SULIT

POLITEKNIK
Jabatan Pengajian Politeknik

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENGAJIAN POLITEKNIK
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2013

JJ309: FLUID MECHANICS

TARIKH : 21 OKTOBER 2013
TEMPOH : 2 JAM (11.15 AM - 1.15 PM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.
Bahagian ini mengandungi **ENAM (6)** soalan esei.
Jawab **EMPAT (4)** soalan sahaja.
Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **SIX (6)** structured questions. Answer **FOUR (4)** questions only.

ARAHAN:

*Bahagian ini mengandungi **ENAM (6)** soalan struktur. Jawab **EMPAT (4)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO1
C1

a) Define the following terms:
Takrifkan istilah berikut :

i. Mass density
Ketumpatan Jisim

ii. Absolute pressure
Tekanan Mutlak

[4 marks]
[4 markah]

CLO2
C2

b) Calculate the depth of a point below the surface of the sea if the pressure reading is 105.55 kN/m^2. Specific gravity of sea water is 1.025.

Kira kedalaman dari permukaan laut jika bacaan tekanan menunjukkan nilai 105.55 kN/m^2. Diberi gravity tentu air laut ialah 1.025.

[5 marks]
[5 markah]

CLO2
C2

c) If the volume and weight of a certain fluid are 6 m^3 and 4900N respectively, calculate the:

Diberi minyak berisipadu 6m^3 dengan berat sebanyak 4900N, kira

i. Mass density
Ketumpatan Jisim

ii. Specific weight
Berat tentu

iii. Specific gravity
Graviti tentu

iv. Specific volume
Isipadu tentu

[16 marks]
[16 markah]

QUESTION 2
SOALAN 2

CLO2
C2

a) Calculate the height of a water column which has the pressure of 20 N/m^2.
(Take into consideration specific weight of water, $\omega_{water} = 1000\ kg/m^3 \times 9.81\ m/s^2$).

Kirakan ketinggian turus air yang mempunyai tekanan sebanyak 20 N/m^2.
(Ambil kira berat tentu air, $\omega_{air} = 1000\ kg/m^3 \times 9.81\ m/s^2$)

[5 marks]
[5 markah]

CLO2
C3

b) A force, F of 650 N is applied to a smaller cylinder of a hydraulic jack. The area, a of the small piston is 15 cm^2 and the area A of the larger piston is 150 cm^2. Sketch each situation below and calculate the load, W if :

i. The pistons are of the same level?

ii. The large piston is 0.65 m below the smaller piston?

iii. The small piston is 0.40 m below the larger piston?

Consider the mass density ρ of the liquid in the jack is 10^3 kg/m^3

Daya, F sebanyak 650 N dikenakan ke silinder kecil bicu hidraulik. Luas omboh kecil,a ialah 15 cm^2 dan luas omboh yang lebih besar, A ialah 150 cm^2. Lakar dan kirakan beban, W yang boleh diangkat oleh omboh yang lebih besar jika:

i. Omboh berada pada tahap yang sama?

ii. Omboh yang besar ialah 0.65 m di bawah omboh yang kecil?

iii. Omboh kecil adalah 0.40 m di bawah omboh yang lebih besar

Anggapkan ketumpatan jisim cecair, ρ dalam bicu adalah 10^3 kg/m^3

[20 marks]
[20 markah]

QUESTION 3

SOALAN 3

CLO1
C1

a) Define **THREE (3)** types of flow as listed below.
*Takrifkan **TIGA (3)** jenis aliran di bawah.*

i. Steady Flow
Aliran mantap

ii. Turbulent Flow
Aliran bergelora

iii. Laminar Flow
Aliran lamina

[6 marks]
[6 markah]

CLO2
C3

b) Benzene with a mass density of 879 kg/m^3 flows through a 150 mm diameter pipe at a mean velocity of 5 m/s. Find the:

i. Flow rate

ii. Mass flow rate

Benzene yang berketumpatan jisim bagi adalah 879 kg/m^3, mengalir di dalam sebatang paip yang berdiameter 150 mm dengan halaju 5 m/s. Cari:

i. *Kadaralir*

ii. *Kadaralir jisim*

[8 marks]
[8 markah]

CLO2
C3

c) Given a horizontal ventury meter tapers from 400 mm in diameter at the entrance to 200mm in diameter at the throat. A U-tube gauge is connected to the entrance and the throat of the ventury meter. A ventury meter is used to measure the water flow rate. Calculate the actual water discharge when the difference of level in the mercury U-tube is 60 mm. Given the coefficient of discharge, $C_d = 0.95$.

Satu meter venture mendatar bergaris pusat 400 mm pada bahagian masukan dan 200 mm pada bahagian leher. Ia digunakan untuk mengukur kadar alir air. Manometer beza raksa/ air digunakan dan menunjukkan perbezaan aras 60 mm. Tentukan kadar alir sebenar. Diberi pekali kadar alir C_d =0.95.

[11 marks]
[11 markah]

QUESTION 4

SOALAN 4

CLO2
C3

a) Water flows from an incline pipeline with a rate of 0.065 m^3/s from pipe 150 mm in a diameter to the pipe 75 mm in a diameter. The exit of the pipe is located 5 m higher than the entrance. (Given $C_c = 0.63$). Calculate;

i. The loss of head due to sudden contraction

ii. The Pressure difference between the two pipes

Air mengalir dalam paip condong dengan kadar 0.065 m^3 / s dari paip berdiameter 150 mm ke paip berdiameter 75mm. Hujung tempat keluar paip terletak 5 m lebih tinggi daripada pintu masuk. (Diberi Cc = 0.63). hitungkan;

i. Kehilangan turus disebabkan oleh pengecutan secara tiba-tiba

ii. Perbezaan tekanan antara dua paip

[10 marks]
[10markah]

CLO2
C3

b) Water is discharged to the atmosphere from a reservoir through a pipe 75 m long which flows at 0.065 m^3/s. The entrance to the pipe is sharp and the diameter is 350 mm for the first 30 m. The remaining of the pipe length is then suddenly contracts to 200 mm in diameter. Take f=0.004 for small the pipe and f=0.003 for the bigger pipe. Assume $C_c = 0.65$. Calculate :

i. The head losses occur in the pipe.

ii. The difference of level between the surface of the reservoir and the pipe exit.

Air dilepaskan ke atmosfera dari takungan melalui paip 75 m panjang yang mengalir pada 0.065 m^3 / s. Permulaan masuk paip adalah tajam dan berdiameter 350 mm bagi 30 m pertama. Baki panjang paip kemudian tiba-tiba mengecil kepada 200 mm diameter. Ambil f = 0.004 untuk paip kecil dan f = 0.003 bagi paip yang lebih besar. Andaikan Cc = 0.65. Kirakan:

i. Kehilangan kepala turus yang berlaku dalam paip

ii. Perbezaan paras di antara permukaan takungan dan saluran paip keluar.

[15 marks]
[15markah]

QUESTION 5

SOALAN 5

CLO1
C1

a) List **FIVE (5)** types of fluid flow.

*Senaraikan **LIMA (5)** jenis aliran bendalir.*

[5 marks]
[5 markah]

CLO1
C2

b) Explain the discharge and mass flow rate.

Terangkan kadaralir dan kadaralir jisim.

[5 marks]
[5 markah]

CLO2
C3

c) The raw oil flows through a pipe with a diameter of 40mm and enters a pipe with a diameter of 25mm. The volume flow rate is at 3. 75 liter/s. Calculate the flow velocity of both pipes and the density of raw oil if the mass flow rate is at 3.23 kg/s.

Minyak mentah mengalir melalui paip diameter 40mm dan memasuki paip berdiameter 25mm. Kadar alir isipadu ialah 3.75 liter/s. Kirakan halaju aliran di kedua-dua paip tersebut dan ketumpatan minyak mentah jika kadar aliran jisim adalah 3.23 kg/s.

[15 marks]
[15 markah]

QUESTION 6

SOALAN 6

CLO1
C1

a) State and sketch **TWO (2)** types of nozzle.

*Nyatakan dan lakarkan **DUA (2)** jenis muncung.*

[5 marks]
[5 markah]

CLO1
C1

b) List **FIVE (5)** applications of nozzle in the engineering field.

*Senaraikan **LIMA (5)** kegunaan muncung dalam bidang kejuruteraan.*

[5 marks]
[5 markah]

CLO2
C3

c) Air at 8.6 *bar* and 190 *°C* expends through a convergent-divergent nozzle into a space at 1.03 *bar*. Given R = 287 Nm/kgK, Cp = 1.005 kJ/kgK and $\gamma = 1.4$.
Assuming that the inlet velocity is negligible, calculate :

i. The mass flow rate if the diameter at the throat is at 60mm

ii. The exit cross-sectional areas of the nozzle if the mass flow rate is 4.5 *kg/s*

Udara pada tekanan 8.6 bar dan suhu 190 ° C dikembangkan melalui muncung tumpu-capah ke dalam atmosfera pada tekanan 1.03 bar. Diberi R = 287 Nm/kgK, Cp = 1.005 kJ/kgK and $\gamma = 1.4$. *Dengan menganggapkan bahawa halaju masukan diabaikan, hitungkan :*

i. Kadaralir jisim jika diameter di bahagian leher ialah 60mm

ii. Luas keratan rentas luar muncung jika kadar alir jisim ialah 4.5 kg / s.

[15 marks]
[15 markah]

END OF QUESTIONS
SOALAN TAMAT

LIST OF FORMULAS
JJ309 - FLUID MECHANICS

FLUID DYNAMICS

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

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

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

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

ENERGY LOSSES IN PIPELINE

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

$$h_c = \left[\frac{1}{c_c} - 1\right]^2 x\,\frac{v^2}{2g}$$

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

$$h_i = \frac{1}{2}\left[\frac{v^2}{2g}\right]$$

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

NOZZLE

$$\frac{P_c}{P_1} = \left[\frac{2}{\gamma + 1}\right]^{\frac{\gamma}{\gamma - 1}}$$

$$\frac{T_c}{T_1} = \frac{2}{\gamma + 1}$$

$$\frac{T_1}{T_2} = \left[\frac{P_1}{P_2}\right]^{\frac{\gamma - 1}{\gamma}}$$

$$V_c = \frac{RT_c}{P_c}$$

$$A_c = \frac{\dot{m}V_c}{C_c}$$

$$C_c = 44.72\sqrt{C_p(T_1 - T_c)}$$