SULIT

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2021 / 2022

DCB20062: FLUID MECHANICS

TARIKH : 8 JULAI 2022
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Bahagian A: Struktur (3 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 75 MARKS
BAHAGIAN A : 75 MARKAH

INSTRUCTION:
This section consists of **THREE (3)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **TIGA (3)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1 C2 (a) Describe **TWO (2)** physical characteristics of liquids and gasses.

*Terangkan **DUA (2)** ciri-ciri fizikal cecair dan gas.*

[5marks]
[*5 markah*]

CLO1 C2 (b) Differentiate dynamic viscosity and kinematic viscosity.

Bezakan kelikatan dinamik dan kelikatan kinematic

[8 marks]
[*8 markah*]

CLO1 C3 (c) A fluid is a gas or liquid that, unlike a solid, flows to assume the shape of the container in which it is placed.

Bendalir adalah cecair atau gas yang tidak seperti pepejal, mengalir mengikut bentuk bekas yang memenuhinya.

i. Explain ideal fluid and real fluid.

Terangkan bendalir ideal dan bendalir nyata.

[6 marks]
[*6 markah*]

ii. Illustrate a graph of shear stress versus velocity gradient that best describes the types of fluid.
Lakarkan graf tekanan ricih melawan kecerunan halaju yang terbaik menggambarkan jenis-jenis bendalir.

[6 marks]
[*6 markah*]

QUESTION 2
SOALAN 2

CLO1 C2 (a) Explain the measurement of pressure using a manometer.
Terangkan mengenai pengukuran tekanan menggunakan manometer.

[5 marks]
[5 *markah*]

CLO1 C3 (b) Illustrate a diagram that best explains the differences between the gauge and absolute pressure.
Lakarkan satu diagram terbaik yang boleh menerangkan mengenai perbezaan antara tekanan tolok dan tekanan mutlak.

[8 marks]
[*8 markah*]

CLO1 C3 (c) A fluid is subjected to pressure due to its weight, whereby the pressure increases as the depth of the liquid increases.
Sesuatu bendalir dikatakan mempunyai tekanan disebabkan oleh beratnya sendiri, di mana tekanan ini akan meningkat selari dengan ketinggian bendalir tersebut.

i. Write the appropriate formula based on the statement above.
Tuliskan rumus yang bersesuaian berdasarkan pernyataan di atas.

[6 marks]
[*6 markah*]

ii. Illustrate a small triangular volume of fluid of unit thickness where pressure, p are *p1 = p2 = p3*. Assume the pressure, p is in a static fluid.
Lakarkan ilustrasikan satu segi tiga kecil berisipadu cecair, serta mempunyai ketebalan unit di mana tekanan, p ialah p1 = p2 = p3. Anggap tekanan, p berada dalam cecair statik.

[6 marks]
[*6 markah*]

QUESTION 3
SOALAN 3

CLO2 C3 (a) The diameters of pipe sections 1-1 and 2-2 are 200mm and 300mm respectively. If the velocity of water flowing through the pipe at section 1-1 is 4m/s, calculate the discharge through the pipe.
Diameter sebatang paip pada keratan rentas 1-1 dan 2-2 adalah masing-masing 200mm dan 300mm. Sekiranya halaju air yang melalui keratan rentas 1-1 adalah 4m/s, kirakan kadaralir bendalir pada paip tersebut.

[5 marks]
[5 *markah*]

CLO2 C3 (b) A horizontal nozzle reduces from 100 mm diameter at the inlet to 50 mm at the exit. It carries liquid with a density of 1000 kg/m^3 at the rate of 0.05 m^3/s. The pressure at the wide end is 500 kPa. Calculate the pressure at the narrow end, neglecting friction.
Satu muncung mendatar berkurang garispusatnya dari 100 mm kepada 50 mm di salur keluar. Ia membawa satu cecair berketumpatan 1000 kg/m^3 pada kadar 0.05 m^3/s. Tekanan pada muncung lebar ialah 500 kPa, kirakan tekanan pada muncung sempit dengan mengabaikan geseran.

[8 marks]
[*8 markah*]

CLO2
C3

(a) Two paralel pipes that connect two reservoirs (A and B) which have a height difference of 10m. Pipe 1 has a diameter 50mm and length of 100m. While pipe 2 has a diameter 100mm and length of 100m. Both have entry loss $k_L = 0.5$ and exit loss kL = 1.0 and Darcy's f of 0.008, calculate :

Dua paip selari menghubungkan dua takungan (A dan B) mempunyai perbezaan ketinggian datum sebanyak 10m. Paip 1 mempunyai diameter 50mm dan panjangnya 100m. Manakala paip 2 mempunyai diameter 100mm dan panjangnya 100m. Setiap paip mempunyai kehilangan paip masuk k_L= 0.5 dan kehilangan paip keluar k_L = 1.0 dan pekali Darcy's adalah 0.008, kirakan :

i. The rate of flow for each pipe;
Kadar alir bagi setiap paip;

[4 marks]
[*4 markah*]

ii. The diameter, d of a pipe 100m long that could replace the two pipes and provide the same flow.
Diameter paip, d bagi paip 100m panjang yang boleh menggantikan kedua-dua paip dan menyediakan aliran yang sama.

[8 marks]
[*8 markah*]

SECTION B : 25 MARKS
BAHAGIAN B : 25 MARKAH

INSTRUCTION:
This section consists of **ONE (1)** structured question. Answer the questions.

ARAHAN:
*Bahagian ini mengandungi **SATU (1)** soalan berstruktur. Jawab semua soalan.*

CLO2
C2

(a) A concrete-lined trapezoidal channel with a uniform flow has a normal depth of 2m. The base width is 5m and the side slopes are equal at 1 : 2. Manning's n can be taken as 0.015, and bed slope, $S_0 = 0.001$. Calculate the discharge, Q.
Satu saluran konkrit linen berbentuk trapezoid dengan aliran air seragam mempunyai kedalaman normal 2m. Lebar asas saluran tersebut ialah 5m dan cerun tepi mempunyai nisbah kecerunan 1 : 2. Pekali Manning boleh diambil sebagai 0.015, dan cerun sisi, $S_0 = 0.001$. Kirakan kadar alir bendalir, Q.

[5marks]
[*5 markah*]

CLO2
C3

(b) A concrete trapezoidal pipe with a uniform flow has a normal depth of 2 m. The base width is 5 m and the side slopes are equal at 1 : 2. Manning's *n* can be taken as 0.015, and the bed slope $S_0 = 0.001$, calculate the flow rate, Q and mean velocity, v.
Sebuah paip konkrit berbentuk trapezoid dengan aliran yang seragam mempunyai kedalaman normal 2m. Lebar tapak adalah 5m dan cerun sisi bersamaan 1 : 2. Pekali Manning, n diberi 0.015 dan cerun dasar adalah $S_0 = 0.001$, kirakan kadar alir, Q dan halaju purata, v.

[8 marks]
[*8 markah*]

CLO2
C3

(c) A channel as in Figure 3 below drains water throughout a paddy field. Take the value of Chezy's constant = 55 and slope of the bed as 1 in 800.
Satu saliran seperti Rajah 3 di bawah mengalirkan air di seluruh kawasan sawah padi. Ambil pekali Chezy = 60 dan cerun dasar adalah 1 dalam 950.

(i) Calculate the area of flow;
Kirakan luas aliran bendalir tersebut;

[4 marks]
[*4 markah*]

(ii) Determine the discharge for the channel.
Tentukan kadar alir bendalir yang mengalir untuk saliran tersebut.

[8 marks]
[*8 markah*]

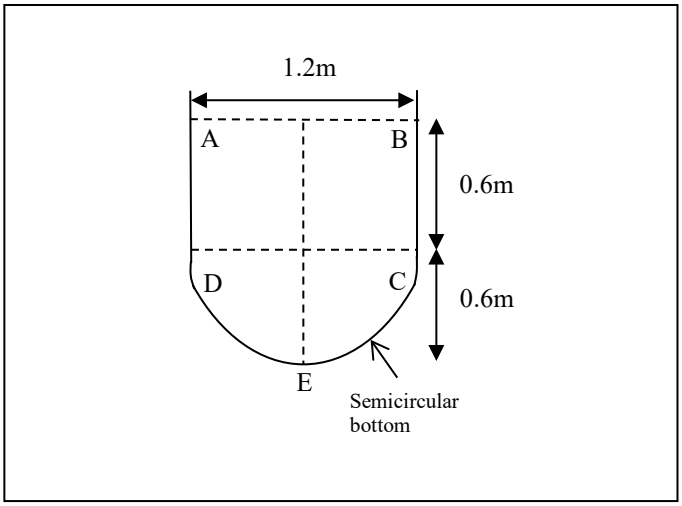

Figure 3 / *Rajah 3*

SOALAN TAMAT

FLUID MECHANICS FORMULA

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

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

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

$S = \frac{\text{Y fluid}}{\text{Y water}}$ or $\frac{\rho \text{ fluid}}{\rho \text{ water}}$

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

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

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

$Q = A \times V$ or $A_1V_1 = A_2V_2$

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

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

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

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

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

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

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

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

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

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

$C_d = \frac{Q_a}{Q_t} = \frac{Q_a}{a \, x \sqrt{2gh}}$

$C_d = C_v \times C_c$

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

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

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

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

$P1 - P2 = \frac{32 \mu VL}{d^2}$

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

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

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

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

$A = WD$

$P = W + 2\,D$

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

$P = 2r\,\theta$

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

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

$A = y\left(b + \frac{y}{y\tan\theta}\right)$

$P = b + \frac{2y}{\sin\theta}$

$A = (W + ZD)D$

$P = W + 2D\sqrt{1 + Z^2}$

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

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

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

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