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 MEKANIKAL

PEPERIKSAAN AKHIR

SESI II : 2024/2025

DJJ20273 : FLUID MECHANICS

TARIKH : 18 MEI 2025
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** 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. Answers **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) State **FIVE (5)** types of pressure equipment.

*Nyatakan **LIMA (5)** jenis alatan tekanan.*

[5 marks]

[5 *markah*]

CLO1 (b) When a dolphin glides through air, it experiences an atmospheric pressure of 116,739 Pa. When the dolphin is 6.5 m below the free surface of the water, Express the value of two types of pressure experienced by the dolphin.

Apabila ikan lumba-lumba meluncur di udara, ia mengalami tekanan atmosfera sebanyak 116,739 Pa. Apabila ikan lumba-lumba berada 6.5 m di bawah permukaan bebas air, tunjukkan nilai dua tekanan yang di alami oleh ikan lumba-lumba tersebut.

i. Gauge pressure

Tekanan tolok

[4 marks]

[*4 markah*]

ii. Absolute pressure

Tekanan mutlak

[4 marks]

[*4 markah*]

CLO1

(c) One litre petrol has a specific gravity of 0.67.
Satu liter petrol mempunyai graviti tentu sebanyak 0.67.

i. Explain the of definition, unit, formula or symbol for mass density, specific weight and specific gravity.
Terangkan maksud, unit, formula atau symbol bagi ketumpatan jisim, berat tentu dan graviti tentu.

[6 marks]
[6 markah]

ii. Express the value of mass density, specific weight and weight of petrol.
Tunjukkan nilai ketumpatan jisim, berat tentu dan berat petrol tersebut

[6 marks]
[6 markah]

QUESTION 2

SOALAN 2

CLO2

(a) A metal block with a density of 8000 kg/m³ and a mass of 400 kg is completely submerged in water (density of water = 1000 kg/m³). Assume that the acceleration due to gravity (g) is 9.81 m/s². Express the values of the block's volume and buoyant force acting on the block.

Sebuah blok logam berketumpatan 8000 kg/m³ dan jisim 400 kg tenggelam sepenuhnya di dalam air (ketumpatan air =1000 kg/m³). Anggap pecutan graviti (g) adalah 9.81 m/s². Tunjukkan nilai isipadu blok tersebut dan daya apungan bagi blok logam tersebut.

[6 marks]

[*6 markah*]

CLO2

(b) A hydraulic jack is used to lift a 2500 kg vehicle. The jack consists of a small piston with a diameter of 75 mm and a large piston with a diameter of 300 mm. A mechanic applies a force of 200 N on the small piston. Calculate:

Sebuah jek hidraulik digunakan untuk mengangkat sebuah kenderaan berjisim 2500 kg. Jek tersebut terdiri daripada piston kecil dengan diameter 75 mm dan piston besar dengan diameter 300 mm. Seorang mekanik mengenakan daya sebanyak 200N pada piston kecil. Kirakan:

i. The weight of the vehicle.

Berat kenderaan

[2 Marks]

[*2 Markah*]

ii. The force that can lift the vehicle if the situation is at the same level.

Daya yang boleh mengangkat kenderaan tersebut jika dalam kedudukan yang sama aras.

[7 Marks]

[*7 Markah*]

CLO2

(c) A differential U-tube manometer is used to measure the pressure difference between two points in a pipeline carrying oil (specific gravity = 0.85). The manometer contains mercury (specific gravity = 13.6) as the manometric fluid. The vertical distance between the two limbs of the manometer is 400 mm, and the oil level in the left limb is 250 mm higher than the right limb as illustrate in Figure 2(c).

Sebuah tiub-U manometer kebezaan digunakan untuk mengukur perbezaan tekanan diantara dua titik dalam paip yang mengandungi minyak (graviti tentu = 0.85). Manometer tersebut mengandungi merkuri (graviti tentu = 13.6) sebagai bendalir manometer. Jarak tegak antara dua lengan manometer adalah 400 mm dan aras minyak pada lengan kiri adalah 250 mm lebih tinggi daripada lengan kanan seperti digambarkan dalam Rajah 2(c).

i. Derive the pressure difference equation in U- tube manometer.
Terbitkan persamaan perbezaan tekanan di dalam manometer U-tiub.

[5 Marks]
[*5 Markah*]

ii. Calculate the pressure difference between two points in the pipeline.
Kirakan perbezaan tekanan di antara dua titik dalam saluran paip.

[5 Marks]
[*5 Markah*]

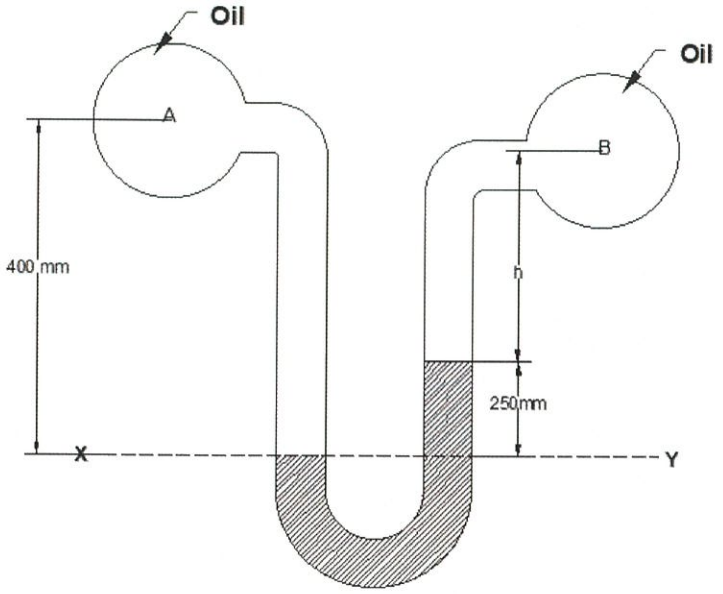

Figure 2 (c) / *Rajah 2(c)*

QUESTION 3

SOALAN 3

CLO2 (a) The behavior of fluids can be classified into different types of flow based on factors such as speed, pattern, and uniformity. Explain:

Tingkahlaku sesuatu bendalir boleh dikasifikasikan kepada jenis aliran yang berbeza berdasarkan faktor halaju, corak dan keseragaman. Terangkan:

i. Laminar flow

Aliran lamina

[2 marks]

[2 *markah*]

ii. Transition flow

Aliran peralihan

[2 marks]

[2 *markah*]

iii. Turbulent flow

Aliran gelora

[2 marks]

[2 *markah*]

CLO2 (b) Kerosene is flowing through a pipe L with a diameter of 650 mm with velocity of 3 m/s. The pipe is then split into two branches M and N. If the diameter of pipe M is 250 mm, velocity in pipe M is 6 m/s and velocity in pipe N is 8 m/s. Calculate:

Minyak tanah mengalir melalui paip L berdiameter 650 mm dengan halaju 3 m/s. Paip tersebut kemudiannya bercabang kepada 2 cabang M dan N. Jika diameter paip M ialah 250 mm, halaju paip M ialah 6 m/s dan halaju paip N ialah 8 m/s. Kirakan kadar alir minyak tanah dalam paip L dan luas keratan rentas paip N.

i. The discharge of kerosene in pipe L.
Kirakan kadar alir minyak tanah dalam paip L.

[3 marks]
[3 *markah*]

ii. The cross-section area of pipe N.
Luas keratan rentas bagi pipe N.

[6 marks]
[6 *markah*]

CLO2 (c) An inclined venturi meter is installed in a pipeline to measure the flow rate of water. The diameter of the pipe at the entrance is 45 cm and the diameter at the throat is 15 cm. The difference in pressure between the entrance and the throat is measured to be 120 kPa. If the density of water is 1000 kg/m^3 and the entrance is 60 cm above the throat, calculate:
Sebuah venturi meter condong dipasang di saluran paip bagi mengukur kadar alir air. Diameter paip di bahagian masukan ialah 45 cm dan diameter di bahagian leher ialah 15 cm. Perbezaan tekanan diantara bahagian masukan dan leher ialah 120 kPa. Jika ketumpatan air ialah 1000 kg/m^3 dan bahagian masukan berada 60 cm di atas bahagian leher, kirakan:

i. The ratio of area venturi meter.
Nisbah luas venturi meter.

[4 marks]
[4 *markah*]

ii. The flow rate of water through the pipe.
Kadar alir air yang mengalir melalui paip.

[6 marks]
[6 *markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Water flows through a pipe as shown in Figure 4(a). Discuss **TWO (2)** energy losses that occurs due to the difference in the diameter of the pipe.

*Air mengalir melalui paip seperti dalam Rajah 4(a). Bincangkan **DUA (2)** kehilangan tenaga yang terjadi disebabkan oleh perubahan diameter paip.*

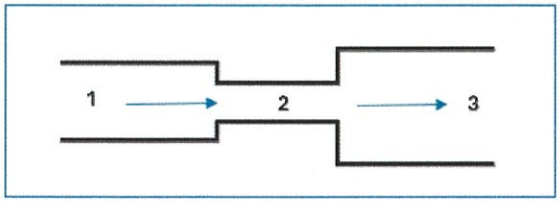

Figure 4(a)/*Rajah 4(a)*

[6 marks]

[*6 markah*]

CLO2 (b) Water flows through a steel pipe with the rate of 0.085 m^3/s from a 250 mm pipe in diameter to a 175 mm pipe in diameter. The exit of the pipe is located 7 m higher than the entrance. Given Cc = 0.73, calculate the loss of head due to sudden contraction and the pressure difference between the two pipes.

Air mengalir melalui paip keluli dengan kadar 0.085 m^3/s dari paip berdiameter 250 mm ke paip berdiameter 175 mm. Tempat keluar pipe terletak 7 m lebih tinggi dari tempat masuk. Diberi Cc = 0.73, Kirakan kehilangan tenaga disebabkan oleh pembesaran mendadak dan perbezaan tekanan di antara kedua-dua paip.

i. The loss of head due to sudden contraction.

Kehilangan tenaga disebabkan oleh pembesaran mendadak

[5 marks]

[*5 markah*]

ii. Pressure difference between the two pipes.

Perbezaan tekanan di antara kedua-dua paip.

[4 marks]

[*4 markah*]

CLO2

(c) Two tanks filled with water are connected by serial pipe A and pipe B. Pipe A has a diameter of 100 cm with a length of 150 m, while pipe B has diameter of 220 cm with a length of 95 m. The velocity of water entering the pipe is 2.5 m/s. Given f=0.01 for both pipes. If energy losses are caused by sudden enlargement and friction only, calculate:

Dua tangki berisi air disambungkan secara bersiri antara paip A dan B. Paip A berdiameter 100 cm dengan panjang 150 m, manakala paip B berdiameter 220 cm dengan panjang 95 m. Halaju air yang memasuki paip ialah 2.5 m/s. Diberi f = 0.01 bagi kedua-dua paip. Jika tenaga yang hilang disebabkan oleh pembesaran mendadak dan geseran sahaja, kirakan:

i. The exit velocity of water.
Halaju air yang keluar.

[4 marks]
[*4 markah*]

ii. The difference of level between both tanks.
Perbezaan aras air di antara kedua-dua tangki.

[6 marks]
[*6 markah*]

SOALAN TAMAT

POLITEKNIK MALAYSIA

LIST OF FORMULA

DJJ 20273 FLUID MECHANICS

FLUID PROPERTIES

$$\rho = \frac{m}{V}$$

$$\omega = \frac{W}{V} = \rho g$$

$$v = \frac{V}{m}$$

$$s = \frac{\rho_{sub}}{\rho_{water}}$$

FLUID STATIC

$$F_b = \rho g V$$

FLUID DYNAMICS

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

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

$$H = x\left(\frac{S_{manometer}}{S_{sub}} - 1\right)$$

$$H = \left(\frac{P_1 - P_2}{\omega_{sub}}\right)$$

$$H = \left(\frac{P_1 - P_2}{\omega_{sub}}\right) + (z_1 - z_2)$$

$$m = \frac{A_1}{A_2}$$

ENERGY LOSS IN PIPELINE

$$h_i = \frac{1}{2}\left(\frac{{v_1}^2}{2g}\right)$$

$$h_L = \frac{(V_1 - V_2)^2}{2g}$$

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

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

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