SULIT

POLITEKNIK MALAYSIA

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

JABATAN KEJURUTERAAN PETROKIMIA

PEPERIKSAAN AKHIR

SESI I : 2022 / 2023

DGP20082 : FLUID MECHANICS

TARIKH : 12 DISEMBER 2022
MASA : 2.30 PETANG – 4.30 PETANG (2 JAM)

Kertas ini mengandungi **ENAM (6)** 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)** structure questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 C1 (a) Define viscosity.

Takrifkan kelikatan.

[3 marks]

[*3 markah*]

CLO1 C2 (b) Convert the following temperatures below according to the specified scales; 150°C to K, 212°C to °F, 225°F to R, and 335 R to K.

Tukar suhu berikut mengikut skala yang ditetapkan; 150 °C *kepada K, 212*°C *kepada* °F, *225*°F *kepada R, dan 335 R kepada K.*

[10 marks]

[*10 markah*]

CLO1 C3 (c) Given the specific weight of fluid, A is 9kN/m^3 and its mass is 5.0 kg. Calculate; Volume of fluid A, Specific Volume of fluid A, and Density of Fluid A.

Diberikan berat tentu bendalir, A ialah 9kN/m^3 dan jisimnya ialah 5.0 kg. Kirakan; Isipadu bendalir A, Isipadu tentu bendalir A, dan Ketumpatan bendalir A.

[12 marks]

[*12 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) State the Archimedes' Principle.
Nyatakan Prinsip Archimedes.

[3 marks]
[*3 markah*]

CLO1
C2

(b) A hydraulic jack consists of small and large cylinders with diameters of 15 cm and 35 cm respectively. The required force, F to lift up a load, W is 500 N. If the large piston is 10 cm higher than the small piston, approximate the weight, W that can be lifted. Given the specific weight of oil is 8500 N/m^3.
Jek hidraulik terdiri daripada silinder kecil dan besar dengan diameter masing-masing 15 cm dan 35 cm. Daya yang diperlukan, F untuk mengangkat beban, W adalah 500 N. Jika omboh besar adalah 10 cm lebih tinggi daripada omboh kecil, anggarkan berat, W yang boleh diangkat. Diberikan berat tentu bagi minyak ialah 8500 N/m^3.

[10 marks]
[*10 markah*]

CLO1
C3

(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. The difference of gauge pressure, P_B-P_A is 3.5 kPa. Assuming the relative density, *s* of liquid γ and mercury are 0.75 and 13.6 respectively. Calculate h, h_1, and h_2 if h= $2h_1$=$4h_2$ and 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. Perbezaan pada pengukur tekanan, P_B-P_A is 3.5 kPa. Dengan anggapan graviti tentu, s untuk cecair dan merkuri adalah 0.75 dan 13.6 masing-masing. Kirakan h, h_1 and h_2 if $h = 2h_1 = 4h_2$ dan berat tentu air adalah 10 kNm^{-3}.

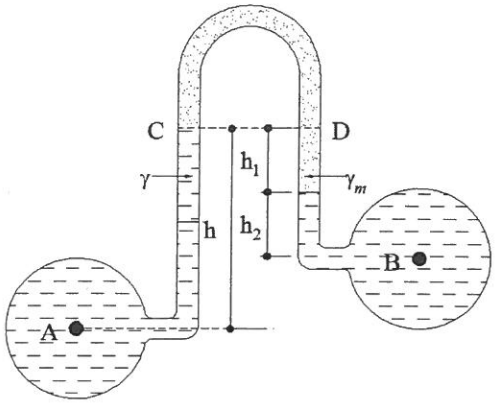

Diagram 2 (c) / *Rajah 2 (c)*

[12 marks]

[*12 markah*]

QUESTION 3

SOALAN 3

CLO2 C1 (a) List **FOUR (4)** types of flow.

*Senaraikan **EMPAT (4)** jenis pengaliran.*

[4 marks]

[*4 markah*]

CLO2 C2 (b) The main AB pipe is split into three and become BC pipe, BD pipe, and BE pipe. Water flows with the rate of 20 mm^3/s through an area of 1.5 mm^2 in AB pipe. The flow rate in BD pipe is 2 times larger than BC pipe and 0.5 times smaller than BE pipe. Given υ_{BC} = 5m/s, υ_{BD} = 4m/s and d_{BE} = 20 mm. Approximate: the velocity in AB pipe and the discharge in BE pipe.

Paip utama AB dibahagikan kepada tiga dan menjadi paip BC, BD dan BE. Air mengalir pada kadar 20mm^3/s melalui paip AB pada luas 1.5mm^2. Kadaraliran pada paip BD ialah 2 kali ganda lebih besar berbanding paip BC dan 0.5 kali lebih kecil berbanding paip BE. Diberi υ_{BC} = 5m/s, υ_{BD} = 4m/s and d_{BE} = 20 mm. Anggarkan; halaju dalam paip AB dan pelepasan dalam paip BE.

[8 marks]

[*8 markah*]

CLO2
C3

(c) A vertical venturi meter has an entrance of 200 mm diameter and a throat of 50 mm diameter. The throat is 150 mm above the entrance. The alcohol that flows in the meter measures the theoretical discharge at $30x10^{-3}$ m^3/s. Given S_{Hg} = 13.6, C_d = 0.98 and $\rho_{alcohol}$ = $789kg/m^3$. Calculate the pressure difference between entrance and throat.

Meter venturi menegak mempunyai satu masukan berdiameter 200mm dan 50mm diameter pada tekak. Tekak berada 150mm di atas masukan. Alkohol yang mengalir di dalam meter yang mengukur pelepasan teori pada $30x10^{-3}$ m^3/s. *Diberi* $S_{Hg}=13.6$, $C_d=0.98$ *dan* $\rho_{alcohol}$ = $789kg/m^3$. *Kirakan perbezaan tekanan di antara masukan dan tekak.*

[13 marks]

[*13 markah*]

QUESTION 4

SOALAN 4

CLO2
C1

(a) List down types of energy loss in the pipeline.

Senaraikan jenis-jenis kehilangan tenaga di dalam saluran paip.

[5 marks]

[*5 markah*]

CLO2
C2

(b) Oil flows through a pipe at a flow rate of $0.047m^3/s$ with a diameter of 100 mm that suddenly enlarges to a diameter of 250 mm. The specific gravity of oil is 0.85. Approximate; the head loss due to the diameter changing and difference of pressure $(P_1 - P_2)$ between both pipes in kN/m^2.

Minyak mengalir melalui sebatang paip pada kadar aliran $0.047m^3/s$ *dengan diameter 100mm yang tiba-tiba membesar kepada diameter 250mm. Graviti tentu minyak ialah 0.85. Anggarkan; kehilangan turus disebabkan perubahan diameter dan perbezaan tekanan* $(P_1 - P_2)$ *di antara kedua-dua paip dalam* kN/m^2.

[8 marks]

[*8 markah*]

CLO2
C3

(c) The two reservoirs in Diagram 4 (c) have a difference in level of H that is 8 m and connected by a pipeline, which is 40mm in diameter for the first 12mm and 25mm for the remaining 5m. Calculate the discharge of flow in m^3/s if the coefficient of friction, f= 0.001 for both pipes and coefficient of contraction, Cc =0.66.

Dua takungan seperti dalam Rajah 4 (c) mempunyai perbezaan dalam tahap H adalah 8 m dan dihubungkan dengan saluran paip, iaitu bergaris pusat 40mm untuk 12mm pertama dan 25mm untuk 5m selebihnya. Kirakan kadaraliran dalam m^3/s jika pekali geseran, $f = 0.001$ untuk kedua-dua paip dan pekali pengecutan, $Cc = 0.66$.

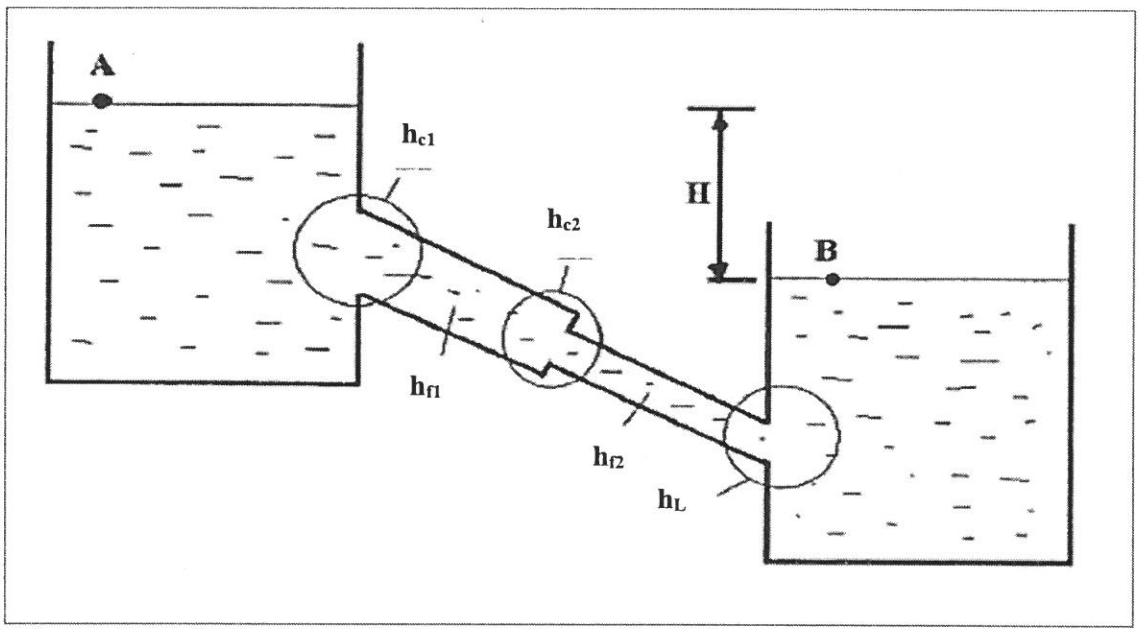

Diagram 4 (c)/ *Rajah 4 (c)*

[12 marks]
[*12 markah*]

SOALAN TAMAT

LIST OF FORMULA

DGP20082 – FLUID MECHANICS

TEMPERATURE UNITS

°C = K -273

R = 1.8K

°F = R – 460

°F = 1.8 °C + 32

PHYSICAL PROPERTIES OF FLUIDS

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

Specific weight, $\omega = \frac{w}{V}$, $\omega = \rho g$

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

$$s = \frac{\omega_{substance}}{\omega_{water}}$$

Specific volume, $v = \frac{V}{m}$, $v = \frac{1}{\rho}$

PRESSURE AND DEPTH

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

FLUID DYNAMICS

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

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

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

$$H = \frac{P_1 - P_2}{\omega} = x\left(\frac{\omega_{Hg}}{\omega_{substance}} - 1\right)$$

PIPE SYSTEMS

$$h_i = \frac{1}{2} x \frac{v_1^2}{2g}$$

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

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

$$h_c = \left(\frac{1}{C_c} - 1\right)^2 x \frac{v_2^2}{2g}$$

$$h_o = \frac{v_2^2}{2g}$$