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 II : 2025/2026

DCC30352 : FLUID MECHANICS

TARIKH : 29 APRIL 2026
MASA : 11.30 PAGI – 1.30 PETANG (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** 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 mechanics is the study of fluids at rest and in motion. Hydrostatics and hydrodynamics are two main branches. Describe **FOUR (4)** main differences between them.

*Mekanik bendalir adalah kajian mengenai cecair yang berada dalam keadaan pegun dan bergerak. Hidrostatik dan hidrodinamik adalah dua cabang utama. Huraikan **EMPAT (4)** perbezaan utama antara kedua-duanya.*

[4 marks]

[*4 markah*]

CLO1 (b) There are several important concepts in understanding the basic properties of fluids. Describe the fluid properties of density, specific weight and specific gravity.

Terdapat beberapa konsep penting dalam memahami sifat asas bendalir. Terangkan ciri-ciri bagi ketumpatan, berat tentu dan graviti tentu.

[9 marks]

[*9 markah*]

CLO1 (c) In a civil engineering laboratory experiment to investigate fluid pressure distribution, a vertical tank is filled with three immiscible liquids - water, petrol, and mercury as shown in Figure 1(c). Given that the specific gravity of petrol and mercury are 0.72 and 13.6, respectively, calculate which point has the highest pressure.

Dalam satu eksperimen makmal kejuruteraan awam bagi mengkaji taburan tekanan bendalir, sebuah tangki menegak diisi dengan tiga jenis bendalir tidak bercampur iaitu air, petrol dan merkuri seperti yang ditunjukkan dalam Rajah 1(c). Diberikan bahawa graviti tentu bagi petrol dan merkuri masing-masing ialah 0.72 dan 13.6, kirakan titik manakah yang mempunyai tekanan paling tinggi.

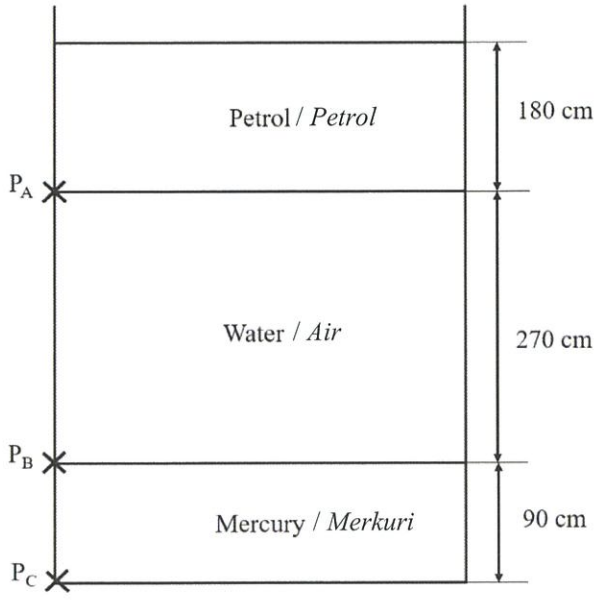

Figure 1 (c)/ *Rajah 1(c)*

[12 marks]

[*12 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) In the study of fluid mechanics, pressure in a fluid can be explained using several basic concepts. Explain the meaning of pressure head in a fluid.

Dalam kajian mekanik bendalir, tekanan dalam bendalir boleh diterangkan menggunakan beberapa konsep asas. Terangkan maksud turus tekanan dalam bendalir.

[4 marks]

[*4 markah*]

CLO1 (b) Pressure is an important parameter in fluid mechanics and can be measured using various types of pressure-measuring instruments. With the aid of a diagram, describe the working of principles of a barometer and a manometer.

Tekanan merupakan satu parameter penting dalam mekanik bendalir dan boleh diukur menggunakan pelbagai jenis alat pengukur tekanan. Dengan bantuan gambarajah, huraikan prinsip operasi barometer dan manometer.

[9 marks]

[*9 markah*]

CLO1 (c) An Inverted U tube differential manometer as shown in the Figure 2(c) is used to measure the pressure between two pipes, which carrying water. Calculate the difference pressure between pipe A and pipe B.

Sebuah manometer bezaan tiub U terbalik seperti yang ditunjukkan dalam Rajah 2(c) digunakan untuk mengukur perbezaan tekanan antara dua paip yang mengandungi air. Kirakan perbezaan tekanan antara paip A dan paip B.

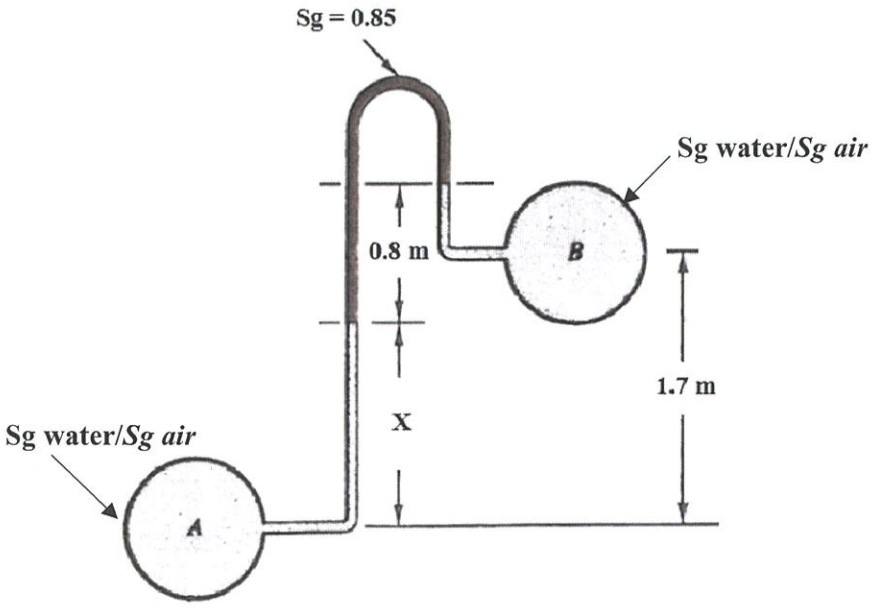

Figure 2(c)/ *Rajah 2(c)*

[12 marks]

[*12 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) Flow behaviour in a circular pipe was studied using a Reynolds experiment conducted in a hydraulic laboratory. Using the data in Table 3 (a), calculate flow rate, velocity, Reynold's number and types of flow.

Kelakuan aliran dalam paip berbentuk bulat telah dikaji menggunakan eksperimen Reynolds yang dijalankan di makmal hidraulik. Berdasarkan data dalam Jadual 3 (a), kirakan kadaralir, halaju, nombor Reynold's dan jenis aliran

Table 3(a) / *Jadual 3(a)*

Diameter of pipe, d *Diameter Paip, d*	20 mm
Volume, V *Isipadu*, V	2 L
Time *Masa*	45s
Kinematic Viscosity of Water, υ *Kelikatan Kinematik Air*, υ	1×10^{-6} m^2/s

[10 marks]

[*10 markah*]

CLO2 (b) Water flows through a horizontal pipe that gradually changes diameter. The diameter of the pipe at section 1 is 0.10 m and section 2 is 0.05m. The velocity of water at section 1 is measured as 1.2 m/s. Using continuity equation, determine the velocity of water at section 2 and the flow rate.

Air mengalir melalui sebuah paip mendatar yang berubah diameter secara beransur-ansur. Diameter paip di seksyen 1 ialah 0.10 m dan di seksyen 2 ialah 0.05 m. Halaju air di seksyen 1 diukur sebagai 1.2 m/s. Dengan menggunakan persamaan kesetaraan, tentukan halaju air di seksyen 2 dan kadar aliran.

[5 marks]

[*5 markah*]

CLO2

(c) Water is flowing through a pipe with a flow rate of 0.8 m^3/s. The pipe has a diameter of 200 mm and 300 mm at the upper and bottom respectively. The intensity of pressure at the upper end is 12740 N/m^2 and the intensity of pressure at the bottom end is 30560 N/m^2. By using Bernoulli's Equation, calculate the difference in datum head.

Air mengalir melalui paip dengan kadar aliran 0.8 m^3/s. Diameter bahagian atas dan bawah paip masing-masing adalah 200 mm dan 300 mm. Tekanan intensiti di hujung atas paip adalah 12740 N/m^2 dan tekanan intensiti di hujung bawah paip adalah 30560 N/m^2. Dengan menggunakan Persamaan Bernoulli, kirakan perbezaan ketinggian paip dari datum.

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Two reservoirs are connected by a long pipe of 20 cm diameter carrying a discharge of 0.15 m^3/s of water. An additional parallel pipe made of the same material is laid alongside the existing pipe, carrying a discharge of 0.25 m^3/s. Neglecting minor losses, calculate the diameter of the parallel pipe.

Dua takungan dihubungkan oleh sebuah paip panjang berdiameter 20 cm yang membawa aliran sebanyak 0.15 m^3/s. Sebuah paip selari tambahan yang diperbuat daripada bahan yang sama dipasang di sebelah paip sedia ada, membawa aliran sebanyak 0.25 m^3/s. Dengan mengabaikan kehilangan kecil, kirakan diameter paip selari tersebut.

[8 marks]

[*8 markah*]

CLO2 (b) Water flows through a 200 mm diameter pipe that suddenly enlarges to 300 mm before discharging. The lengths of the 200 mm and 300 mm pipe sections are 5 m and 6 m, respectively. The flow rate is 0.12 m^3/s, and both pipes are made of the same material. Determine all minor losses of the pipes.

Air mengalir melalui paip berdiameter 200 mm yang membesar secara tiba-tiba kepada 300 mm sebelum dilepaskan keluar. Panjang bahagian paip 200 mm dan 300 mm masing-masing ialah 5 m dan 6 m. Kadar alir ialah 0.12 m^3/s, dan kedua-dua paip diperbuat daripada bahan yang sama. Tentukan semua kehilangan kecil dalam paip tersebut.

[7 marks]

[*7 markah*]

CLO2

(c) When a water jet strikes a curved vane, it interacts with the surface of the vane, transferring momentum and causing a deflection of the jet's flow direction. Figure 4(c) shows a water jet with a diameter 50 mm having a velocity of 20 m/s enters tangentially a stationary curved vane and is deflected an angle of 40°. Calculate the magnitude and direction of the resultant force on the curved vane.
Apabila jet air mengenai plat lengkung, ia berinteraksi dengan permukaan plat, memindahkan momentum dan menyebabkan pembelokan arah aliran jet. Rajah 4(c) menunjukkan satu jet air berdiameter 50 mm mempunyai halaju 20 m/s menghentam plat lengkung pegun yang membias melalui sudut 40°. Kirakan magnitud dan arah daya paduan terhasil pada plat lengkung tersebut.

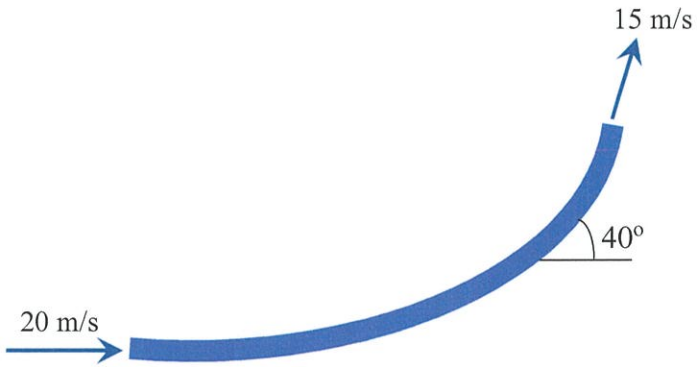

Figure 4(c) / *Rajah 4(c)*

[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

$$Q = A\, v$$

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

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

$$H = \left(\frac{s_h}{s_o} - 1\right) \times h$$

$$H = \left(1 - \frac{s_h}{s_o}\right) \times h$$

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

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

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

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

$$C_d = C_v \times C_c$$

$$v_{the} = \sqrt{2\, g\, H}$$

$$v_{act} = C_v \sqrt{2\, g\, H}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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