan prinsip pembinaan dan pengunaannya. Tafsirkan perbezaan **EMPAT (4)** jenis alat pengukur tekanan seperti:*

i. Barometer
Barometer

ii. Piezometer
Pizometer

iii. Manometer
Manometer

iv. Differential manometer
Manometer kebezaan

[12 marks]
[*12 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) State with formula **TWO (2)** types of equation commonly used to analyse open channel flows.
*Nyatakan dengan formula **DUA (2)** persamaan yang biasa digunakan untuk menganalisis aliran saluran terbuka.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Describe **TWO (2)** types of flow liquid with the aid of a diagram.
*Jelaskan **DUA (2)** jenis aliran bendalir dengan bantuan gambarajah.*

[8 marks]
[*8 markah*]

CLO2
C2

(c) Describe the Bernoulli Theorem with its limitations.
Jelaskan Teori Bernoulli beserta dengan syarat limitasinya.

[12 marks]
[*12 markah*]

SECTION B: 50 MARKS
BAHAGIAN B: 50 MARKAH

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

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

QUESTION 1
SOALAN 1

CLO2
C2

(a) The specific gravity and velocity for kinematic viscosity of oil are 0.95 and 0.0011 Ns/m^2 respectively. Determine the kinematic viscosity of oil.
Graviti tentu dan halaju untuk kelikatan kinematik minyak adalah masing-masing 0.95 dan 0,0011 Ns/m^2. Tentukan kelikatan kinematik minyak tersebut.

[5 marks]
[*5markah*]

CLO2
C3

(b) The weight for 1 liter of crude oil is 15.5 N. Calculate the specific weight, density, specific gravity and specific volume of the crude oil.
Berat untuk 1 liter minyak mentah adalah 15.5 N. Kirakan berat tentu, ketumpatan, graviti tentu dan isipadu tentu untuk minyak mentah tersebut.

[8 marks]
[*8 markah*]

CLO2
C3

(c) A U-tube with different manometer connects two pressure pipes A and B as shown in Figure 1. Pipe A contains castor oil with specific gravity 1.6 under a pressure of 120 kPa. Pipe B contains oil of specific gravity 0.8 under a pressure of 200 kPa. Pipe A lies 2.5 m above pipe B. Calculate the difference of pressure measured by mercury as fluid filling U-tube.
Satu tiub-U dengan manometer berbeza menghubungkan dua paip tekanan A dan B seperti yang ditunjukkan dalam Rajah 1. Paip A mengandungi minyak kastor dengan graviti tentu 1.6 di bawah tekanan 120 kPa. Paip B mengandungi minyak dengan graviti spesifik 0.8 di bawah tekanan 200 kPa. Paip A terletak 2.5 m di atas paip B. Kirakan perbezaan tekanan dengan merkuri sebagai cecair mengisi tiub-U.

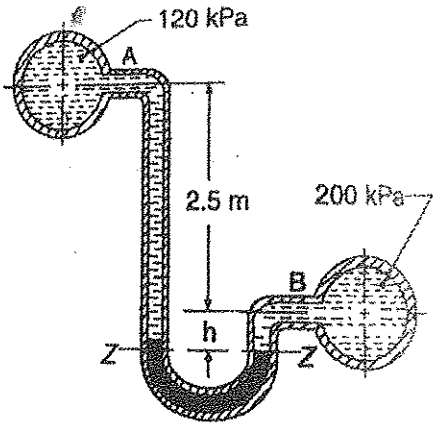

Figure 1 / *Rajah 1*

[12 marks]

[*12 markah*]

QUESTION 2
SOALAN 2

CLO2
C2

(a) A pipe is 50 mm in diameter and the pressure is 200 kN/m^2 with an average velocity of 2 m/s. Plumbing is at a level of 9 m from the datum. Compute the total energy when water flows through the pipe.

Sebatang paip mempunyai diameter 50 mm dan tekanan 200 kN/m^2 dengan halaju purata 2 m/s. Paip berada pada paras ketinggian 9 m dari datum. Kirakan jumlah tenaga apabila air mengalir melalui paip tersebut.

[5 marks]

[*5markah*]

CLO2
C3

(b) A pipeline of 300 mm diameter and 3200 m long is used to pump 50 liters per second of oil whereby the specific gravity is 0.95 and the kinematic viscosity is $2.1 \times 10^{-4} m^2/s$.

calculate:

Saluran paip berdiameter 300 mm sepanjang 3200 m digunakan untuk mengepam 50 liter sesaat minyak dengan gravity tentu minyak ialah 0.95 dan kelikatan kinematik $2.1 \times 10^{-4} m^2/s$. Kirakan:

i. the type of flow
jenis aliran

ii. the loss of head due to viscosity
kehilangan turus disebabkan oleh kelikatan

[8 marks]

[*8 markah*]

CLO2
C3

(c) The first section diameter of a pipe changes from 200 mm at the 5 meters above datum to 50 mm at a second section 3 meters above datum. The pressure of water at first section is 500 kPa. If the rate of flow is 31.42 liters/s, calculate the intensity of pressure at the second section.

Diameter paip pada seksyen pertama bertukar dari 200 mm pada paras 5 meter di atas datum kepada 50 mm di bahagian kedua pada paras 3 meter di atas datum. Tekanan air di bahagian pertama adalah 500 kPa. Jika kadar aliran adalah 31.42 liter / s, kirakan keamatan tekanan pada seksyen kedua.

[12 marks]

[*12markah*]

QUESTION 3

SOALAN 3

CLO2
C2

(a) Water is flowing through a pipe of 100 mm diameter with an average velocity of 10 m/s. Determine the rate of discharge of the water and calculate the velocity of water at the other end of the pipe, if the diameter of the pipe is sudden enlargement changed to 200 mm.

Air yang mengalir melalui paip berdiameter 100 mm dengan halaju purata 10 m/s. Tentukan kadar alir air yang melalui paip tersebut dan kirakan halaju air pada hujung paip, jika diameter paip berubah membesar secara tiba-tiba kepada 200 mm.

[5 marks]

[*5markah*]

CLO2
C3

(b) A pipe of 100 mm diameter is suddenly enlarged to 200 mm diameter. Calculate the loss of head, when the discharge is 360 liters/min.

Satu paip berdiameter 100 mm membesar secara tiba-tiba hingga 200 mm diameter. Kira kehilangan turus, apabila kadar alir air ialah 360 liter/min.

[8 marks]

[*8 markah*]

CLO2
C3

(c) A water having kinematic viscosity of 4×10^{-5} m^2/s is flowing through a pipe of 60 meters long and 150 mm in diameter is connected to a water tank at one end and flows freely into the atmosphere at the other end. The height of water level in the tank is 2.6 meters above the centre of the pipe. The pipe horizontal and $f = 0.01$. Calculate the discharge through the pipe in liters/s and identify the type of flow, if all the minor losses (entrance and exit) are to be considered.

Air yang mempunyai kelikatan kinematik 4×10^{-5} m^2/s mengalir melalui paip sepanjang 60 meter dan berdiameter 150 mm menghubungkan sebuah tangki air di satu hujung dan mengalir bebas ke atmosfera di bahagian hujung yang lain. Ketinggian paras air dalam tangki 2.6 meter di atas pusat paip. Paip mendatar dan $f = 0.01$. Kira kadar alir air melalui paip dalam liter/s dan tentukan jenis aliran, jika semua kehilangan kecil (masuk dan keluar) hendaklah dipertimbangkan.

[12 marks]

[*12markah*]

QUESTION 4

SOALAN 4

CLO2 C2

(a) The density of magnetic oil at 20°C is 825 kg/m^3. Determine the specific gravity and kinematic viscosity if the dynamic viscosity is 3.5 x 10^{-3} kg/ms.

Ketumpatan minyak magnetik pada suhu 20°C adalah 825 kg/m^3. Tentukan graviti tentu dan kelikatan kinematik jika kelikatan dinamik ialah 3.5 x 10^{-3} kg/ms.

[5 marks]

[*5markah*]

CLO2 C3

(b) A channel has two sides vertical and semi-circular bottom of 2 meters diameter. Calculate the discharge of water through the channel, when the depth of flow is 2 meters. Take C = 70 and slope of bed as 1 in 1000.

Satu saluran mempunyai dua sisi pada bahagian menegak dan berdiameter separa bulat sebesar 2 meter. Kirakan kadar alir air yang melalui saluran, apabila kedalaman aliran adalah 2 meter. Ambil C = 70 dan kecerunan lantai ialah 1 dalam 1000.

[8 marks]

[*8 markah*]

CLO2 C3

(c) Water is flowing at the rate of 16.5 m^3/s in an earthen trapezoidal channel with bed width 9 meters, water depth 1.2 meter and side slope 1:2. Calculate the bed slope, if the value of C in the Chezy's formula is 49.5.

Air yang mengalir pada kadar 16.5 m^3/s dalam saluran trapezoid mempunyai kelebaran lantai 9 meter, kedalaman air 1.2 meter dan kecerunan 1:2. Kirakan cerun dasar, jika nilai C dalam formula Chezy ialah 49.5.

[12 marks]

[*12markah*]

SOALAN TAMAT

Hydraulic Formula

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

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

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

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

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

$$P = F/A$$

$$P = \rho gh$$

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

$$Q = A \times V$$

$$\rho A_1 V_1 = \rho A_2 V_2$$

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

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

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

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

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

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

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

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

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

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

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

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

$$c_d = c_v \times c_c$$

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

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

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

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

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

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

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

$$h_L = \frac{32\mu LV}{\rho g d^2}$$

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

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

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

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

$$\frac{1}{d^5} = \frac{1}{d_1^5} + \frac{1}{d_2^5} + \frac{1}{d_3^5}.$$

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

$$P = B + 2D$$

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

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

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

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

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

$$A = by$$
$$P = b + 2y$$
$$R_h = \frac{by}{b + 2y}$$

$$A = \pi d^2/8$$
$$P = \pi d/2$$
$$R_h = d/4$$

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

$$A = (b + xy)\,y$$
$$P = b + 2y\sqrt{1 + x^2}$$
$$R_h = \frac{(b + xy)y}{b + 2y\sqrt{1 + x^2}}$$