SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2017

DCB3102 : HYDRAULICS

TARIKH : 22 OKTOBER 2017
MASA : 2.30 PETANG - 4.30 PETANG (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Esei Berstruktur (2 soalan)
Bahagian B: Esei Berstruktur (4 soalan)
Dokumen sokongan yang disertakan : Hydraulic Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

STRUCTURAL/ ESSAY (100 MARKS)
STRUKTUR/ESEI (100 MARKAH)

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** structural essay questions.
Answer **ALL** questions.

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

QUESTION 1
SOALAN 1

CLO1
C1

(a) Describe the types of fluids listed below:

i. Newtonian Fluid

ii. Non-Newtonian Fluid

Terangkan berkenaan jenis bendalir di bawah:

i. Bendalir Newtonian

ii. Bendalir Bukan Newon

[5 marks]
[*5 markah*]

CLO1
C2

(b) Describe the terms below :

i. Specific weight

ii. Specific gravity

Terangkan terma-terma berikut :

i. Berat tentu

ii. Graviti tentu

[8 marks]
[*8markah*]

CLO1 C3 (c) Pressure measurement is important in many fluid mechanics related applications. Based on an appropriate pressure measurements velocity, aerodynamics forces and moments can be determined. Pressure is measured by the force acting on unit area.

Pengukuran tekanan adalah penting dalam kebanyakan aplikasi mekanik bendalir. Berdasarkan pengukuran halaju tekanan yang berkaitan, tekanan aerodinamik dan selainnya boleh ditentukan. Tekanan ini diukur berdasarkan daya per unit luas.

Based on the statement above, illustrate the pressure terminology relating to atmospheric pressure, gauge pressure and absolute pressure.
Berdasarkan pernyataan di atas, lakarkan terminologi tekanan yang mengaitkan tekanan atmosfera, tekanan tolok dan tekanan mutlak.

[12 marks]
[12 markah]

QUESTION 2
SOALAN 2

CLO1 C1 (a) Define uniform flow in an open channel.

Takrifkan aliran seragam di dalam saluran terbuka.

[5 marks]
[*5 markah*]

CLO1 C2 (b) Demonstrate the 'Reynolds Experiment' procedure that could interpret the Reynold's number used to determine the types of flow.

Tunjukkan prosedur Eksperimen Reynold yang boleh mentafsirkan nombor Reynold dalam menentukan jenis-jenis aliran dalam bendalir.

[8 marks]
[8 markah]

CLO1 C2 (c) Explain the relation equation of continuity for a steady flow with the aid of a diagram.

Terangkan hubungan persamaan keterusan bendalir bagi aliran tetap dengan bantuan gambarajah.

[12 marks]
[12 markah]

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 esei berstruktur.*
*Jawab **DUA (2)** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO2 C2 a) The viscosity of liquid is 0.15 Ns/m^2 and specific gravity of the liquid is 0.9. Based on the statement above, determine the kinematic viscosity of liquid.

Kelikatan cecair adalah 0.15 Ns/m^2 dan nilai graviti tentu cecair ialah 0.9. Berdasarkan pernyataan di atas, tentukan kelikatan kinematik bagi cecair tersebut.

[5 marks]
[*5 markah*]

CLO2 C3 b) Calculate specific weight, density, specific volume and specific gravity of 0.5 m^3 of mercury that weighs 136 x 10^4 N.

Kirakan berat tentu,ketumpatan, isipadu tentu dan graviti tentu bagi 0.5 m^3 merkuri yang mempunyai berat 136 x 10^4 N.

[8 marks]
[*8 markah*]

CLO2 C3 c) Calculate the differential reading of 'h' of an inverted U-tube manometer containing oil with a specific gravity of 0.7 as the manometer fluid when pipe A and B are connected as shown in Figure 2 below. Assume the fluid in pipe A and B has specific gravities of 1.2 and 1.0 respectively. Both pipes are located at the same level and the pressures are equal.

Kirakan perbezaan bacaan ketinggian 'h' bagi sebuah manometer tiub-U terbalik yang mengandungi minyak dengan graviti tentu 0.7 sebagai cecair manometer apabila disambungkan pada paip A dan B seperti yang ditunjukkan dalam Rajah 2 di bawah. Dengan cecair Paip A dan B mempunyai graviti tentu 1.2 dan 1.0 dan terletak pada kedudukan yang sama dan menganggap tekanan di A dan B adalah sama.

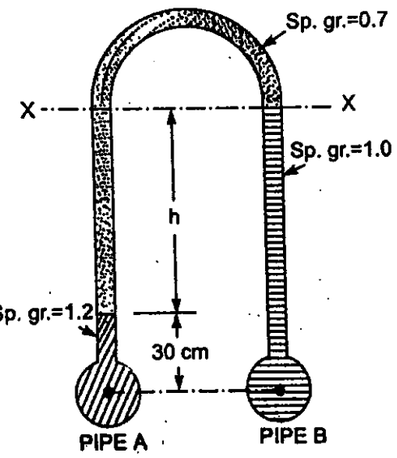

Figure 2 / *Rajah 2*

[12 marks]
[*12 markah*]

QUESTION 2
SOALAN 2

CLO2 C2 a) A pipe with a diameter of 100 mm carries liquid at a steady flow with a mean velocity of 0.4 m/s. If the diameter is suddenly changed to 155 mm, determine the mean velocity of flow in this pipe.

Satu aliran mantap mengalir pada paip berdiameter 100 mm dan halaju cecair ialah 0.4 m/s. Jika diameter paip tiba-tiba berubah kepada 155 mm, tentukan halaju aliran dalam paip ini.

[5 marks]
[*5 markah*]

CLO2 C3 b) Two reservoirs are connected by two pipes of the same length laid in parallel. The diameters of the pipes are 100 mm and 300 mm respectively. If the discharge through 100 mm diameter pipe is 0.01 m^3/sec, calculate the discharge through 300 mm pipe. Assume that friction factor is the same for both pipes.

Dua takungan yang dihubungkan dengan dua paip secara selari yang sama panjangnya. Diameter paip ialah 100 mm dan 300 mm. Sekiranya kadar alir yang melalui paip berdiameter 100 mm adalah 0.01 m^3/s, kirakan kadar alir pada paip 300 mm. Andaikan faktor geseran adalah sama untuk kedua-dua paip.

[8 marks]
[*8 markah*]

CLO2 C3 c) A pipe line carrying water changes in diameter from 300 mm to 600 mm and is at a height of 5 m. If the pressures at positions A and B are 100 kN/m^2 and 600 kN/m^2 respectively and the discharge is 300 liters/s, calculate the difference in the head loss in both streams.

Air dialirkan melalui sebaris paip berdiameter dari 300 mm kepada 600 mm dengan kedudukan pada paras 5 m. Jika kadar alir adalah 300 liter/s dengan tekanan masing-masing di kedudukan A dan B adalah 100 kN/m^2 dan 600 kN/m^2, kirakan perbezaan kehilangan turus pada kedua-dua aliran.

[12 marks]
[*12 markah*]

QUESTION 3
SOALAN 3

CLO2 C2 a) Determine the velocity of the head of stream equals to 80 cm.

Tentukan turus halaju aliran air bersamaan dengan 80 cm.

[5 marks]
[*5 markah*]

CLO2 C3 b) The rate of flow through a horizontal pipe is 0.5 m^3/s. The diameter of the pipe is suddenly enlarged from 125 mm to 155 mm. Calculate the loss of head due to the sudden enlargement.

Kadar alir melalui paip mendatar adalah 0.5 m^3/s. Pembesaran diameter paip secara tiba-tiba dari 125 mm ke 155 mm. Kirakan kehilangan turus disebabkan pembesaran tersebut.

[8 marks]
[*8 markah*]

CLO2 C3

c) Water flows through a pipe of 150 mm diameter with a velocity of 5 m/s. The length of the pipe is 300 m.

Air mengalir melalui paip berdiameter 150 mm dengan halaju 5 m/s. Panjang paip adalah 300 m.

i) Calculate the loss of head at the inlet and exit of the pipe.

Kirakan kehilangan turus pada aliran masuk dan keluar.

ii) Calculate the total loss of head. given f = 0.001.

Kirakan jumlah kehilangan turus. Diberi f = 0.001

[12 marks]
[*12 markah*]

QUESTION 4
SOALAN 4

CLO2 C2

a) Determine the specific gravity of the liquid whose specific weight is 9.95 x 10^{-3} N/cm^3.

Tentukan graviti tentu yang mempunyai berat tentu 9.95 x 10^{-3} N/cm^3.

[5 marks]
[*5 markah*]

CLO2 C3

b) Calculate the discharge flowing through a rectangular channel of 6 m wide. The depth of water in the channel is 4 m and the channel is running full. Assume Chezy constant C = 56 and bed slope 1: 1000.

Kirakan kadar alir yang melalui saluran segiempat tepat dengan kelebaran 6 m. Kedalaman air pada saluran itu adalah 4 m dan saluran sedang mengalir penuh. Andaikan pekali Chezy, C = 56 dan nilai cerun dasar 1:1000.

[8 marks]
[*8 markah*]

CLO2 C3

c) Calculate the bed slope of a rectangular channel of 6 m widE with the depth of water is 2.0 m and flow rate is 22 m^3/s. Given 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 22 m^3/s. Diberi pekali Chezy, C = 50.

[12 marks]
[*12 markah*]

SOALAN TAMAT

Hydraulic Formula

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

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

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

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

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

$$P = F/A$$

$$P = \rho gh$$

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

$$Q = A \times V$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$c_d = c_v \times c_c$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$P = B + 2D$$

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

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

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

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

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

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

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

$$A = y^2 \tan\theta$$

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

$$R_h = \frac{y \sin\theta}{2}$$

$$A = (b + xy)\, y$$

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

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