SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI DISEMBER 2016

DCC5143 : FLUID MECHANICS

TARIKH : 10 APRIL 2017
MASA : 11.15 AM - 1.15 PM (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (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** questions.

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

CLO1
C1

QUESTION 1
SOALAN 1

(a) State **TWO (2)** differences in physical properties between ideal fluid and Newtonian fluid.

*Nyatakan **DUA (2)** perbezaan ciri-ciri fizikal antara bendalir ideal dan bendalir Newton.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Determine the depth below the surface of oil with specific gravity of 0.8, that produces a pressure of 120 kN/m^2. Then, calculate the depth of water using the same pressure value.

Tentukan ketinggian di bawah permukaan minyak dengan gravity tentu 0.8, yang menghasilkan tekanan 120 kN/m^2. Kemudian, kirakan ketinggian air jika menggunakan tekanan yang sama.

[6 marks]
[*6 markah*]

CLO1
C3

(c) Referring to **Figure A1**, fluid A is water and fluid B is gasoline with specific gravity of 0.739. The pressure at point B is 175 kN/m^2. Calculate the water pressure of the system.

*Merujuk kepada **Rajah A1**, cecair A ialah air dan cecair B ialah minyak petrol yang mengandungi graviti tentu 0.739. Tekanan pada titik B adalah 175 kN/m^2. Kirakan tekanan air pada sistem tersebut.*

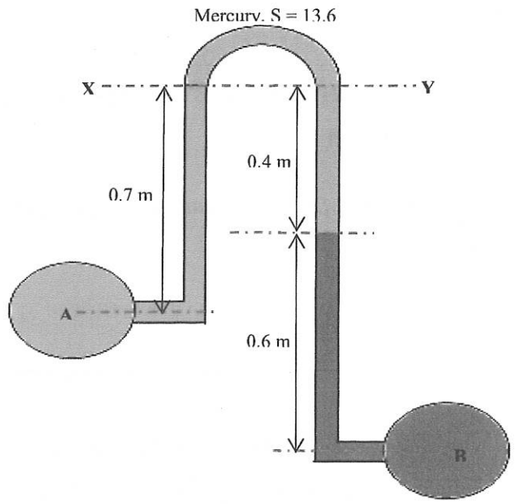

Figure A1 / *Rajah A1*

[14 marks]
[*14 markah*]

QUESTION 2
SOALAN 2

CLO2
C1

(a) Define the terms centroid and centre of pressure.
Takrifkan maksud sentroid dan pusat tekanan.

[4 marks]
[4 *markah*]

CLO2
C2

(b) Determine the total force on a circular plate of diameter 250cm which is placed vertically 370cm below the free water surface as shown in **Figure A2(a).**

*Tentukan jumlah daya di atas plat bulat berdiameter 250cm yang diletakkan secara menegak 370cm di bawah permukaan air seperti ditunjukkan dalam **Rajah A2(a).***

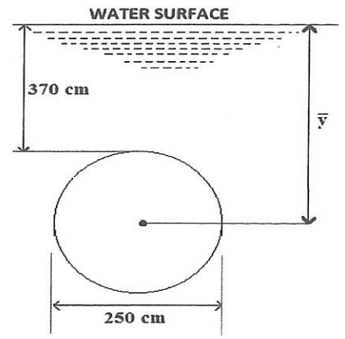

Figure A2 (a) / *Rajah A2 (a)*

[9 marks]
[*9 markah*]

CLO2
C3

(c) **Figure A2(b)** shows a gate having a quadrant shape of radius 1500 mm. Calculate the Resultant Force due to water per meter length of the gate and also the angle at which the total force will act.

***Rajah A2(b)** menunjukkan sebuah pintu air yang mempunyai bentuk sukuan berjejari 1500 mm. Kirakan daya paduan per meter panjang oleh air di pintu dan juga sudut di mana daya paduan tersebut akan bertindak.*

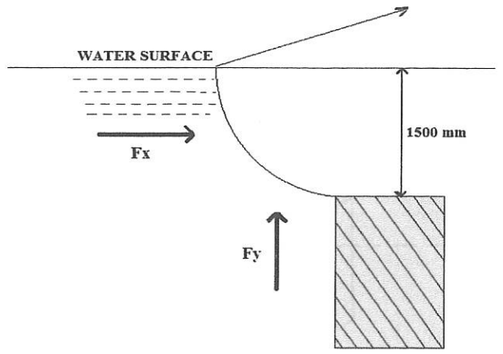

Figure A2(b)/ *Rajah A2(b)*

[12 marks]
[*12 markah*]

SECTION B: 50 MARKS
BAHAGIAN B: 50 MARKAH

INSTRUCTION
This section consists of **FOUR (4)** structured question. Answer **TWO (2)** questions only.

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

QUESTION 1
SOALAN 1

CLO2 C2 (a) A wood cube measures 0.6 m was floating in water. The wood density was 700 kgm^{-3}. Calculate the depth of immersed, d, of the wood.

Sepotong kayu berbentuk kiub yang berukuran 0.6 m terapung di atas air. Ketumpatan kayu ialah 700 kgm^{-3}. Kirakan kedalaman, d, bahagian kayu yang tenggelam.

[10 marks]
[*10 markah*]

CLO2 C3 (b) A mass of 750 kg cylinder tank with diameter of 2.5 m and height of 1.5 m was floating in water as shown in **Figure B1**. Find the metacentric height and determine the type of equilibrium.

*Sebuah tangki silinder berjisim 750 kg dengan diameter 2.5 m dan tinggi 1.5 m terapung di atas air seperti **Rajah B1**. Carikan ketinggian pusat meta bagi tangki silinder tersebut dan tentukan jenis keseimbangannya.*

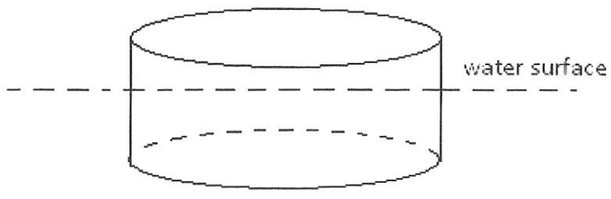

Figure B1/Rajah B1

[15 marks]
[*15 markah*]

QUESTION 2
SOALAN 2

CLO2 C2 (a) Water is flowing through AB pipe of 30 cm diameter. It branches into BC and BD. BC is 20 cm diameter and another one is 15 cm diameter. If the velocity pipes AB are 2.5 m/s and 2 m/s in pipe BC, determine the discharge in all pipes and the velocity in 15 cm pipe.

Air mengalir melalui sebatang paip AB diameter 30cm. Paip tersebut bercabang kepada paip BC dan BD. Diameter paip BC adalah 20 cm manakala BD adalah 15 cm. Jika halaju dalam paip AB ialah 2.5 m/s dan 2 m/s dalam paip BC, tentukan kadaralir dalam semua paip serta halaju dalam paip yang berdiameter 15 cm.

[10marks]
[*10 markah*]

CLO2 C3 (b) A venturimeter with 20 cm diameter inlet and 12.5 cm throat is laid with its axis horizontal is used to measure the flow of water.The mercury manometer shows 87.8 cm. Calculate the discharge through the meter and the velocity at the throat.

Sebuah meter venturi berdiameter 20 cm di ruang masuk dan 12.5 cm di leher beroperasi secara mengufuk dan digunakan untuk mengukur aliran air. Manometer mercury menunjukkan bacaan 87.8 cm. Kirakan kadaralir melalui meter dan halaju di leher.

[15marks]
[*15 markah*]

QUESTION 3
SOALAN 3

(a) Pipe losses its energy due to several factors and occur as the fluid flows along straight lengths of pipe:

Kehilangan tenaga di dalam paip berlaku disebabkan beberapa faktor dan berlaku sepanjang aliran paip:

CLO1 C2

i. Identify **FOUR (4)** types of minor losses in pipe.

*Kenalpasti **EMPAT (4)** jenis kehilangan tenaga kecil dalam paip.*

[4 marks]

[*4 markah*]

CLO1 C2

ii. Based on the following information, calculate the energy loss due to friction in a pipe, with the pipe length of 450m and diameter of 20cm. Given velocity of water is 3m/s and coefficient of friction=0.01.

Kirakan kehilangan tenaga bagi geseran dalam paip, panjang paip ialah 450m dan diameter ialah 20cm. Diberi halaju air ialah 3m/s dan pekali geseran = 0.01.

[6 marks]

[*6 markah*]

CLO1 C3

(b) Referring **Figure B3** , 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 120m. Calculate the discharge in pipe 1. Given coefficient of friction, f=0.008.

*Merujuk **Rajah B3**, 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 120m. Kira kadaralir aliran dalam paip 1. Di beri pekali geseran, f=0.008.*

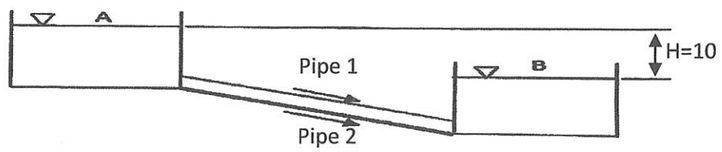

Figure B3 / *Rajah B3* [15 marks]

[*15 markah*]

QUESTION 4
SOALAN 4

CLO2 C1

(a) State Newton's second law of motion with respect to change of momentum.

Nyatakan Hukum Newton kedua yang berkaitan dengan perubahan momentum.

[4 marks]

[*4 markah*]

CLO2 C2

(b) A 95 mm diameter jet having a velocity of 50 meters per second strikes a flat plate. Calculate the normal force on the plate

i. when the plate is stationary, and

ii. when the plate is moving with a velocity of 35 m/sec and away from the jet.

Satu jet air berdiameter 95 mm dengan halaju 50 meter per saat menghentam sebuah plat rata. Kira daya normal ke atas plat

i. bila plat dalam keadaan pegun dan

ii. bila plat bergerak dengan halaju 35 m/s menjauhi jet.

[9 marks]

[*9 markah*]

CLO2
C3

(c) A 400 mm diameter pipe carries water under a head of 30 meters with a velocity of 3.5 m/s. If the axis of the pipe turns through 46°, determine the magnitude and the direction of the resultant force at the bend. Refer to **Figure B4**.

*Satu paip diameter 400 mm mengalirkan air dibawah turus tekanan 30 m dengan halaju 3.5 m/s. Jika paip melengkung pada sudut 46°, kira magnitud dan arah daya paduan pada liku paip. Rujuk **Rajah B4**.*

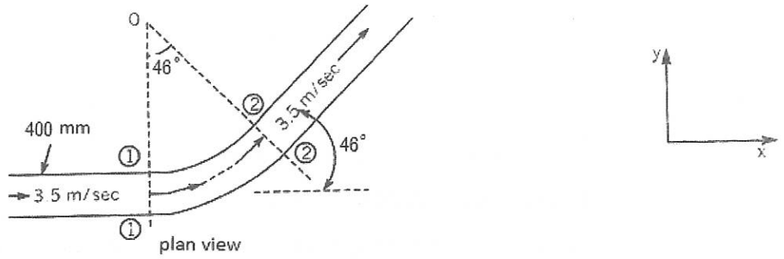

Figure B4 /Rajah B4

[12 marks]
[*12 markah*]

SOALAN TAMAT

FORMULAE DCC5143 – FLUID MECHANICS

LIST FORMULAE	
1. $H = z + \frac{p}{\rho g} + \frac{v^2}{2g}$	12. $C_v = \frac{V_{actual}}{V_{theory}}$
2. $Q = C_d A \sqrt{\frac{2gH}{m^2-1}}$	13. $C_c = \frac{A_j}{A_o}$
3. $Q = C_d \, x \, ((A_1A_2)/\sqrt{(A_1^2A_2^2)}) \, x \, \sqrt{2gh}$	14. $P = \rho gh$
4. $H = hm \left(\frac{\rho_m}{\rho} - 1\right)$	15. $Q = Av$
5. $Q = C_d A_o \sqrt{2gH}$	16. $F_x = \rho g A \hat{y}$
6. $C_d = C_v \, x \, C_c$	17. $F_y = \rho G v$
7. $C_v = \sqrt{\frac{x^2}{4yh}}$	18. $h_p = \hat{y} + \frac{I_{cg} \sin^2\theta}{A\hat{y}}$
8. $h_L = k\left(\frac{v^2}{2g}\right)$	19. $MG = BM - BG$
9. $h_L = k\frac{[(v_1 - v_2)^2]}{2g}$	20. $BM = \frac{I_{xx}}{V_d}$
10. $h_L = \left(\frac{1}{C_c} - 1\right)^2 \frac{v^2}{2g}$	21. $F = \rho A v^2$
11. $h_{fL} = \frac{4fL}{d}\frac{v^2}{2g} = \frac{fLQ^2}{3d^5}$	22. $F = \rho A(v-u)^2 \, kos\, \theta$
	23. $F = \rho A(v-(u/kos\,\theta))\,(vkos\,\theta - u)$
	24. $F_x = \rho Q(v_{x1} - v_{x2})$
	25. $F_y = \rho Q(v_{y1} - v_{y2})$