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 PETROKIMIA

PEPERIKSAAN AKHIR

SESI I : 2024 / 2025

DGP20082 : FLUID MECHANICS

TARIKH : 05 DISEMBER 2024
MASA : 11.30 PAGI - 1.30 PETANG (2 JAM)

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

Struktur (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)** questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) Define fluid mechanics.

Takrifkan mekanik bendalir.

[3 marks]

[*3 markah*]

CLO1 (b) Convert the following temperatures according to the specified scales; 1500°C to K, 2120°C to °F, 2250°F to R, and 3350 R to K.

Tukar suhu berikut mengikut skala yang ditetapkan; 1500 °C *kepada K, 2120*°C *kepada* °F, *2250*°F *kepada R, dan 3350 R kepada K.*

[10 marks]

[*10 markah*]

CLO1 (c) Given the specific gravity of Ethylene glycol is 0.9 and its mass is 2kg. Calculate the value of specific weight (ω), mass density (ρ), specific volume (v) and volume (V) of Ethylene glycol.

Diberi graviti tentu bagi Ethylene glycol ialah 0.9 dan jisimnya ialah 2kg. Kirakan berat tentu (ω), *ketumpatan* (ρ), *isipadu tentu* (v) *dan isipadu* (V) *bagi Ethylene glycol.*

[12 marks]

[*12 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) State the Pascal's law.

Nyatakan Prinsip Paskal.

[3 marks]

[*3 markah*]

CLO1 (b) A hydraulic jack consists of small and large cylinders with diameters of 100 mm and 3000 mm respectively. The required force, F to lift a load, W is 3000 N. If the large piston is 50 cm lower than the small piston, approximate the weight, W that can be lifted by the hydraulic jack. Given the specific weight of oil is 9500 N/m^3.

Jek hidraulik terdiri daripada silinder kecil dan besar dengan diameter masing-masing 100 mm dan 3000 mm. Daya yang diperlukan, F untuk mengangkat beban, W adalah 3000 N. Jika omboh besar adalah 50 cm lebih rendah daripada omboh kecil, anggarkan berat, W yang boleh diangkat oleh jek hidraulik. Diberikan berat tentu bagi minyak ialah 9500 N/m^3.

[10 marks]

[*10 markah*]

CLO1 (c) An inverted U-tube mercury manometer shown in Diagram 2 (c) is used to measure small pressure differences of two points of liquid in a pipe. Calculate the difference of gauge pressure, P_A-P_B if h=10 cm, h_1=5 cm, and h_2=3 cm. Given the relative density, *s* of liquid γ and γ_m are 0.75 and 13.6 respectively. Assume the specific weight of water is 10 kNm^{-3}.

Manometer merkuri tiub-U terbalik yang ditunjukkan seperti Rajah 2(c) digunakan untuk mengukur perbezaan tekanan di antara 2 titik cecair di dalam paip. Kirakan perbezaan pada pengukur tekanan, P_A-P_B jika h=10 cm, h_1=5 cm, and h_2=3 cm. Diberi ketumpatan relatif, s untuk cecair γ and γ_m ialah masing-masing 0.75 dan 13.6. Anggapkan berat tentu air ialah 10 kNm^{-3}.

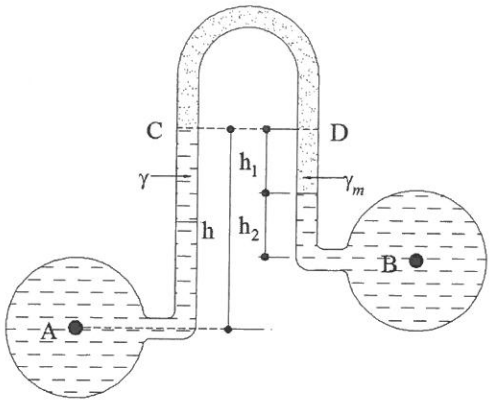

Diagram 2(c)/*Rajah 2 (c)*

[12 marks]

[*12 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) List **TWO (2)** forms of energy.

*Senaraikan **DUA (2)** bentuk tenaga.*

[4 marks]

[*4 markah*]

CLO2 (b) Diagram 3 (b) shows a drainage system consisting of round pipes and mutiple reducers. Two different inlet sources are combined and drained to a larger pipes via Y-type connection and finally to the main drain pipe through a reducer. Calculate Q_1, Q_2 ,v_3 and v_4. Assume 1" = 0.0254 m.

Rajah 3 (b) menunjukkan sistem saliran yang terdiri daripada paip bulat dan peredam. Dua saluran masuk yang berbeza digabungkan dan disalurkan ke paip besar dengan sambungan jenis Y dan akhirnya ke paip utama . Hitungkan Q_1, Q_2, v_3 dan v_4. Anggapkan 1" = 0.0254 m.

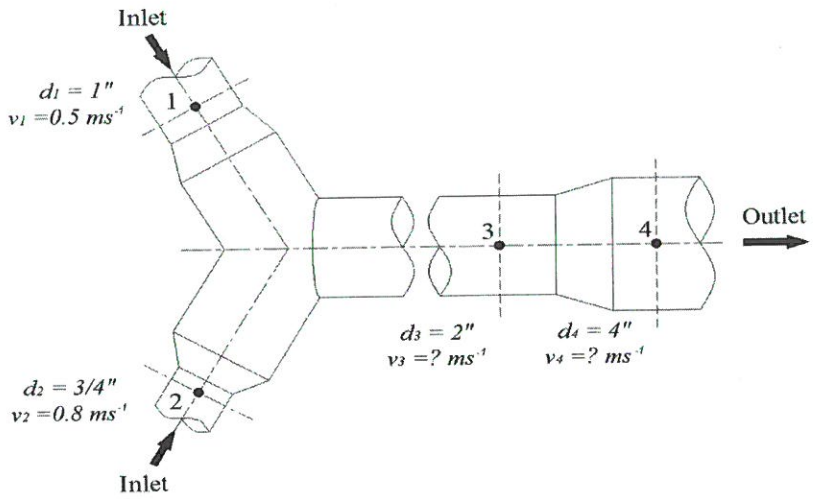

Diagram 3(b)/*Rajah 3(b)*

[8 marks]

[*8 markah*]

CLO2 (c) A meter orifice with diameter 25 cm is inserted in a pipe of 85 cm diameter. Coefficient of discharge, $C_d = 0.62$ and specific gravity of oil in the pipe, $s_{oil} = 0.89$. The pressure difference that is measured by the manometer is 825 cm. Calculate the flow rate of the oil through the pipe.

Satu orifis meter dengan diameter 25 cm dimasukkan ke dalam sebatang paip berdiameter 85 cm. Pekali pelesan, $C_d = 0.62$ dan graviti tentu bagi minyak di dalam paip, $s_{oil} = 0.89$. Perbezaan tekanan yang diukur oleh manometer ialah 825 cm. Kirakan kadar aliran minyak mengalir melalui paip.

[13 marks]

[*13 markah*]

QUESTION 4
SOALAN 4

CLO2 (a) Based on Diagram 4(a), label correctly the velocity profile A, B and C in a round pipe system.

Berpandukan kepada Rajah 4(a), labelkan dengan betul profil halaju A, B dan C dalam sistem paip bulat.

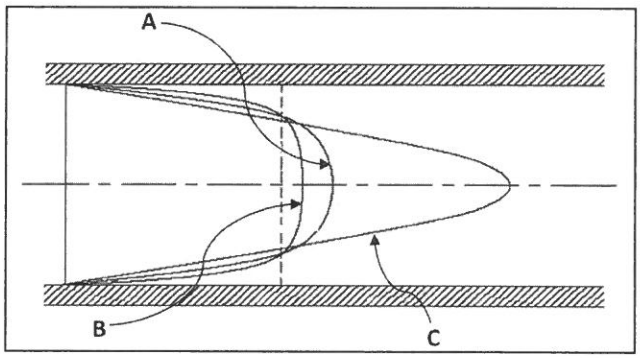

Diagram 4(a) : Velocity Profile

Diagram 4(a) : Profil Halaju

[5 marks]

[*5 markah*]

CLO2 (b) A pipe carrying 1000 l/min of water enlarged suddenly from 20 mm to 50 mm in diameter. Approximate the head loss due to the sudden enlargement and the pressure difference between the two pipes.

Paip mendatar yang membawa 1000 l/min air membesar secara tiba-tiba dalam diameter daripada 20 mm kepada 50 mm. Anggarkan kehilangan turus disebabkan oleh pembesaran mendadak dan perbezaan tekanan di antara kedua-dua paip.

[8 marks]

[*8 markah*]

CLO2 (c) Two tanks with difference in water surface level 12 m are connected in series with two pipes. The diameter of the pipe is 35 cm and 55 cm and lengths 12 m and 22 m respectively. Calculate the rate of flow of water if the coefficient of friction for both pipes is 0.007. Assume coefficient of contraction, $C_d = 0.66$.

Dua tangki dengan perbezaan paras permukaan air 12 m disambung secara siri dengan dua paip. Diameter paip ialah masing-masing 35 cm dan 55 cm dan panjang 12 m dan 22 m. Kirakan kadar aliran air jika pekali geseran bagi kedua-dua paip ialah 0.007. Anggapkan pekali penguncupan, $C_d = 0.66$.

[12 marks]

[*12 markah*]

SOALAN TAMAT

LIST OF FORMULA

BASIC CONCEPTS OF FLUID MECHANICS:

$T(K) = T(°C) + 273$

$T(°F) = \left(\frac{9}{5}\right) T(°C) + 32$

$T(°R) = \left(\frac{9}{5}\right) T(K)$

$T(°F) = T(°R) - 460$

mass density, $\rho = \frac{m}{V}$

specific weight, $\omega = \frac{W}{V} = \rho g$

specific gravity, $s = \frac{\omega_{substance}}{\omega_{water}} = \frac{\rho_{substance}}{\rho_{water}}$

specific volume, $v = \frac{1}{\rho}$

FLUID STATICS:

$P = \frac{F}{A} = \rho g h$

$B = \rho g V$

$F_{buoyancy} = w = pgv = pgBLD$

FLUID DYNAMICS:

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

$Q_{Theory} = A_1 \sqrt{\frac{2gh}{m^2 - 1}}$

$Q_{Actual} = C_d(Q_{Theory})$

$Q_{Actual} = C_d A_1 \sqrt{\frac{2gH}{(m^2 - 1)}}$

$H = \frac{P_1 - P_2}{\omega_{sub}} + (z_1 - z_2) = x\left[\frac{\omega_{tube}}{\omega_{pipe}} - 1\right]$

$Q_{actual} = \frac{C_d A_1}{\sqrt{(m^2 - 1)}} \sqrt{2g\left[\frac{P_1 - P_2}{\omega} + (Z_1 - Z_2)\right]}$

ENERGY LOSS IN PIPELINES:

$h_c = \left[\frac{1}{C_c} - 1\right]^2 \times \frac{v_2^2}{2g}$

$h_i = \frac{1}{2} \frac{v^2}{2g}$

$h_f = \frac{4fl}{d} \frac{v^2}{2g}$

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

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