SULIT

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DCC30122 : FLUID MECHANICS

TARIKH : 19 DISEMBER 2022
MASA : 02.30 PETANG - 04.30 PETANG (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.

Bahagian A: Struktur (2 soalan)
Bahagian B: Esei (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)** structured questions. Answer **ALL** the questions.

ARAHAN :
*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1
C2

(a) Fluid mechanics is the study of fluid behavior either liquid or a gas.Explain **TWO (2)** differences in physical characteristic between liquid and gas.
*Mekanik bendalir adalah kajian mengenai perlakuan bendalir sama ada cecair atau gas.Terangkan **DUA (2)** perbezaan ciri-ciri fizikal antara cecair dan gas.*

[5 marks]
[*5markah*]

CLO1
C2

(b) Fluid possess different basis properties which can be used to characterize the fluids. Identify the formula for the fluid properties below:

Bendalir mempunyai beberapa sifat asas yang boleh digunakan dalam pengelasan sifat cecair. Kenalpasti formula bagi sifat cecair dibawah:

i) Specific weight
Berat tentu

[4 marks]
[*4 markah*]

ii) Specific gravity
Graviti tentu

[4 marks]
[*4 markah*]

CLO1
C2

(c) An overhead tank has length, width and height of 2.5m, 3.0 m and 2.0m respectively. If the water is filled up to three quarters of its height, explain;
Sebuah tangki mempunyai panjang, lebar dan tinggi 2.5m, 3.0m dan 2.0m masing-masing. Jika air diisi sehingga tiga per empat daripada tinggi tangki, terangkan;

i) The mass and weight of the water inside the tank
Jisim dan berat air di dalam tangki

[6 marks]
[*6markah*]

ii) If a similar tank is filled to the same level with oil with a mass of 3500kg, identify the density and specific gravity of the oil.
Jika tangki yang sama diisi dengan 3500kg minyak dengan ketinggian yang sama, kenalpasti ketumpatan dan graviti tentu minyak tersebut.

[6 marks]
[*6 markah*]

QUESTION 2
SOALAN 2

CLO1
C2

(a) Pressure measurements are generally indicated as being either absolute or gauge pressure. The absolute pressure at point A is $750x10^3$ N/m^2. Identify the gauge pressure if the atmospheric pressure is 101.3kN/m^2.

Pengukuran tekanan biasanya ditunjukkan sama ada dalam tekanan mutlak atau tekanan tolok. Tekanan mutlak pada point A ialah $750x10^3$ N/m^2. Kenalpasti tekanan tolok jika tekanan atmosfera ialah 101.3kN/m^2.

[5 marks]
[*5 markah*]

CLO1 C2

(b) Liquid pressure at a point increases with the increase in height of the liquid. Explain the depth below the surface of oil with specific gravity of 0.8, that produces a pressure of 220 kN/m^2. Then, identify the depth of water using the same pressure value.

Tekanan cecair pada satu titik meningkat dengan peningkatan ketinggian cecair.Terangkan ketinggian di bawah permukaan minyak dengan graviti tentu 0.8, yang menghasilkan tekanan 220 kN/m^2. Kemudian, kenalpasti ketinggian air jika menggunakan tekanan yang sama.

[8 marks]
[*8 markah*]

CLO1 C2

(c) A U- tube differential manometer is connected to pipe P and pipe Q as shown in **Figure A2(c)**. Pipe P flows water with the density ρ_w = 1000 kg/m^3 and in pipe Q contains oil with the density ρ_o = 900 kg/m^3. If the pressure in pipe P is 200kN/m^2, and U-tube contains mercury (ρ_w = 13600 kg/m^3)

*Sebuah manometer bezaan disambungkan kepada paip P dan paip Q seperti ditunjukkan dalam **Rajah A2(c)**. Paip P mengalirkan air dengan ketumpatan, ρ_w = 1000kg/m^3, sementara paip Q mengandungi minyak yang berketumpatan ρ_o = 900 kg/m^3. Jika tekanan didalam paip P adalah 200 kN/m^2 dan manometer tiub U mengandungi Merkuri (ρ_w = 13600 kg/m^3);*

i) Express an equation for the pressure in the U-tube differential manometer
Tunjukkan persamaan dalam manometer U-tube tersebut.

[6 marks]
[*6 markah*]

ii) Identify a pressure in pipe Q
Kenalpasti tekanan di dalam paip Q

[6 marks]
[*6 markah*]

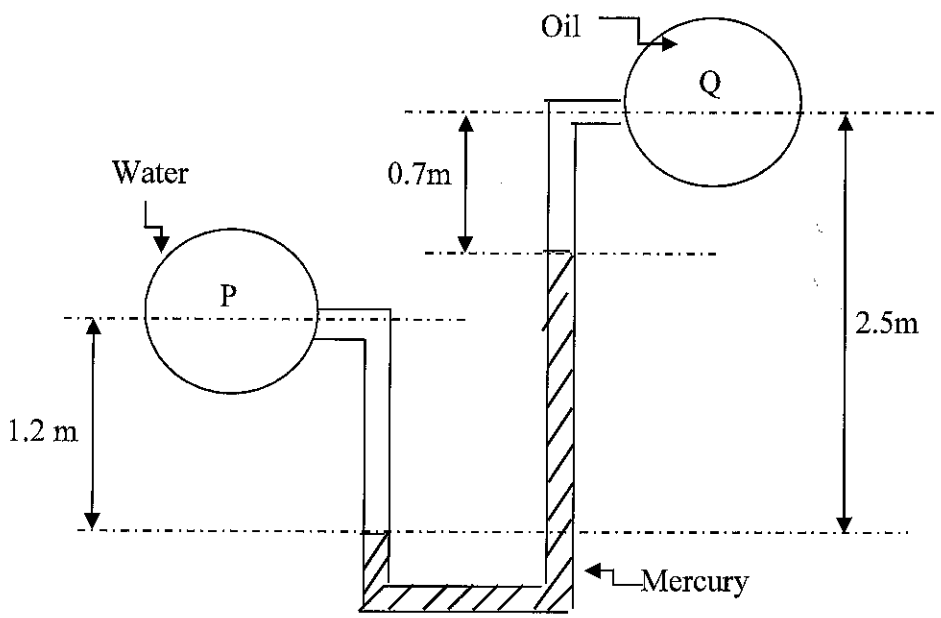

Figure A2(c)/Rajah A2(c)

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

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

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

QUESTION 1
SOALAN 1

CLO2
C3

(a) The Reynold's Number is the ratio of inertial forces to viscous forces within a fluid, which is subjected to relative internal movement due to different fluid velocities. Identify the Reynold's Number formula and the **THREE (3)** categorization of Reynold's Number.

*Nombor Reynold adalah nisbah daya inersia kepada daya kelikatan di dalam bendalir, tertakluk kepada pergerakan dalaman relatif disebabkan halaju bendalir yang berbeza. Kenalpasti formula Nombor Reynold's dan **TIGA (3)** kategori Nombor Reynold's.*

[5 marks]
[*5 markah*]

CLO2
C4

(b) The Reynold's Number (R_e) is an important dimensionless quantity in fluid mechanics used to help predict flow patterns in fluid flow situation. An oil having dynamic viscosity of 0.205Ns/m^2 and specific gravity of 0.9 is flowing through a pipe of 775mm in diameter. The value of discharge through the pipe is 120 liter/s. Determine the types of flow.

Nombor Reynold (Re) ialah kuantiti tanpa dimensi di dalam mekanik bendalir yang digunakan untuk membantu meramal corak aliran dalam situasi aliran bendalir. Minyak mempunyai kelikatan dinamik 0.205 Ns/m^2 dan graviti tentu 0.9 sedang mengalir melalui paip berdiameter 775mm. Nilai kadar alir yang melalui paip ialah 120liter/s. Tentukan jenis aliran.

[8 marks]
[*8 markah*]

CLO2
C4

(c) A student has conducted a Reynold's experiment in hydraulic laboratory and the test result is as in **Table B1(c)**.

*Seorang pelajar telah menjalankan eksperimen Reynold di makmal hidraulik dan keputusan ujian adalah seperti **Jadual B1(c).***

Table B1(c) / Jadual B1(c)

Diameter of pipe, d *Diameter paip*	0.01m
Kinematic viscosity of water, ν *Kelikatan kinematic air, ν*	$1 \times 10^{-3}\, m^2/s$
Volume, V Isipadu, V	450ml
Time *Masa*	37.39s

Calculate:

Kirakan:

i) Area of cross section for the pipe

Luas keratan rentas paip

[1 mark]

[*1 markah*]

ii) Flow rate

Kadar aliran

[4 marks]

[*4 markah*]

iii) Flow velocity

Halaju aliran

[2 marks]

[*2 markah*]

iv) Reynold's Number

Nombor Reynolds

[3 marks]

[*3 markah*]

v) Type of flow

Jenis aliran

[2 marks]

[*2 markah*]

QUESTION 2
SOALAN 2

CLO2 C3 (a) Flow measurement is an action to measure the flow of liquids, gases and vapors using a flow measurement instrument or device, which measures the rate of flow or the quantity of flow. Explain the meaning of velocity, flow rate and continuity equation.

Pengukuran aliran ialah aliran cecair, gas dan wap menggunakan alat atau peranti pengukuran aliran, yang mengukur kadar aliran kadar aliran atau kuantiti aliran. Terangkan maksud halaju, kadar alir dan persamaan keterusan.

[5 marks]
[*5 markah*]

CLO2 C4 (b) Water flows at a rate of 15liters/s in a 100mm diameter pipe. Pipe AB branches into three pipes at its end which are pipes at its end which are pipes BC, BD and BE as shown in **Figure B2(b)**. The diameters of BD and BC are 25mm and BE is 50mm. The flowrate in pipe BC is three times than pipe BE. The velocity in pipe BD is 4m/s. Calculate the velocity in pipe BC and BE.

*Air mengalir pada kadar alir 15liter/s dalam paip bergarispusat 100mm. Paip AB bercabang kepada tiga paip di hujungnya iaitu paip-paip BC, BD dan BE ditunjukkan seperti **Rajah B2(b)** di bawah. Garis pusat BD dan BC ialah 25mm dan BE ialah 50mm. Kadalir di dalam paip BC ialah tiga kali ganda kadar alir di dalam paip BE. Halaju didalam paip BD ialah 4m/s. kirakan kadar alir didalam paip-paip BC serta halaju dalam paip BC dan BE.*

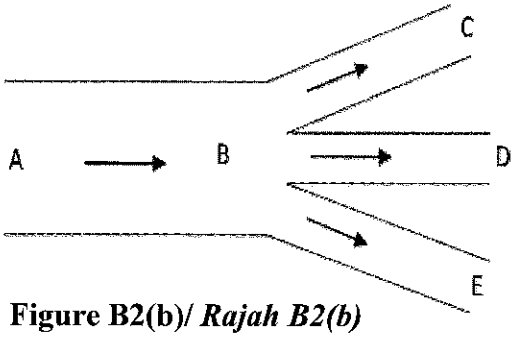

Figure B2(b)/ *Rajah B2(b)*

[8marks]
[*8 markah*]

CLO2
C4

(c) A ventury meter is being used to measure discharge in a pipeline of diameter 25cm which carries water. When the different in pressure on a mercury manometer is 375mm, calculate the discharge in the pipeline. The venturi meter has a throat diameter of 80mm with 0.96 coefficient of discharge. (Given density of mercury = 13600kg/m^3)

Sebuah meter venturi digunakan untuk mengira kadar alir di dalam sebuah paip dengan diameter 25cm yang mengandungi air. Apabila perbezaan tekanan di dalam manometer merkuri ialah 375mm, kirakan kadar alir di dalam paip tersebut. Diameter di leher paip ialah 80mm dan pekali kadar alir adalah sebanyak 0.96. (Diberi ketumpatan merkuri = 13600 kg/m^3)

[12marks]
[*12 markah*]

QUESTION 3
SOALAN 3

CLO2
C3

(a) Pipe losses its energy due to several factors and occur as the fluid flows along straight lengths of pipe. Identify **FIVE (5)** types of minor losses in pipe.

*Kehilangan tenaga di dalam paip berlaku disebabkan beberapa faktor dan berlaku sepanjang aliran paip. Kenalpasti **LIMA (5)** jenis kehilangan tenaga kecil dalam paip.*

[5 marks]
[5 *markah*]

CLO2
C4

(b) The amount of energy lost depends on a number of factors such as the fluid's speed and viscosity. Calculate the energy loss due to friction in a pipe, with the pipe length of 400m and diameter of 20cm. Given velocity of water is 2m/s and coefficient of friction = 0.01.

Jumlah tenaga yang hilang bergantung kepada beberapa faktor seperti kelajuan dan kelikatan bendalir. Kirakan kehilangan tenaga bagi geseran dalam paip, panjang paip ialah 400m dan diameter ialah 20cm. Diberi halaju air ialah 2m/s dan pekali geseran = 0.01.

[8 marks]
[*8 markah*]

CLO2
C4

(c) Referring to **Figure B3(c)**, two pipes are connected parallel to each other between two reservoirs. The diameter is 50mm for pipe 1 and 100mm for pipe 2 and both pipes have the length of 150m. Calculate the discharge in pipe 1. Given coefficient of friction, f = 0.008.

*Merujuk **Rajah B3(c)**, dua paip disambung secara selari di antara dua takungan. Diameter paip 1 ialah 50mm dan diameter paip 2 ialah 100mm dan kedua-dua paip mempunyai panjang 150m. Kira kadaralir aliran dalam paip 1. Di beri pekali geseran, f=0.008.*

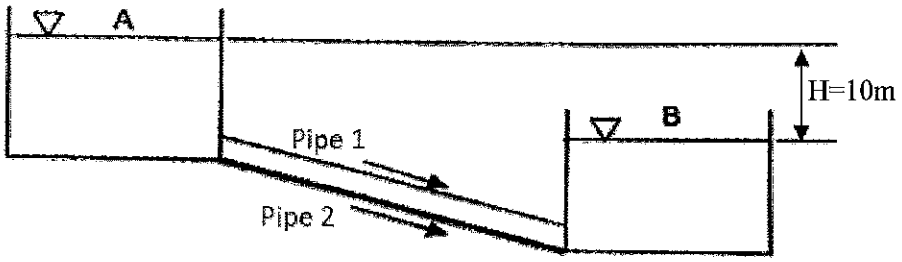

Figure B3(c) / *Rajah B3(c)*

[12 marks]
[*12 markah*]

QUESTION 4
SOALAN 4

CLO2
C3

(a) Newton's law for fluids states that the rate of shear strain in a fluid is directly proportional to applied shear stress. Explain the following law of motion for;
Hukum Newton untuk bendalir menyatakan bahawa kadar terikan ricih dalam bendalir adalah berkadar terus dengan tegasan ricih yang dikenakan. Terangkan Hukum pergerakan berikut;

(i) Newton's Second Law
Hukum Newton's kedua

[2 marks]
[*2 markah*]

(ii) Newton's Third Law
Hukum Newton's Ketiga

[3 marks]
[*3 markah*]

CLO2
C4

(b) An oil jet with 75 mm diameter having specific gravity 0.8 strikes normally a stationary flat plate. If the force exerted by the oil jet on the plate is 1200N, calculate the velocity of jet oil.

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

[8 marks]

[*8 markah*]

CLO2
C4

(c) A water jet with 50 mm diameter and having a velocity of 25m/s enters tangentially a stationary curved vane without shock and is deflected though an angle of 45° shown in **Figure B4(c)** below. Calculate the magnitude and direction of the resultant force on the vane.

*Satu jet air yang berdiameter 50 mm dan mempunyai halaju 25m/s menghentam plat lengkung pegun yang membias melalui sudut 45° ditunjukkan dalam **Rajah B4(c)** di bawah. Kirakan daya dan arah tindakan daya pada bilah tersebut.*

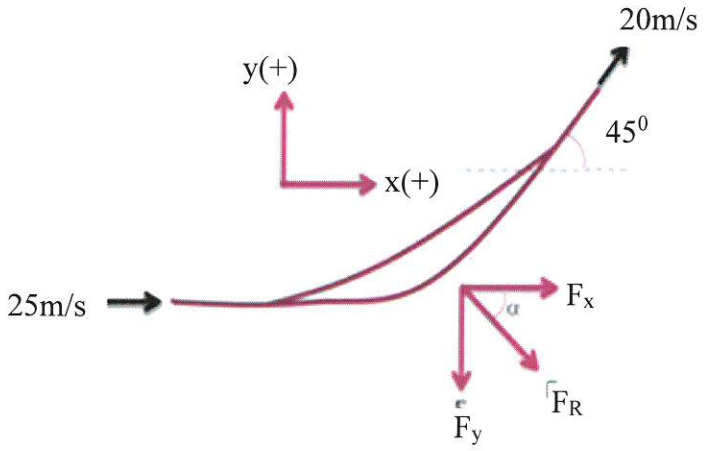

Figure B4(c) / *Rajah B4(c)*

[12 marks]

[*12 markah*]

Notes
Assessment items for this course have covered elements of the Dublin Problem: DP1, DP2 and DP3 as mention in FEIST.

SOALAN TAMAT

FORMULA DCC30122 - FLUID MECHANICS

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

$s = \rho_{liquid} / \rho_{water}$

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

$v = \mu / \rho$

$P = \rho g h$

$Q = Av$

$H = \frac{P}{\rho g} + \frac{V^2}{2g} + Z$

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

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

$H = \frac{(sm' - sl)x}{sl}$

$Q_s = C_d A c \sqrt{2gh}$

$v_c = C_v \sqrt{2gh}$

$C_c = Ac / A$

$C_v = v_c / v$

$C_d = Cc \times Cv$

$C_v = \sqrt{\frac{x^2}{4yh}}$

$Q = \frac{2}{3} C_d b \sqrt{2g} \left[H_2^{3/2} - H_1^{3/2}\right]$

$h_f = \frac{4.f.l.v^2}{2gd}$

$h_f = \frac{flQ^2}{3d^5}$

$h_L = \frac{V_1^2}{2g}$

$h_L = \frac{0.5V^2}{2g}$

$h_L = (\frac{1}{C_C} - 1)^2 \frac{V_2^2}{2g}$

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

$F = \rho A V. (V_1 - V_2)$

$F = \rho A V^2 \cos \theta$

$F = \rho A V^2 (1 + \cos \theta)$

$F = \rho A V^2 \sin \theta$