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 : 2024/2025

DCC30122: FLUID MECHANICS

TARIKH : 09 DISEMBER 2024
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

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

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)** subjective questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Identify **TWO (2)** differences in physical properties between liquid and gas.

*Kenal pasti **DUA (2)** perbezaan ciri-ciri fizikal antara cecair dan gas.*

[4 marks]

[*4 markah*]

CLO1 (b) The dynamic viscosity of an oil is given as 10^{-3} Ns/m^2. Estimate the kinematic viscosity if the volume and mass of the oil are 7.3 m^3 and 6500 kg.

Kelikatan dinamik minyak diberikan sebagai 10^{-3} Ns/m^2. Anggarkan kelikatan kinematik jika isipadu dan jisim minyak ialah 7.3 m^3 dan 6500 kg.

[8 marks]

[*8 markah*]

CLO1

(c) A 150 mm diameter cylindrical can is filled to a depth of 10 mm with fuel. The oil has a mass of 1.56 kg. Estimate the oil value of:

Tin silinder dengan diameter 150 mm diisi pada kedalaman 10 mm dengan bahan api. Minyak tersebut mempunyai jisim 1.56 kg. Anggarkan nilai minyak pada:

i. Specific weight.
Berat tentu.

[6 marks]
[6 *markah*]

ii. Specific gravity.
Graviti tentu.

[7 marks]
[*7 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Identify the absolute water pressure at a depth of 4 m below the free surface. Atmospheric pressure is at 101.3 kN/m^2.

Kenalpasti tekanan mutlak air pada kedalaman 4 m di bawah permukaan air. Tekanan atmosfera adalah 101.3 kN/m^2.

[4 marks]

[*4 markah*]

CLO1 (b) The gauge pressure in oil is 120 kN/m^2, estimate the pressure head of the oil (s.g = 0.8) and the depth of water if the fluid is changed to water using the same pressure value.

Tekanan salur minyak adalah 120 kN/m^2, anggarkan tinggi turus minyak (s.g=0.8) dan kedalaman air jika cecair tersebut ditukar dengan air menggunakan nilai tekanan yang sama.

[8 marks]

[*8 markah*]

CLO1 (c) Figure A1(c) shows a U-Tube differential manometer is connected to pipe A and pipe B. Pipe A contains a liquid of specific gravity 1.594 under a pressure of 10.3 x 10^4 N/m^2 and pipe B contains oil of specific gravity 0.8 under a pressure 17.16 x 10^4 N/m^2. Pipe A lies 2.5 m above pipe B. Estimate the value of *h.*

Rajah A1 (c) menunjukkan satu manometer pembezaan yang menghubungkan paip A dan B. Paip A mengandungi cecair yang mempunyai graviti tentu 1.594 di bawah tekanan 10.3 x 10^4 N/m^2 dan paip B mengandungi minyak dengan gravity tentu 0.8 di bawah tekanan 17.16 x 10^4 N/m^2. Paip A terletak 2.5 m di atas paip B. Anggarkan nilai h.

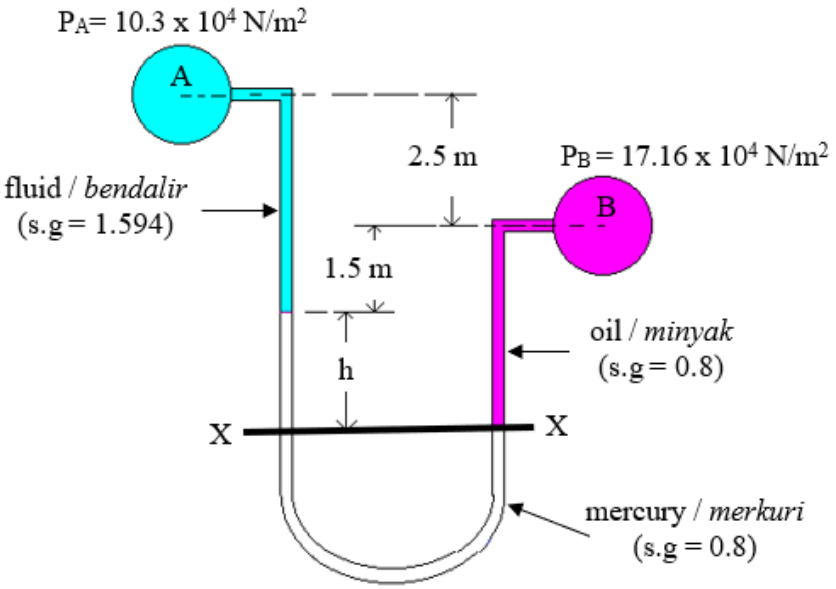

Figure A1(c) / *Rajah A1(c)*

[13 marks]

[*13 markah*]

SECTION B: 50 MARKS
BAHAGIAN B: 50 MARKAH

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

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO2 (a) Determine **THREE (3)** types of flow according to Osborne Reynolds. States the formula and characteristics of the related flow.
*Tentukan **TIGA (3)** jenis aliran berpandukan Osborne Reynolds. Nyatakan formula dan ciri-ciri aliran yang berkaitan.*

[4 marks]
[4 *markah*]

CLO2 (b) An oil having kinematic viscosity of 35.4×10^{-4} m^2/s is flowing through a pipe of 300 mm diameter. Determine the type of flow if the discharge through the pipe is 23 litres/s.
Minyak yang mempunyai kelikatan kinematik 35.4×10^{-4} m^2/s mengalir melalui paip diameter 300 mm. Tentukan jenis aliran, jika pelepasan melalui paip adalah 23 liter/s.

[9 marks]
[9 *markah*]

CLO2 (c) Differentiate between laminar flow, turbulent flow and transition flow.
Bezakan aliran laminar, aliran turbulen dan aliran transisi.

[12 marks]
[*12 markah*]

QUESTION 2

SOALAN 2

CLO2 (a) Water flows through pipe A of 1.2 m diameter at 4 m/s and then passes through pipe B with a diameter of 0.9 m as shown in Figure B2(a). Determine the velocity at pipe B using the Continuity equation.

Air mengalir melalui 1.2 m diameter paip A pada 4 m/s dan kemudian melalui paip B berdiameter 0.9 m seperti yang ditunjukkan dalam Rajah B2(a). Tentukan halaju di paip B menggunakan persamaan kesinambungan.

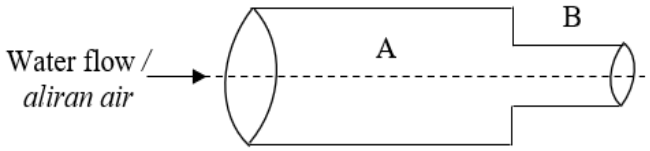

Figure B2(a) / *Rajah B2(a)*

[4 marks]

[*4 markah*]

CLO2 (b) An orifice with a diameter of 6 cm at the wall of a tank discharging the water below 7 m of head. Calculate the real flowrate and water jet velocity at vena contracta if given $C_d = 0.55$ and $C_v = 0.8$.

Sebuah orifis mempunyai diameter 6 cm pada dinding tangki mengeluarkan air di bawah turus 7 m. Kirakan kadar alir sebenar dan halaju jet air pada vena kontrakta jika diberi $C_d = 0.55$ dan $C_v = 0.8$.

[9 marks]

[*9 markah*]

CLO2 (c) A horizontal venturi meter with inlet and throat diameters of 300 mm and 180 mm respectively is used to measure the flow of water. The reading of mercury in the differential manometer that is connected to the inlet and the throat is 7 cm. Based on Figure B2(c), calculate the flow rate of water. (C_d = 0.98).

Satu venturi meter yang mendatar dengan diameter masuk dan leher masing-masing 300 mm dan 180 mm digunakan untuk mengukur kadar aliran air. Bacaan merkuri pada manometer kebezaan yang disambungkan ke bahagian masuk dan leher adalah 7 cm. Berdasarkan Rajah B2(c), kirakan kadar aliran air (C_d = 0.98).

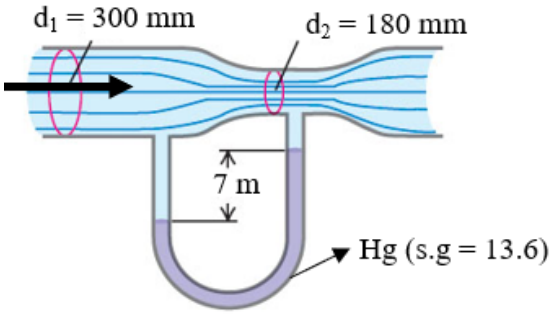

Figure B2(c) / *Rajah* B2(c)

[12 marks]

[*12 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) A 150 mm diameter horizontal pipe with flowing water at 3.0 m/s velocity from tank A to tank B. Calculate the head loss and the flow rate at the entrance of the pipe.

Paip melintang berdiameter 150 mm mengalirkan air pada halaju 3.0 m/s dari tangki A ke tangka B. Kirakan kehilangan tenaga dan kadar aliran air pada laluan masuk paip.

[4 marks]

[*4 markah*]

CLO2 (b) Determine the energy loss due to friction in the 55000 cm length of pipe and diameter of 120 mm when the flowrate is 1.65 m^3/min. Given the friction factor, f = 0.015.

Tentukan kehilangan tenaga kerana rintangan geseran dalam paip 55000 cm panjang dan bergarispusat 120 mm apabila kadaralir adalah 1.65 m^3/min. Diberi faktor geseran, f = 0.015.

[9 marks]

[*9 markah*]

CLO2

(c) A 300 m long concrete pipe with a diameter of 60 cm (sharp-edge entrance) is used to convey 15ºC water from reservoirs A to B as shown in Figure B3(c). At the end of the pipe, a diffuser with an exit is installed to reduce discharge loss. If the friction coefficient in the diffuser is 0.008, evaluate the flow rate in the pipe.

Paip konkrit dengan panjang 300 m berdiameter 60 cm (pintu masuk tajam) digunakan untuk mengalirkan air 15ºC dari takungan A ke B seperti yang ditunjukkan dalam Rajah B3(c). Pada akhir paip, paip keluar dipasang untuk mengurangkan kehilangan keluaran. Sekiranya pekali geseran dalam paip adalah 0.008, nilaikan kadar aliran dalam paip tersebut.

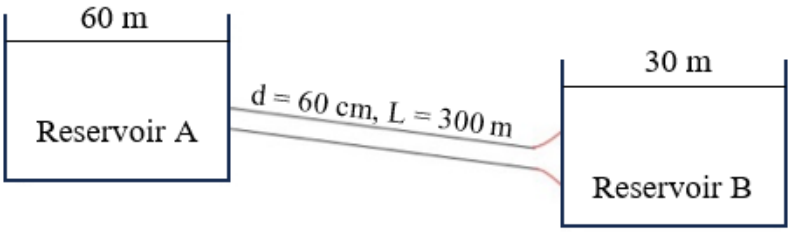

Figure B3(c) / *Rajah B3(c)*

[12 marks]

[*12 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) A 75 mm diameter jet of oil that has a specific gravity of 0.8 normally strikes a stationary flat plate. If the force exerted by the jet on the plate is 1200 N, calculate the velocity of the jet oil.

Satu jet minyak berdiameter 75 mm yang mempunyai gravity tentu 0.8 menghentam sebuah plat rata. Jika daya hentaman jet minyak tersebut adalah sebanyak 1200 N, kirakan halaju jet minyak tersebut.

[4 marks]

[*4 markah*]

CLO2 (b) A water jet with a diameter of 10 cm strikes flat plates at an angle of 60° to the plate with a velocity of 20 m/s. Calculate the normal pressure when the plate is stationary and moving with a velocity of 10 m/s in the direction of the jet.

Jet air berdiameter 10 cm menghentam plat rata bersudut 60^o dengan plat pada kelajuan 20 m/s. Kirakan tekanan normal pada plat apabila plat dalam keadaan pegun dan bergerak dengan halaju 10 m/s pada arah jet.

[9 marks]

[*9 markah*]

CLO2

(c) A horizontal pipeline bend in Figure B4(c) has been installed to deflect the flow of water from a diameter of 500 mm to a diameter of 300 mm at an angle of 60°. If the pressure from entry to bend is 120 kN/m^2, and the flow rate is 800 litre/second, calculate the magnitude of the force exerted on the pipe bend by the water.

Saluran paip mendatar dalam Rajah B4(c) *telah dipasang untuk memesongkan aliran air dari diameter 500 mm hingga diameter 300 mm pada sudut 60°. Jika diketahui bahawa tekanan semasa masuk ke selekoh adalah 120 kN/m^2, dan kadar aliran adalah 800 liter/saat, kirakan magnitud daya yang dikenakan pada selekoh paip oleh air.*

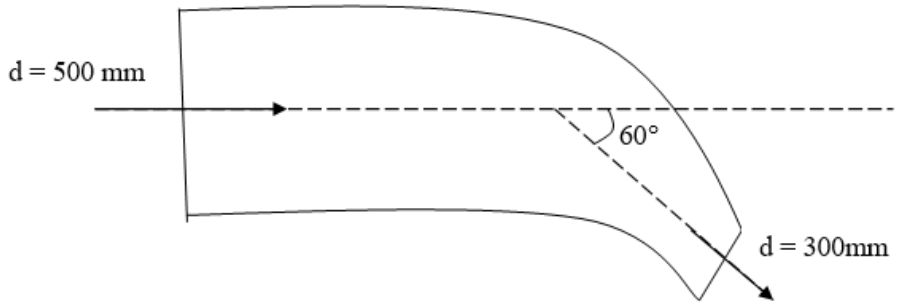

Figure B4(c) / *Rajah B4(c)*

[12 marks]

[*12 markah*]

SOALAN TAMAT

FORMULA DCC30122 – FLUID MECHANICS

LIST FORMULA

1. $\tau = \mu \frac{d_c}{d_y}$
2. $\upsilon = \frac{\mu}{\rho}$
3. $P = \rho g h$
4. $Re = \frac{\rho v d}{\mu}$ @ $Re = \frac{v d}{\upsilon}$
5. $Q_1 = Q_2$
6. $Q = AV$
7. $H = \frac{P}{\rho g} + \frac{v^2}{2g} + z$
8. $H = \left[\frac{\rho_m}{\rho_o} - 1 \right] x \; h$
9. $Q = C_d A \sqrt{\frac{2gH}{m^2 - 1}}$ @

   $Q = C_d \left[\frac{A_1 \; x \; A_2}{\sqrt{A_1^2 - A_2^2}} \right] x \; \sqrt{2gH}$
10. $V_{act} = C_v \; x \; \sqrt{2gH}$
11. $Q_{act} = C_d A_o \; \sqrt{2gH}$
12. $C_c = \frac{A_j}{A_o}$
13. $C_v = \frac{V_{act}}{V_{theory}}$
14. $C_d = C_c \; x \; C_v$
15. $Q = \frac{2}{3} C_d \; b \sqrt{2g} \; [H_2^{3/2} - H_1^{3/2}]$
16. $h_L = \left[\frac{v^2}{2g} \right]$
17. $h_L = \left[\frac{(v_1 - v_2)^2}{2g} \right]$
18. $h_L = \left[\frac{1}{C_c} - 1 \right]^2 \frac{v^2}{2g}$
19. $hf = \frac{4fLv^2}{2gd}$ @ $\frac{fLQ^2}{3d^5}$
20. $F = \rho A v^2$
21. $F_n = \rho A v^2 \sin \theta°$
22. $F_x = F_n \sin \theta°$
23. $F_y = F_n \cos \theta°$
24. $F_x = \rho A \; (v - u)^2$
25. $F_n = \rho A \; (v - u)^2 \sin \theta°$
26. $F_x = \rho A v \; [(v_{1x} \cos \alpha°) + (v_{2x} \cos \beta°)]$
27. $F_y = \rho A v \; [(v_{1y} \sin \alpha°) - (v_{2y} \sin \beta°)]$
28. $F_x = \rho A (v - u) \; [((v_{1x} - u) \cos \alpha°) + ((v_{2x} - u) \cos \beta°)]$
29. $F_y = \rho A (v - u) \; [((v_{1y} - u) \sin \alpha°) - ((v_{2y} - u) \sin \beta°)]$
30. $F_R = \sqrt{(F_x)^2 + (F_y)^2}$
31. $\alpha = \tan^{-1} \left[\frac{F_y}{F_x} \right]$