

**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 : 2023/2024**

**DGP20082 : FLUID MECHANICS**

**TARIKH : 16 DISEMBER 2023**

**MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

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Kertas ini mengandungi **LIMA (5)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**



**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

- (a) Define pressure.  
*Takrifkan tekanan.*

[3 marks]

[3 markah]

CLO1

- (b) Convert the temperatures below according to the specified scales, 125 °C to K, 480 K to °F, 320 R to °C and 200 °F to °C.  
*Tukar suhu di bawah mengikut skala yang ditetapkan, 125 °C kepada K, 480 K kepada °F, 320 R kepada °C and 200 °F kepada °C.*

[10 marks]

[10 markah]

CLO1

- (c) Given the specific gravity of fluid, K is 0.95 and its mass is 8.1 kg. Calculate the density, specific volume, and specific weight of fluid K.  
*Diberikan gravity tentu cecair, K ialah 0.95 dan jisimnya ialah 8.1 kg. Kirakan yang berikut ketumpatan, isipadu tentu dan berat tentu cecair K.*

[12 marks]

[12 markah]

**QUESTION 2****SOALAN 2**

CLO1

- (a) State the relationship of pressure and depth.  
*Nyatakan hubungkait antara tekanan dan kedalaman.*

[3 marks]

[3 markah]

CLO1

- (b) A hydraulic jack consists of small and large cylinders with diameters of 60 cm and 830 mm respectively. The required force,  $F$  to lift a load,  $W$  is 840 N. If the large piston is 230 mm higher than the small piston, approximate the weight,  $W$  that can be lifted. Given the density of oil equals to  $890 \text{ kg/m}^3$ .

*Jek hidraulik terdiri daripada silinder kecil dan besar dengan diameter masing-masing 60 cm dan 830 mm. Daya yang diperlukan,  $F$  untuk mengangkat beban,  $W$  adalah 840 N. Jika omboh besar adalah 230 mm lebih tinggi daripada omboh kecil, anggarkan berat,  $W$  yang boleh diangkat. Diberikan berat tentu bagi minyak ialah  $890 \text{ kg/m}^3$ .*

[10 marks]

[10 markah]

CLO1

- (c) A U-tube manometer shown in Diagram 2(c) measures the pressure difference between two points, A and B in a liquid. The U tube contains mercury. Calculate the difference in pressure if  $h = 2.8 \text{ m}$ ,  $h_2 = 0.6 \text{ m}$ , and  $h_1 = 0.95 \text{ m}$ . The liquid of A and B is oil ( $s=0.9$ ) and the specific gravity of mercury is 13.6.

*Sebuah U-tiub manometer seperti yang ditunjukkan dalam Rajah 2(c) mengukur perbezaan tekanan di antara titik A dan B di dalam cecair. U-tube tersebut mengandungi merkuri. Kirakan perbezaan tekanan jika  $h = 2.8 \text{ m}$ ,  $h_2 = 0.6 \text{ m}$  dan  $h_1 = 0.95 \text{ m}$ . Cecair pada A dan B ialah minyak ( $s=0.9$ ) dan graviti tentu merkuri ialah 13.6.*

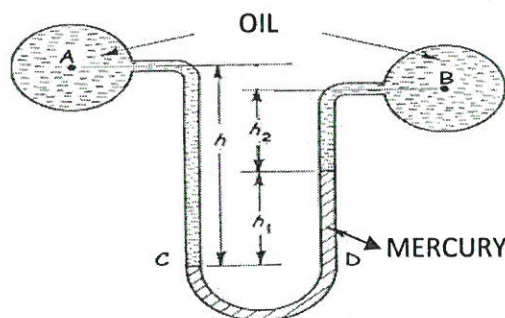


Diagram 2(c)/Rajah 2 (c)

[12 marks]

[12markah]

## QUESTION 3

## SOALAN 3

- CLO2 (a) Describe Bernoulli's Theorem.

*Huraikan Teori Bernoulli's.*

[4 marks]

[4 markah]

- CLO2 (b) The main AB pipe is split into three and become BC pipe, BD pipe, and BE pipe. Water flows with the rate of  $44 \text{ cm}^3/\text{s}$  through an area of  $3.2 \text{ cm}^2$  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  $v_{BC} = 8\text{m/s}$ ,  $v_{BD} = 7\text{m/s}$  and  $d_{BE} = 42 \text{ cm}$ . 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  $44 \text{ cm}^3/\text{s}$  melalui paip AB pada luas  $3.2 \text{ cm}^2$ . Kadar aliran pada paip BD ialah 2 kali ganda lebih besar berbanding paip BC dan 0.5 kali lebih kecil berbanding paip BE. Diberi  $v_{BC} = 8\text{m/s}$ ,  $v_{BD} = 7\text{m/s}$  and  $d_{BE} = 42 \text{ cm}$ . Anggarkan halaju dalam paip AB dan pelepasan dalam paip BE.*

[8 marks]

[8 markah]

- CLO2 (c) A vertical venturi meter has an entrance of 32 cm diameter and a throat of 9 cm diameter. The throat is 21 cm above the entrance. The alcohol that flows in the meter measures the theoretical discharge at  $44 \times 10^{-3} \text{ m}^3/\text{s}$ . Given  $S_{Hg} = 13.6$ ,  $C_d = 0.9$  and  $\rho_{\text{alcohol}} = 850 \text{ kg/m}^3$ . Calculate the pressure difference between entrance and throat.

*Meter venturi menegak mempunyai satu masukan berdiameter 32 cm dan 9 cm diameter pada tekak. Leher berada 21 cm di atas masukan. Alkohol yang mengalir di dalam meter yang mengukur pelepasan teori pada  $44 \times 10^{-3} \text{ m}^3/\text{s}$ . Diberi  $S_{Hg}=13.6$ ,  $C_d=0.9$  dan  $\rho_{\text{alcohol}} = 850 \text{ kg/m}^3$ . Kirakan perbezaan di antara masukan dan tekak.*

[13 marks]

[13 markah]

## QUESTION 4

## SOALAN 4

- CLO2 (a) A pipe is defined as a closed conduit of circular section through which the fluid flows. Therefore, the fluid in the pipe has no free surface. List **FIVE (5)** losses of energy in pipe line.
- Paip ditakrifkan sebagai saluran tertutup keratan bulat di mana cecair mengalir. Oleh itu, cecair di dalam paip tidak mempunyai permukaan yang bebas. Senaraikan **LIMA (5)** kehilangan tenaga di dalam saluran paip.*
- [5 marks]  
[5 markah]
- CLO2 (b) Oil flows through a pipe at a flow rate of  $0.089 \text{ m}^3/\text{s}$  with a diameter of 24 cm that suddenly enlarges to a diameter of 36 cm. The specific weight of the oil is 0.91. Approximate the head loss due to diameter changing and pressure difference ( $P_1 - P_2$ ) between both pipes in  $\text{kN/m}^2$ .
- Minyak mengalir melalui sebatang paip pada kadar aliran  $0.089 \text{ m}^3/\text{s}$  dengan diameter 24 cm yang tiba-tiba membesar kepada diameter 36 cm. Berat tentu minyak ialah 0.91. Anggarkan kehilangan turus disebabkan perubahan diameter dan perbezaan tekanan ( $P_1 - P_2$ ) di antara kedua-dua paip dalam  $\text{kN/m}^2$ .*
- [8 marks]  
[8 markah]
- CLO2 (c) Two tanks with difference in water surface level 32 m are connected in series with two pipes. The diameter of each pipe is 36 cm and 9 cm and the lengths are 35 m and 55 m respectively. Calculate the rate of flow of water if the coefficient of friction is 0.009 and 0.0095. Assume  $C_c = 0.85$ .
- Dua tangki dengan perbezaan paras permukaan air 32 m disambung secara siri dengan dua paip. Diameter paip ialah 36 cm dan 9 cm dan panjang 35 m dan 55 m masing-masing. Kirakan kadar aliran air jika pekali geseran ialah 0.009 dan 0.0095. Anggapkan  $C_c=0.85$*
- [12 marks]  
[12 markah]

## SOALAN TAMAT

**LIST OF FORMULA**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>BASIC CONCEPTS OF FLUID MECHANICS:</b></p> $T(K) = T(^{\circ}C) + 273$ $T(^{\circ}F) = \left(\frac{9}{5}\right) T(^{\circ}C) + 32$ $T(^{\circ}R) = \left(\frac{9}{5}\right) T(K)$ $T(^{\circ}F) = T(^{\circ}R) - 460$ <p>mass density, <math>\rho = \frac{m}{V}</math></p> <p>specific weight, <math>\omega = \frac{W}{V} = \rho g</math></p> <p>specific gravity, <math>s = \frac{\omega_{\text{substance}}}{\omega_{\text{water}}} = \frac{\rho_{\text{substance}}}{\rho_{\text{water}}}</math></p> <p>specific volume, <math>v = \frac{1}{\rho}</math></p> | <p><b>FLUID STATICS:</b></p> $P = \frac{F}{A} = \rho g h$ $B = \rho g V$                                                                                                                                                                   |
| <p><b>FLUID DYNAMICS:</b></p> $\frac{P_1}{\omega} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\omega} + \frac{v_2^2}{2g} + z_2$ $Q_{\text{Theory}} = A_1 \sqrt{\frac{2gh}{m^2 - 1}}$ $Q_{\text{Actual}} = C_d (Q_{\text{Theory}})$ $Q_{\text{Actual}} = C_d A_1 \sqrt{\frac{2gH}{(m^2 - 1)}}$ $H = \frac{P_1 - P_2}{\omega_{\text{sub}}} + (z_1 - z_2) = x \left[ \frac{\omega_{\text{tube}}}{\omega_{\text{pipe}}} - 1 \right]$ $Q_{\text{actual}} = \frac{C_d A_1}{\sqrt{(m^2 - 1)}} \sqrt{2g \left[ \frac{P_1 - P_2}{\omega} + (z_1 - z_2) \right]}$                   | <p><b>ENERGY LOSS IN PIPELINES:</b></p> $h_c = \left[ \frac{1}{C_c} - 1 \right]^2 \times \frac{v_2^2}{2g}$ $h_i = \frac{1}{2} \frac{v^2}{2g}$ $h_f = \frac{4fl}{d} \frac{v^2}{2g}$ $h_L = \frac{(v_1 - v_2)^2}{2g}$ $h_o = \frac{v^2}{2g}$ |

