SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

CB306: HYDRAULICS

TARIKH : 22 OKTOBER 2015
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Soalan Struktur (6 soalan).
Jawab mana-mana **EMPAT (4)** soalan sahaja.
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 100 MARKS
BAHAGIAN A : 100 MARKAH

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

ARAHAN:
*Bahagian ini mengandungi **ENAM (6)** soalan berstruktur. Jawab **EMPAT (4)** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO1
C1

a) Define the following fluid properties:
Tentukan sifat bendalir berikut:

i. Density / *Ketumpatan* [2 marks */2 markah*]
ii. Specific weight / *Berat tentu* [2 marks */ 2 markah*]
iii. Specific gravity / *Graviti tentu* [3 marks */ 3 markah*]

CLO1
C1

b) Calculate the specific weight, density and specific gravity of 3 litre of petrol which weights 10N

Kirakan berat tentu, ketumpatan dan graviti tentu bagi 3 liter petrol di mana beratnya adalah 10N.

[10 marks]
[10 markah]

CLO1
C1

c) Define dynamic viscosity and kinematic viscosity in fluid and give the units of dynamic viscosity and kinematic viscosity.

Takrifkan kelikatan dinamik dan kelikatan kinematik di dalam bendalir dan berikan unit kedua-duanya sekali

[8 marks]
[8 markah]

QUESTION 2

SOALAN 2

CLO2
C3

a) Gauge pressure of fluid in cylinder is 450 kN/m^2. Find the pressure in pressure head for (a) water,(b) mercury (S = 13.6) And also calculate the absolute pressure in cylinder.

Tekanan tolok bendalir di dalam silinder ialah 450 kN/m^2. Cari tekanan di dalam ungkapan turus bagi (a) air, (b) raksa (s = 13.6) dan kirakan tekanan mutlak di dalam silinder.

[9 marks]
[9 markah]

CLO2
C3

b) A U tube manometer is connected to a point in a pipe line having fluid of 0.9 specific gravity. The other end of the tube is open to atmosphere. The center line of pipe is 14 cm below the level of mercury in both the limb is 30 cm. Calculate the pressure of fluid in the pipe.

Satu manometer U tiub bersambung dengan paip mempunyai bendalir gravity tentu 0.9. manakala tiub sebelah lagi terdedah kepada udara. Titik tengah bagi paip adalah 14 cm manakala tinggi merkuri pula adalah 30 cm. Kirakan tekanan di dalam paip (takungan).

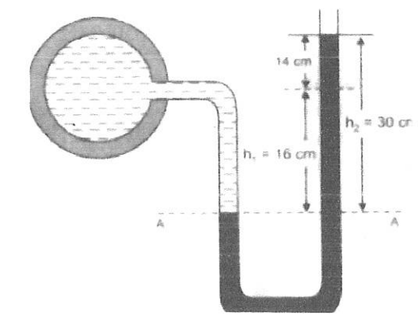


Figure 1

[8 marks]
[8 markah]

CLO2
C3

c) **Figure 2** shows an inverted differential manometer having an oil of specific gravity 0.8 connected to two different pipes carrying water. Calculate the pressure in the pipe B if the pressure in pipe A is 2.0 meters of water.

Gambarajah 2 *menunjukkan manometer kerbeza songsang yang mengandungi minyak (s = 0.8) bersambung dengan dua paip yang membawa air. Kirakan tekanan di paip (takungan) B jika tekanan di paip A adalah 2.0 meter.*

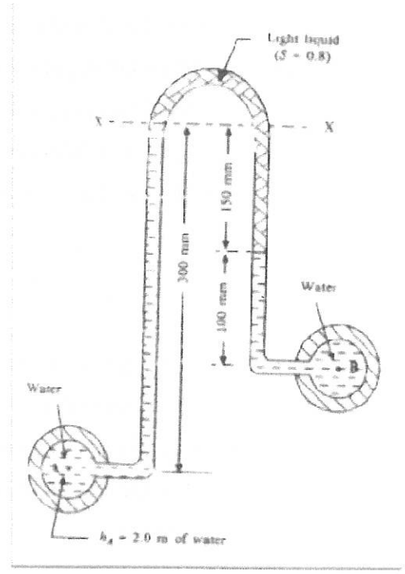


Figure 2

[8 marks]
[8 markah]

QUESTION 3

SOALAN 3

CLO2
C3

a) A pipe 5 m long is inclined at an angle of 15^0 with the horizontal. The diameters of pipe at smaller section to the biggest are 80 mm and 240 mm respectively. If the pipe is uniformly tapering and the velocity of water at the smaller section is 1 m/s, calculate the difference of pressures between the two sections ($p_1 - p_2$).

Sebatang paip berukuran 5 meter panjang dicondongkan pada sudut 15° dengan mendatar. Diameter di paip yang seksyen yang lebih kecil ke seksyen yang lebih besar masing-masing adalah 80mm dan 240mm. Jika paip ini menirus secara seragam dan halaju air di seksyen paling kecil adalah 1 m/s, kirakan perbezaan tekanan di antara dua seksyen ini ($p_1 - p_2$).

[12 marks]

[12 markah]

CLO2
C3

b) Water flowing through a pipe AB with diameter 150cm at 4.5m/s and then passes through a pipe BC with diameter of 175cm. At C, the pipe is branches into pipe CD and CE. Given the diameter and the discharge of pipe CD is 200cm and one-third of the discharge in pipe AB respectively. The velocity in pipe CE is 5m/s. Determine:

Air mengalir melalui paip AB dengan diameter 150cm pada 4.5m/s dan kemudian melalui paip BC dengan diameter 175cm. Di C, paip bercabang kepada paip CD dan CE. Diberi diameter dan kadar alir paip CD iaitu 200cm dan satu per tiga daripada kadar alir paip AB masing-masing. Halaju paip CE adalah 5m/s. Tentukan:

i. Discharge at pipe AB / *Kadar alir di paip AB* [5 marks */5 markah*]
ii. Velocity in BC / *Halaju di BC* [2 marks */2 markah*]
iii. Velocity in CD / *Halaju di CD* [2 marks */2 markah*]
iv. Diameter of CE / *Diameter CE* [4 marks */4 markah*]

QUESTION 4

SOALAN 4

CLO 2
C1

a) List **THREE (3)** types of energy of a liquid.

*Senaraikan **TIGA (3)** jenis tenaga di dalam bendalir bergerak.*

[3 marks]

[3 markah]

CLO 2
C3

b) A horizontal venturi meter with an inlet diameter of 30cm and throat diameter of 15cm is used to measure the flow of water. The reading in the differential manometer connected to the inlet and throat is 10cm of mercury. Determine the flow rate if the coefficient of venturi meter is 0.98. Refer **Figure 3.**

*Sebuah jangka venturi yang digunakan secara mengufuk mempunyai paip masuk berdiameter 30cm manakala lehernya berdiameter 15cm. Manometer kerbeda raksa yang disambungkan di leher jangka venturi tersebut menunjukkan bacaan 10cm. Tentukan kadar alir sekiranya pekali kadaralir bagi jangka venturi tersebut adalah 0.98. Rujuk **Rajah 3**.*

[12 marks]

[12 markah]

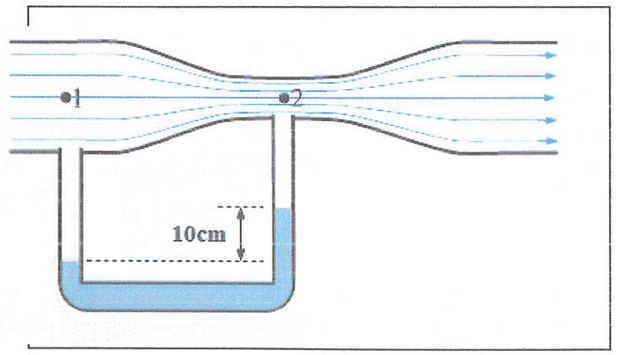


Figure 3

CLO 2
C3

c) Water is flowing through a pipe of 250mm diameter under a gauge pressure of 65kPa, and with a mean velocity of 2.5m/s. Determine the total head, if the pipe is 4.5 metres above the datum line.

Air mengalir melalui sebatang paip bersaiz 250mm diameter yang mempunyai tekanan sebanyak 65kPa dan halaju puratanya ialah 2.5m/s. Tentukan kehilangan turus sekiranya paip tersebut berada 4.5m dari garisan datum.

[10 marks]
[10 markah]

QUESTION 5

SOALAN 5

CLO3
C2

a) The water is flowing through a pipe of 200 mm diameter and 90 meter length with the velocity of 5 m/s. Then find the head loss using Darcy's formula. Take $\nu = 0.02 \times 10^{-4}$ m^2/sec.

Air mengalir menerusi paip berdiameter 200mm dan panjang 90m dengan halaju 5m/s. Cari kehilangan turus dengan menggunakan formula Darcy. Ambil $\nu = 0.02 \times 10^{-4}$ m^2/sec

[6 marks]
[6 markah]

CLO3
C3

b) Kinematic viscosity of an oil is 22.4 stoke. The oil flows through a pipe of 40 cm diameter. Flow rate of oil through the pipe is 0.015 m^3/s. Calculate Reynold's Number for this oil.

Kelikatan kinematik minyak adalah 22.4 stoke. Minyak tersebut mengalir melalui paip berdiameter 40cm. Kadar alir minyak tersebut adalah 0.015m^3/s. Kirakan Nombor Reynold bagi minyak ini.

[9 marks]
[9 markah]

CLO3
C3

c) Calculate the head loss due to friction in a pipe of diameter 350 mm and length 200 m, through which water is flowing at 3 m/s. Take $\nu = 0.02$ stokes.

Kirakan kehilangan turus yang disebabkan geseran di dalam paip berdiameter 350mm dan panjang 200m, di mana air mengalir pada halaju 3m/s. Ambil $\nu = 0.02$ stokes.

[10 marks]
[10 markah]

QUESTION 6

SOALAN 6

CLO 3 C1

a) State **FIVE (5)** minor losses of energy in pipelines.

*Berikan **LIMA (5)** kehilangan turus di dalam aliran paip.*

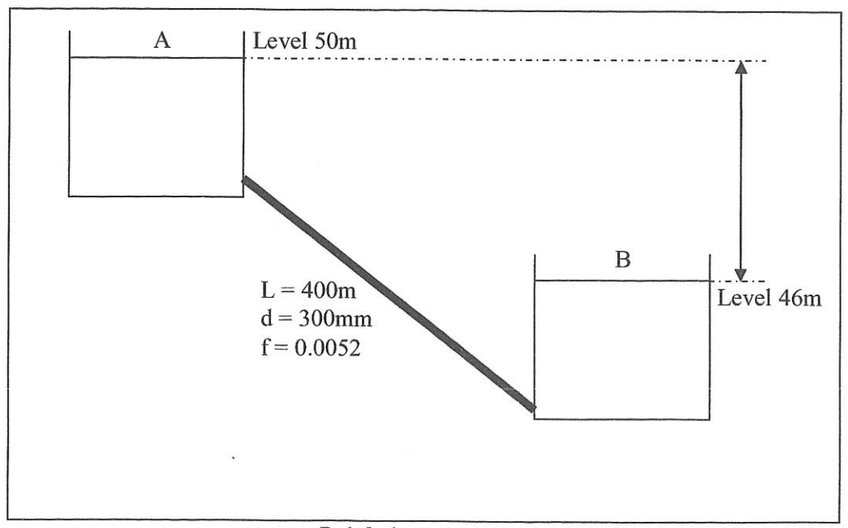
[5 marks]

[5 markah]

CLO 3 C3

b) Calculate the rate of flow for the pipe that is connected in series as **Figure 4** below. The major and minor losses are taken into consideration.

*Kirakan kadar alir bagi paip seperti **Rajah 4** di bawah yang disambungkan secara bersiri. Ambilkira semua kehilangan turus utama dan turus kecil.*



Rajah 4

[20 marks]

[20 markah]

SOALAN TAMAT

LAMPIRAN

Hydraulic Formula

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

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

$$W = m \times g$$

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

$$V_s = \frac{1}{\rho}$$

$$\nu = \frac{\mu}{\rho}$$

$$P = \rho g h = \omega h$$

$$P = \frac{F}{A}$$

$$Q_{in} = Q_{out}$$

$$Q = A v$$

$$A = \frac{\pi d^2}{4} = \pi r^2$$

$$V_{cylinder} = \frac{\pi d^2 h}{4} = \pi r^2 h$$

$$H = \frac{P}{w} + \frac{v^2}{2g} + Z$$

$$\frac{P_1}{w} + \frac{v_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{v_2^2}{2g} + Z_2$$

$$H = \frac{(\rho' - \rho).x}{\rho}$$

$$Q = \frac{A_1 A_2}{\sqrt{(A_1^2 - A_2^2)}} \sqrt{2gH}$$

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

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

$$C_c = \frac{A_{vena}}{A_{orifice}}$$

$$C_v = \frac{v_{vena}}{v_{theory}}$$

$$C_d = Q_{orifice} = C_c \times C_v$$

$$\frac{\text{---------}}{Q_{theory}}$$

Head loss in orifice

$$C_r = \frac{\text{---------}}{\text{Orifice head}}$$

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

$$Re = \frac{vd}{\nu} = \frac{\rho vd}{\mu}$$

$$h_f = \frac{4flv^2}{2gd}$$

$$h_f = \frac{f.l.Q^2}{3d^5}$$

$$f = \frac{16}{Re}$$

$$f = \frac{0.0791}{(Re)^{1/4}}$$

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

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

$$h_L = \frac{0.05v^2}{2g}$$

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

$$h_L = (\frac{1}{C_C} - 1)^2 \frac{v_2^2}{2g}$$

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

$$\frac{P_1}{w} + \frac{v_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{v_2^2}{2g} + Z_2$$

+ Major loss

+ Minor losses