SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

DCB3102: HYDRAULICS

TARIKH : 22 OKTOBER 2015
MASA : 8.30 AM- 10.30 AM (2 JAM)

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

Dokumen sokongan yang disertakan : RUMUS

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)** essay questions. Answer **ALL** questions.

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

QUESTION 1
SOALAN 1

CLO1
C1

a) Define a fluid and list **FOUR (4)** classifications of fluid depending on the presence of viscosity.

*Nyatakan bendalir dan senaraikan **EMPAT (4)** klasifikasi bendalir yang bergantung kepada kehadiran kelikatan.*

[5 marks]
[*5markah*]

CLO1
C2

b) Identify the formula for the quantities stated below:

Kenalpasti formula untuk kuantiti seperti yang dinyatakan di bawah:

i) Density / *Ketumpatan.*
ii) Specific weight / *Berat tentu.*
iii) Kinematic viscosity / *Kelikatan kinematik.*
iv) Specific Gravity / *Graviti tentu.*

[8 marks]
[*8 markah*]

CLO1 C3 c) Interpret and sketch the relationship between absolute pressure, gauge pressure and atmospheric pressure.

Lakar dan huraikan hubungan di antara tekanan mutlak, tekanan tolok dan tekanan atmosfera.

[12 marks]
[*12markah*]

QUESTION 2
SOALAN 2

CLO1 C1 a) List **FIVE (5)** types of open channel flow.

*Senaraikan **LIMA (5)** jenis aliran saluran terbuka.*

[5 marks]
[*5markah*]

CLO1 C2 b) With the aid of diagrams, describe the velocity distribution of laminar and turbulent flow.

Dengan bantuan gambar rajah, huraikan agihan halaju bagi aliran laminar dan aliran gelora.

[8 marks]
[*8 markah*]

CLO1 C2 c) Explain Bernoulli's theorem. Describe the assumptions involved in the derivation of Bernoulli's theorem.

Terangkan teorem Bernoulli. Huraikan anggapan yang terlibat dalam menerbitkan teorem Bernoulli.

[12 marks]
[*12markah*]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

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

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan struktur/esei. Jawab **DUA (2)** 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:

Berat untuk 1 liter minyak mentah adalah 15.5 N. Kirakan:

i) Specific weight / *Berat tentu.*
ii) Density / *Ketumpatan.*
iii) Specific gravity / *Gravity tentu.*
iv) Specific volume / *Isipadu tentu.*

[8 marks]
[*8 markah*]

CLO2
C3

c) A U-tube with different manometer is connected to two pressure pipes, A and B, as shown in Diagram 1. Pipe A contains castor oil with the specific gravity of 1.6 under a pressure of 120 kPa. Pipe B contains oil with the specific gravity of 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 the fluid fills the 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.

[12 marks]
[*12 markah*]

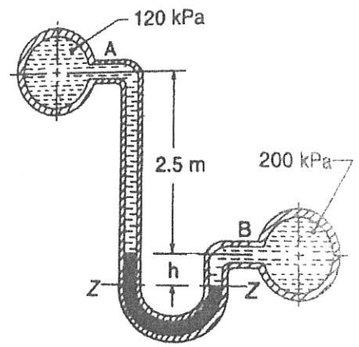

Diagram 1 / *Rajah 1*

QUESTION 2
SOALAN 2

CLO2
C3

a) A tapered pipe carries water from A to B. The diameter of section A pipe is 300 mm and section B is 100 mm. Calculate the velocity of water in section B pipe if the velocity of water in section A pipe is 4.5 m/s.

Sebatang paip tirus membawa air dari A ke B. Diameter paip pada seksyen A ialah 300 mm dan seksyen B ialah 100 mm. Kirakan halaju air dalam seksyen B paip jika halaju air di bahagian paip A adalah 4.5 m/s.

[5 marks]
[*5 markah*]

CLO2
C3

b) Calculate the loss of head due to friction if a discharge is 0.05 m^3/s of petrol (sp. Gr. 0.7) flow through a 0.2 m diameter and 1000 m long steel pipe. Use co-efficient of friction f = 0.0025 in Darcy relation.

Kira kehilangan turus akibat geseran jika kadar aliran adalah 0.05 m^3/s petrol (sp. Gr. 0.7) mengalir melalui paip keluli berdiameter 0.2m dan 1000m panjang. Ambil pekali geseran f = 0.0025 bagi Darcy.

[8 marks]
[*8 markah*]

CLO2
C3

c) Water is flowing through a pipe of 600 mm and 400 mm diameter at the bottom and upper end respectively as shown in Diagram 2. The intensity of pressure at the bottom end is 350 kN/m^2 and the pressure at the upper end is 100 kN/m^2. Calculate the difference in datum head if the rate of flow through the pipe is 0.06 m^3/s.

Air mengalir melalui paip yang mempunyai diameter 600 mm dan 400 mm masin-masing di bahagian bawah dan bahagian atasnya seperti yang ditunjukkan dalam Rajah 2. Keamatan tekanan pada bahagian yang bawah adalah 350 kN/m^2 dan tekanan di hujung atas adalah 100 kN/m^2. Kirakan perbezaan datum jika kadar aliran melalui paip ialah 0.06 m^3/s.

[12 marks]
[*12 markah*]

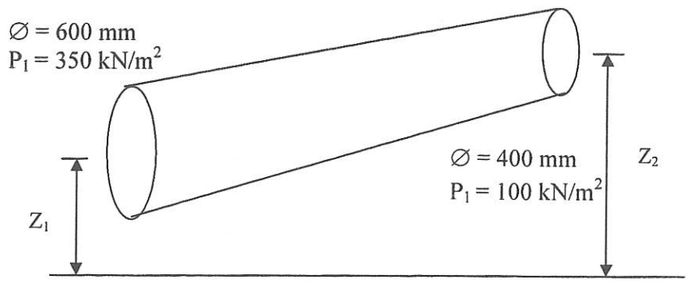

Diagram 2/ *Rajah 2*

QUESTION 3
SOALAN3

CLO2 C2 a) A pipe carries water from A to B. The diameter of section A pipe is 450 mm and section B is 110 mm. Calculate the flow rate of water in mm^3/s unit if the velocity in section A pipe is 6.5 m/s.

Sebatang paip membawa air dari A ke B. Diameter bahagian paip A ialah 450 mm dan bahagian paip B adalah 110 mm. Kirakan kadar aliran dalam unit mm^3/s *jika halaju air di bahagian paip A adalah 6.5 m/s.*

[5 marks]
[5 *markah*]

CLO2 C3 b) A pipe is 60 mm diameter and 450 m long. An oil of dynamic viscosity 0.9 Ns/m^2 and specific gravity of 0.9 is required to be pumped at the rate of 5 liters/sec. Calculate and classify the types of flow.

Sebatang paip berdiameter 60 mm dan 450 m panjang. Kelikatan dinamik minyak 0.9 Ns/m^2 *dan graviti tentu 0.9 perlu dipam pada kadar 5 liter/saat. Kira dan kelaskan jenis aliran tersebut.*

[8 marks]
[8 *markah*]

CLO2 C3 c) The diameter of a horizontal pipe which is 300 mm is suddenly enlarged to 600 mm. The rate of flow of water through this pipe is 0.4 m^3/s. Calculate :

Diameter paip mendatar iaitu 300 mm secara tiba-tiba membesar sehingga 600 mm. Kadar aliran air melalui paip ini ialah 0.4 m^3 */ s. Kirakan :*

i) Velocity at 300 mm and 600 mm

Halaju pada 300 mm dan 600 mm

[8 marks]
[8 *markah*]

ii) Loss of head due to sudden enlargement

Kehilangan turus akibat pembesaran secara tiba-tiba

[4 marks]
[4 *markah*]

QUESTION 4
SOALAN 4

CLO3 C2 a) The specific gravity of liquid is 0.95, determine :

Graviti tentu cecair adalah 0.95, tentukan :

i) Mass density / *Ketumpatan jisim.*
ii) Specific volume / *Isipadu tentu.*
iii) Specific weight / *Berat tentu.*

[5 marks]
[5 *markah*]

CLO3 C2 b) Water flows in a rectangular, concrete, open channel that is 12 m wide at the depth of 2.5 m. The channel slope is 0.0028. Calculate the water velocity and the flow rate. Use Manning coefficient of n = 0.013.

Air mengalir di dalam sebuah saluran segiempat tepat, konkrit, lebar saluran 12 m pada kedalaman 2.5 m. Kecerunan saluran adalah 0,0028. Kira halaju air dan kadar aliran. Ambil pekali Manning, n=0.013.

[8 marks]
[8 *markah*]

CLO3
C2

c) Calculate the velocity and discharge through a trapezoidal channel of 8 m width and side slopes of 1:3. The depth of water is 2.4 m and the bed slope is 1:4000. Use Chezy's coefficient of C = 60.

Kira halaju dan kadar alir yang melalui saluran berbentuk trapezoid dengan lebar 8 m dan cerun sisi 1:3. Kedalaman air adalah 2.4 m dan cerun dasar 1:4000. Ambil pekali Chezy, C = 60.

[12 marks]
[*12 markah*]

SOALAN TAMAT

Hydraulic Formula

$P = F/A$

$P = \rho gh$

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

$Q = A \times V$

$A_1V_1 = A_2V_2$

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

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

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

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

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

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

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

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

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

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

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

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

$$c_d = c_v \times c_c$$

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

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

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

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

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

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

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

$$H_L = \frac{32\mu VL}{\rho g d^2}$$

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

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

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

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

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

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

$$P = B + 2D$$

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

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

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

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

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

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

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

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

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

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