SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2025/2026

DCC30352 : FLUID MECHANICS

TARIKH : 30 NOVEMBER 2025
MASA : 2.30 PETANG – 4.30 PETANG (2 JAM)

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

Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

This section consists of **FOUR (4)** subjective questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Fluid possesses different basic properties which can be used to characterize the fluids. Describe the definition of specific gravity and kinematic viscosity together with respective formulas and units.

Bendalir mempunyai beberapa sifat asas yang boleh digunakan dalam pengelasan sifat bendalir. Huraikan definisi graviti tentu dan kelikatan kinematik beserta formula serta unit masing-masing.

[4 marks]

[*4 markah*]

CLO1 (b) A cylindrical container with a diameter of 75 cm is filled with a liquid to a depth of 100 cm. The liquid has a mass of 600 kg. Estimate the density and specific weight of the liquid.

Satu bekas silinder dengan diameter 75 cm diisi pada kedalaman 100 cm dengan satu cecair. Cecair tersebut mempunyai jisim 600 kg. Anggarkan Ketumpatan dan berat tentu cecair tersebut.

[9 marks]

[*9 markah*]

CLO1 (c) Pressure head in a piezometer is 1.5 m above point A in a pipe. Identify the pressure in water, oil (sg = 0.8) and mercury (sg = 13.6).

Turus tekanan pada sebuah piezometer adalah 1.5 m di atas titik A dalam satu paip. Kenal pasti tekanan dalam air, *minyak* (sg = 0.8) *dan merkuri* (sg = 13.6).

[12 marks]

[*12 markah*]

QUESTION 2

SOALAN 2

CLO2 (a) Pressure measurements are generally indicated as being either absolute or gauge pressure. Identify the absolute water pressure at a depth of 4 m below the free surface if the atmospheric pressure is at 101.3 kN/m^2.

Pengukuran tekanan biasanya ditunjukkan sama ada dalam tekanan mutlak atau tekanan tolok. Kenal pasti tekanan mutlak air pada kedalaman 4m di bawah permukaan air jika tekanan atmosfera adalah 101.3 kN/m^2.

[4 marks]

[*4 markah*]

CLO2 (b) A liquid pressure at a point increase with the height of the liquid. Figure 2(b) shows a tank with two liquids. Identify the pressure at point A and B if the density of oil is 800 kg/m^3.

Tekanan cecair pada satu titik bertambah dengan bertambahnya ketinggian cecair tersebut. Rajah 2(b) menunjukkan sebuah tangki yang mengandungi dua jenis cecair. Kenalpasti tekanan pada Titik A dan B jika ketumpatan minyak ialah 800 kg/m^3.

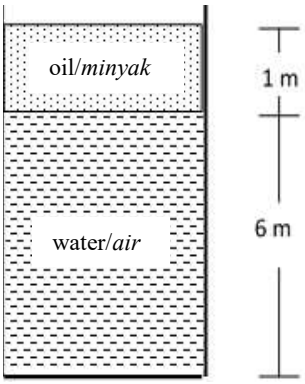

Figure 2(b)*/ Rajah 2(b)*

[9 marks]

[*9 markah*]

CLO2 (c) The right limb of a simple U–tube manometer, as shown in Figure 2(c) contains mercury which is exposed to the atmosphere, while the left limb is connected to a pipe that carries a fluid with a specific gravity of 0.86. The centre of the pipe is 12 cm below the level of mercury in the right limb. Determine the pressure of the fluid in the pipe if the difference in mercury level in the two limbs is 20 cm.

Tiub kanan sebuah manometer tiub U seperti yang ditunjukkan dalam Rajah 2(c) mengandungi merkuri yang terdedah kepada atmosfera manakala tiub kiri disambungkan kepada paip yang mengalirkan cecair dengan gravity tentu 0.86. Titik tengah paip berada 12 cm di bawah aras merkuri dalam tiub kanan. Tentukan tekanan dalam paip jika perbezaan aras ketinggian merkuri dari titik pertemuan dua cecair adalah 20 cm.

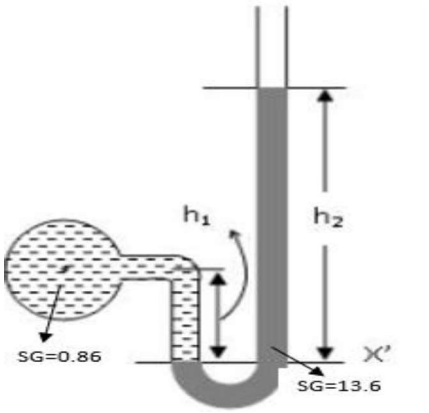

Figure 2(c)/ *Rajah 2(c)*

[12 marks]

[*12 markah*]

QUESTION 3
SOALAN 3

CLO2 (a) Water flows through a pipe have a dynamic viscosity of 8.9×10^{-4} Ns/m^2 and a density of 1000 kg/m^3. The pipe has a diameter of 25 mm and the flow rate is 500 ml/s. Calculate the Reynolds number for the flow.
Air mengalir melalui paip dengan kelikatan dinamik adalah 8.9×10^{-4} Ns/m^2 dan ketumpatan ialah 1000 kg/m^3. Paip mempunyai diameter 25 mm dan kadar alir 500 ml/s. Kirakan nombor Reynolds aliran tersebut.

[10 marks]
[*10 markah*]

CLO2 (b) The Reynolds number can be used to determine the characteristics of flow. Explain the type of flow in the pipe with a diagram, if Reynolds number is greater than 4000.
Nombor Reynolds boleh digunakan untuk menentukan ciri-ciri aliran. Terangkan jenis aliran dalam paip dengan gambar rajah jika nombor Reynolds lebih daripada 4000.

[5 marks]
[*5 markah*]

CLO2 (c) The Reynolds number is important in hydrodynamics analysis to help predict flow patterns. A pipe, with a diameter of 225 mm, carries oil at a rate of 12000 L/min. If the specific gravity of oil is 0.9 and the dynamic viscosity is 0.4 Ns/m^2, evaluate the Reynolds number and the type of flow.
Nombor Reynolds penting dalam analisis hidrodinamik untuk membantu meramal corak aliran sesuatu bendalir. Sebatang paip dengan diameter 225 mm mengalirkan minyak pada kadar 12000 L/min. Jika graviti tentu minyak ialah 0.9 dan kelikatan dinamik ialah 0.4 Ns/m^2, nilaikan nombor Reynolds dan jenis alirannya.

[10 marks]
[*10 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) A horizontal pipe with a diameter of 150 mm carries water at the velocity of 3.0 m/s. Determine the head loss at the entrance of the pipe and the flow rate.

Paip melintang berdiameter 150 mm mengalirkan air pada halaju 3.0 m/s. Tentukan kehilangan tenaga di pintu masuk dan kadar alirannya.

[8 marks]

[*8 markah*]

CLO2 (b) Water flows through 1.5 m pipe A at 4 m/s and then passes through pipe B with a diameter of 0.9 m as shown in Figure 4(b). Determine the velocity and flow rate at pipe B using Continuity equation.

Air mengalir melalui paip A 1.5 m pada 4 m/s dan kemudian melalui paip B diameter 0.9 m seperti yang ditunjukkan dalam Rajah 4(b). Tentukan halaju dan kadar alir di paip B menggunakan Persamaan keterusan.

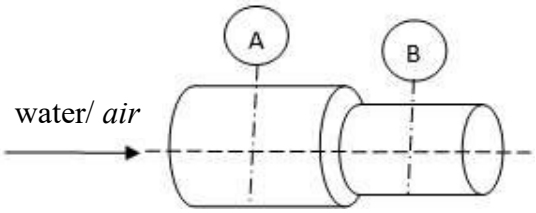

Figure 4(b)/ *Rajah 4(b)*

[7 marks]

[*7 markah*]

CLO2 (c) A jet of water with a diameter of 10 cm strikes a flat plate with a velocity of 18 m/s. Calculate the force exerted by the jet on the plate If the plate is static and the plate is moving at a velocity of 7 m/s away from the jet.

Aliran air berdiameter 10 cm melanggar satu plat rata dengan kelajuan 18 m/s. Kirakan daya hentamanjet ke atas plat jika plat itu static dan jika plat itu bergerak dengan halaju 7 m/s menjauhi jet.

[10 marks]

[*10 markah*]

SOALAN TAMAT

LIST OF FORMULAS
DCC30352 FLUID MECHANICS

Fluid Characteristics

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

$$s = \frac{\rho_{liquid}}{\rho_{water}}$$

$$\omega = \frac{W}{V}$$

$$W = m\,g$$

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

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

Measurement of Pressure

$$P = \rho g h$$

$$P_{abs} = P_{atm} + P_g$$

Hydrodynamics

$$R_e = \frac{\rho\, v\, d}{\mu} = \frac{v\, d}{\vartheta}$$

Flow Measurement and Bernoulli's Equation

$$Q = A\, v$$

$$H = \frac{P}{\rho g} + \frac{v^2}{2g} + z$$

$$\frac{P_1}{\rho g} + \frac{{v_1}^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{{v_2}^2}{2g} + z_2$$

$$H = \left(\frac{S_h}{S_o} - 1\right) \times h$$

$$H = \left(1 - \frac{S_h}{S_o}\right) \times h$$

$$Q_{act} = C_d \times \left[\frac{A_1 \times A_2}{\sqrt{(A_1)^2 - (A_2)^2}}\right] \times \sqrt{2gh}$$

$$Q = \frac{2}{3} C_d\, b \sqrt{2g} \times \left[(H_2)^{\frac{3}{2}} - (H_1)^{\frac{3}{2}}\right]$$

$$C_c = \frac{A_j}{A_0}$$

$$C_v = \frac{v_{actual}}{v_{theory}}$$

$$C_d = C_v \times C_c$$

$$\mathrm{v}_{the} = \sqrt{2\, g\, H}$$

$$\mathrm{v}_{\mathrm{act}} = C_v \sqrt{2\, g\, H}$$

$$Q_{the} = A_o \sqrt{2\, g\, H}$$

$$Q_{act} = C_d A_o \sqrt{2\, g\, H}$$

Fluid Flow

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

$$h_L = \left[\frac{1}{C_c} - 1\right]\frac{(v_2)^2}{2g}$$

$$h_L = \frac{0.5\,(v_1)^2}{2g}$$

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

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

$$h_f = \frac{4\,f\,L\,v^2}{2gd} = \frac{f\,L\,Q^2}{3d^5}$$

$$h_f = \frac{32\,\mu\,v\,L}{\rho g d^2}$$

$$\frac{P_1 - P_2}{\rho g} = h_f = \frac{32\,\mu\,v\,L}{\rho g d^2}$$

$$\frac{P_1}{\rho g} + \frac{{v_1}^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{{v_2}^2}{2g} + z_2 + \Sigma_{loss}$$

$$\frac{4\,f_1\,L_1\,(v_1)^2}{2gd_1} = \frac{4\,f_2\,L_2\,(v_2)^2}{2gd_2}$$

Momentum Equation

$$\mathrm{F_x} = \rho\,\mathrm{A}\,v^2$$

$$\mathrm{F}_x = \rho\,\mathrm{A}\,(v-u)^2$$

$$\mathrm{F}_n = \rho\,\mathrm{A}\,v^2 sin\theta$$

$$\mathrm{F_n} = \rho\,\mathrm{A}\,(v-u)^2\,sin\theta$$

$$\mathrm{F}_x = \mathrm{F}_n\,sin\theta$$

$$\mathrm{F}_y = \mathrm{F}_n\,cos\theta$$

$$\mathrm{F_x} = \rho\,\mathrm{A\,v}\,[\,v_{1x}\,cos\,\alpha + v_{2x}\,cos\,\beta\,]$$

$$\mathrm{F_y} = \rho\,\mathrm{A\,v}\,[\,v_{1y}\,sin\,\alpha - v_{2y}\,sin\,\beta\,]$$

$$\mathrm{F_x} = \rho\,\mathrm{A}\,(\mathrm{v}-\mathrm{u})[(v_{1x} - u)\,cos\,\alpha + (v_{2x} - u)\,cos\,\beta]$$

$$\mathrm{F_y} = \rho\,\mathrm{A}\,(\mathrm{v}-\mathrm{u})\big[(v_{1y} - u)\,sin\,\alpha - (v_{2y} - u)\,sin\,\beta\big]$$

$$\mathrm{F_x} = \rho\,\mathrm{Q}\,[\,v_{1x} - v_{2x}\,cos\,\theta\,] + P_{1x}A_{1x} - P_{2x}A_{2x}\,cos\,\theta\,]$$

$$\mathrm{F_y} = -\rho\,\mathrm{Q}\,(\,v_{2y}\,sin\,\theta\,) - P_{2y}A_{2y}\,sin\,\theta$$

$$\mathrm{F_R} = \sqrt{{F_x}^2 + {F_y}^2}$$

$$\alpha = tan^{-1}\left(\frac{F_y}{F_x}\right)$$