

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI  
KEMENTERIAN PENDIDIKAN MALAYSIA**

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI JUN 2019**

**DCC5143 : FLUID MECHANICS**

**TARIKH : 07 NOVEMBER 2019**

**MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)**

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Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.

Bahagian A: Struktur (2 soalan)

Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf/Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**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.*

**QUESTION 1****SOALAN 1**

CLO1  
C1

(a) Define for the fluid properties below;

*Takrifkan bagi sifat cecair di bawah;*

(i) Density

*Ketumpatan*

[3 marks]

[3 markah]

(ii) Specific weight

*Berat tentu*

[2 marks]

[2 markah]

CLO1  
C2

(b) An object is located at a depth of 2m from the surface of an oil with specific weight of  $8\text{kN/m}^3$ . Calculate:

*Objek yang terletak pada kedalaman 2m dari permukaan minyak dengan berat tentu  $8\text{kN/m}^3$ . Kirakan;*

(i) intensity of pressure at the point.

*Keamatan tekanan di tempat berkenaan.*

[4 marks]

[4 markah]

(ii) the height of water column corresponding to the value of pressure.

*Ketinggian air yang bersamaan dengan nilai tekanan.*

[4 marks]

[4 markah]

CLO1  
C3

- (c) A U-tube differential manometer shown in **Figure A1(c)** connects pipe A and B. Pipe A contains a liquid of specific gravity 1.594 under a pressure of  $10.3 \times 10^4 \text{ N/m}^2$  and pipe B contains oil of specific gravity 0.8 under a pressure  $17.16 \times 10^4 \text{ N/m}^2$ . Pipe A lies 2.5m above pipe B. Calculate the value of  $h$ .

*Rajah A1(c)* menunjukkan satu manometer pembezaan yang menghubungkan paip A dan B. Paip A mengandungi cecair yang mempunyai graviti tentu 1.594 di bawah tekanan  $10.3 \times 10^4 \text{ N/m}^2$  dan paip B mengandungi minyak dengan graviti tentu 0.8 di bawah tekanan  $17.16 \times 10^4 \text{ N/m}^2$ . Paip A terletak 2.5m di atas paip B. Kirakan nilai  $h$ .

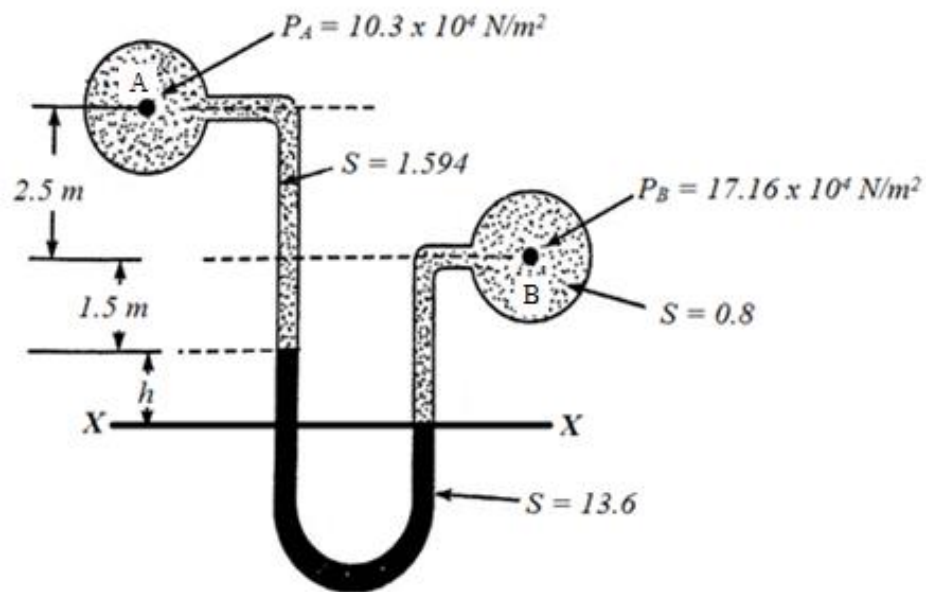


Figure A1(c) / Rajah A1(c)

[12 marks]

[12 markah]

**QUESTION 2**  
**SOALAN 2**CLO1  
C1

- (a) Energy loss for fluid flowing within a pipe system can be divided into major and minor losses. Define;

*Kehilangan tenaga aliran bagi bendalir yang mengalir dalam paip terbahagi kepada kehilangan utama dan kehilangan kecil. Takrifkan;*

- (i) major loss.  
*kehilangan utama*

[2 marks]  
[2 markah]

- (ii) minor loss.  
*kehilangan kecil*

[3 marks]  
[3 markah]

CLO1  
C2

- (b) A horizontal pipe of diameter 150mm flowing water at 3.0m/s velocity. Calculate the head loss at the entrance of pipe and the flow rate.

*Paip melintang berdiameter 150mm mengalirkan air pada halaju 3.0m/s. Kira kehilangan tenaga di pintu masuk dan kadar alirannya.*

[8 marks]  
[8 markah]

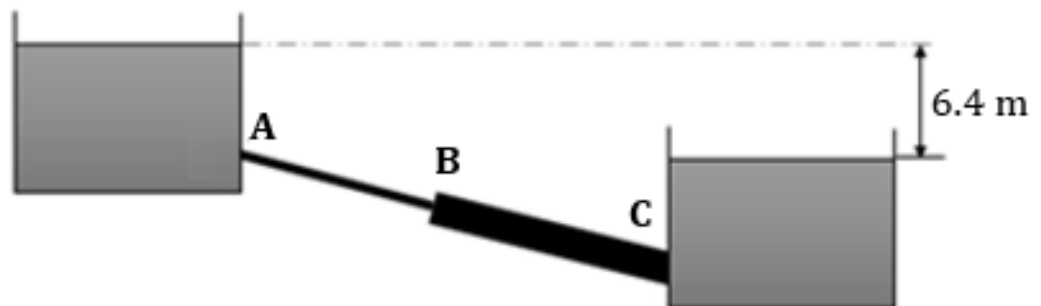
CLO1  
C3

- (c) Two reservoirs are connected by series of line as shown in **Figure A2(c)**. Calculate the flow rate in the pipe of the following data given in **Table A2(c)**. Neglect all minor losses.

*Dua takungan dihubungkan secara siri seperti yang ditunjukkan dalam **Rajah A2(c)**. Kirakan kadar alir dalam paip mengikut data yang diberikan dalam **Jadual A2(c)**. Abaikan semua kehilangan kecil.*

**Table A2(c) / Jadual A2(c)**

Pipe	Diameter, d (mm)	Length, L (m)	Friction Factor, f
AB	120	50	0.01
BC	150	50	0.01



**Figure A2(c) / Rajah A2(c)**

[12 marks]  
[12 markah]

**SECTION B: 50 MARKS****BAHAGIAN B: 50 MARKAH****INSTRUCTION:**

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

**ARAHAN:**

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

**QUESTION 1****SOALAN 1**CLO2  
C1

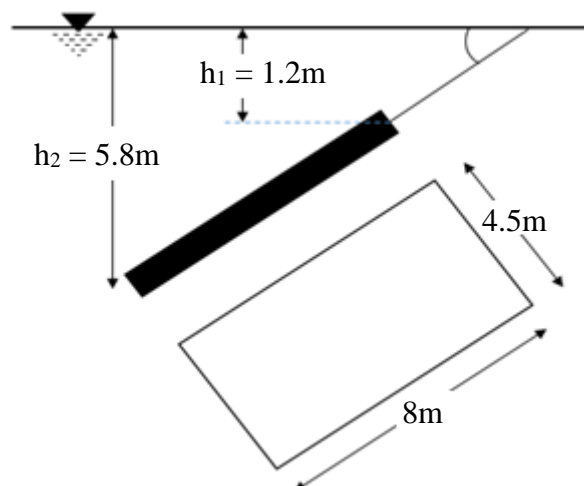
- (a) Define Centroid and Centre of pressure.  
*Takrifkan sentroid dan pusat tekanan.*

[4 marks]  
[4 markah]

CLO2  
C2

- (b) A rectangular plate 4.5m wide and 8m height is immersed in liquid shown in **Figure B1(b)**. Calculate hydrostatic force that acts on the plate and the position of the centre of pressure. Given the density of liquid is  $950 \text{ kg/m}^3$ .

*Sebuah plat segiempat berukuran 4.5 m lebar dan 8 m tinggi ditenggelam dalam cecair seperti yang ditunjukkan dalam **Rajah B1(b)**. Kirakan daya hidrostatik yang bertindak ke atas plat tersebut dan kedudukan pusat tekanannya. Diberi ketumpatan cecair tersebut adalah  $950 \text{ kg/m}^3$ .*



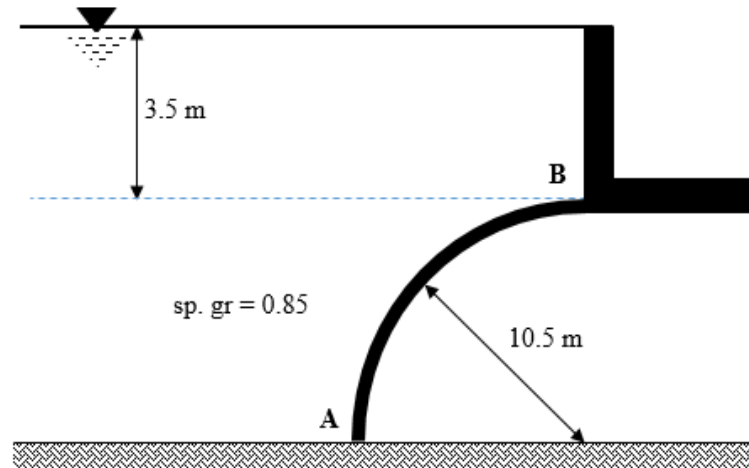
**Figure B1(b) / Rajah B1(b)**

[8 marks]  
[8 markah]

CLO2  
C3

- (c) Calculate the magnitude and the direction of the force that act on the curved plates 1.2m long as shown in the **Figure B1(c)** below.

*Kirakan magnitud dan arah daya paduan yang bertindak pada plat melengkung sepanjang 1.2m seperti dalam **Rajah B1(c)** di bawah.*



**Figure B1(c) / Rajah B1(c)**

[13 marks]  
[13 markah]

**QUESTION 2**  
**SOALAN 2**

CLO2  
C1

- (a) Define meta centric and centre of buoyancy.  
*Berikan takrifan bagi pusat meta dan pusat keapungan.*

[4 marks]  
[4 markah]

CLO2  
C2

- (b) A solid cylinder of 3m diameter floating in fresh water. If the draft of the cylinder is 2m, calculate;  
*Suatu silinder pepejal diameter 3m terapung di dalam air tawar. Jika draf silinder adalah 2m, kirakan;*

- (i) Weight of cylinder.  
*Berat bagi silinder*

[4 marks]  
[4 markah]

- (ii) the draft of the cylinder if placed in seawater with a density of  $1025\text{kg/m}^3$

*draft silinder tersebut jika diletakkan di dalam air laut dengan ketumpatan  $1025\text{kg/m}^3$ .*

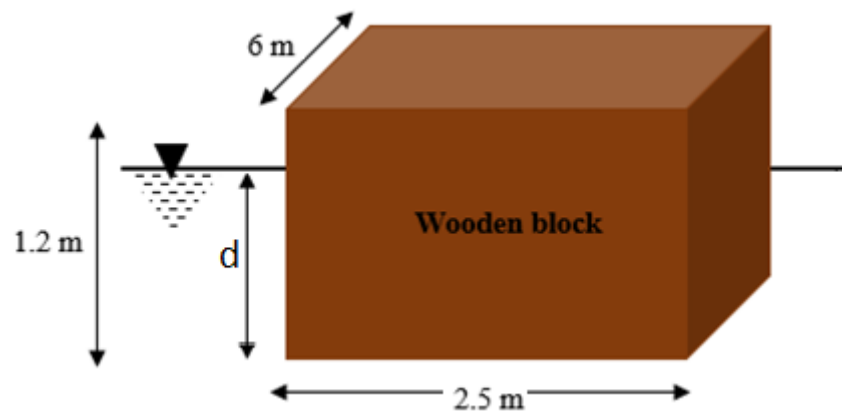
[4 marks]

[4 markah]

CLO2  
C3

- (c) The specific gravity of wooden block is 0.65 and its length is 6.0 m floats in water as shown in **Figure B2(c)**. Calculate the metacentric height of the wooden block.

*Graviti tentu bagi blok kayu adalah 0.65 dan panjang 6.0 m terapung dalam air seperti dalam **Rajah B2(c)** di bawah. Kirakan ketinggian pusat meta bagi blok kayu tersebut.*



**Figure B2(c) / Rajah B2(c)**

[13 marks]

[13 markah]



**QUESTION 3****SOALAN 3**CLO2  
C1

- (a) Loss of energy in the pipeline occurs due to several factors. Identify **FOUR (4)** types of small energy losses in pipes.

*Kehilangan tenaga di dalam aliran paip berlaku disebabkan beberapa faktor.*

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

[4 marks]

[4 markah]

CLO2  
C2

- (b) Based on **Figure B3(b)** as shown below, the diameters of a pipe at the section 1 and 2 are 10cm and 15cm respectively. Calculate;

*Berdasarkan **Rajah B3(b)** yang ditunjukkan di bawah, diameter sebatang paip pada keratan 1 dan 2 adalah 10cm dan 15cm masing-masing. Kirakan;*

- (i) the flow rate through the pipe if the velocity of water flowing through the pipe at section 1 is 5m/s.

*kadar alir yang melalui paip tersebut jika halaju aliran dalam keratan 1 adalah 5m/s.*

[4 marks]

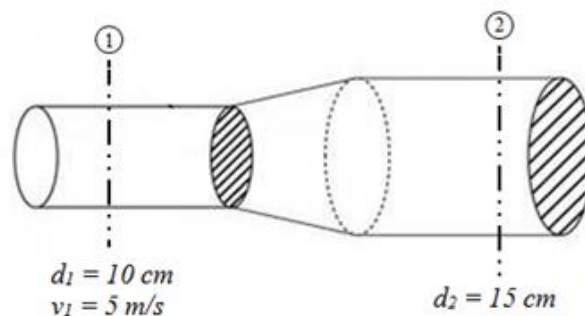
[4 markah]

- (ii) the velocity at section 2

*halaju pada keratan 2*

[4 marks]

[4 markah]



**Figure B3(b) / Rajah B3(b)**

CLO2  
C3

- (c) A 35mm diameter of orifice drains water from the tank at a velocity of 8.5m/s. The water head above the orifice is 5.0 m. Calculate the coefficient of velocity ( $C_v$ ), coefficient of contraction ( $C_c$ ) and the coefficient of discharge ( $C_d$ ) if the actual flow rate is 0.008 m<sup>3</sup>/s.

*Satu orifis yang berdiameter 35mm mengalirkan air dari tangki dengan halaju 8.5m/s. Ketinggian turus air dari bukaan atas orifis adalah 5.0m. Kirakan nilai pekali halaju ( $C_v$ ), pekali pengecutan ( $C_c$ ) dan pekali kadar alir ( $C_d$ ) jika kadar alir sebenar adalah 0.008 m<sup>3</sup>/s.*

[13 marks]  
[13 markah]

**QUESTION 4**  
**SOALAN 4**

CLO2  
C1

- (a) Describe the following law of motion;  
*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

[2 marks]  
[2 markah]

CLO2  
C2

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

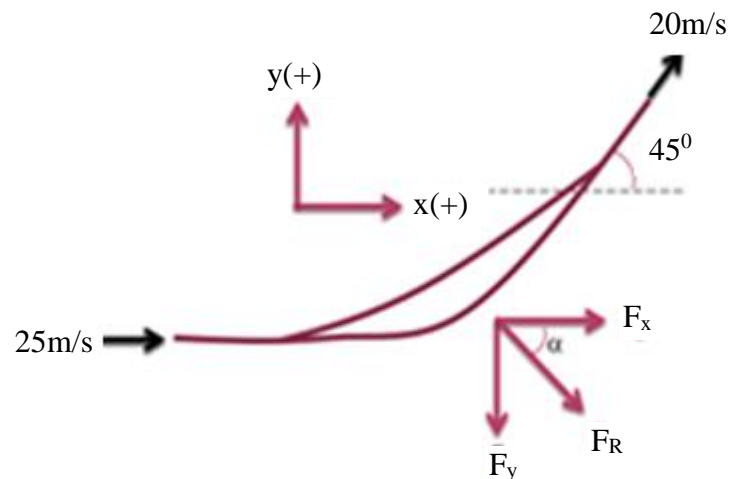
*Satu jet minyak berdiameter 75mm yang mempunyai graviti tentu 0.8 menghentam sebuah plat rata. Jika daya hentaman jet minyak tersebut adalah sebanyak 1200N, kirakan halaju jet minyak tersebut.*

[8 marks]  
[8 markah]

CLO2  
C3

- (c) A jet of water 50mm diameter and having a velocity of 25m/s enters tangentially a stationary curved vane without shock and is deflected through an angle of  $45^\circ$  shown in **Figure A4(c)** below. Calculate the magnitude and direction of the resultant force on the vane.

*Satu jet air yang berdiameter 50mm dan mempunyai halaju 25m/s menghentam plat lengkung yang membias melalui sudut  $45^\circ$  ditunjukkan dalam **Rajah A4(c)** di bawah. Kirakan daya dan arah tindakan daya pada bilah tersebut.*



**Figure A4(c) / Rajah A4(c)**

[13 marks]  
[13 markah]

**SOALAN TAMAT**

## FORMULAE DCC5143 – FLUID MECHANICS

### LIST FORMULAE

$$1. H = z + \frac{p}{\rho g} + \frac{v^2}{2g}$$

$$2. Q = C_d A \sqrt{\frac{2gH}{m^2 - 1}}$$

$$3. Q = C_d \frac{(A_1 A_2)}{\sqrt{(A_1^2 - A_2^2)}} \times \sqrt{2gh}$$

$$4. H = h \left( \frac{\rho_m}{\rho} - 1 \right)$$

$$5. Q = C_d A_o \sqrt{2gH}$$

$$6. C_d = C_v \times C_c$$

$$7. C_v = \sqrt{\frac{x^2}{4yh}}$$

$$8. h_L = k \left( \frac{v^2}{2g} \right)$$

$$9. h_L = k \frac{[(v_1 - v_2)^2]}{2g}$$

$$10. h_L = \left( \frac{1}{C_c} - 1 \right)^2 \frac{v^2}{2g}$$

$$11. h_{fl} = \frac{4fL}{d} \frac{v^2}{2g} = \frac{fLQ^2}{3d^5}$$

$$12. C_v = \frac{V_{actual}}{V_{theory}}$$

$$13. C_c = \frac{A_j}{A_o}$$

$$14. P = \rho gh$$

$$15. Q = Av$$

$$16. F_x = \rho g A \hat{y}$$

$$17. F_y = \rho Gv$$

$$18. h_p = \hat{y} + \frac{I_{cg} \sin^2 \theta}{A \hat{y}}$$

$$19. MG = BM - BG$$

$$20. BM = \frac{I_{xx}}{V_d}$$

$$21. F = \rho A v^2$$

$$22. F = \rho A (v-u)^2 \cos \theta$$

$$23. F = \rho A (v - (u/\cos \theta)) (v \cos \theta - u)$$

$$24. F_x = \rho Q (v_{x1} - v_{x2})$$

$$25. F_y = \rho Q (v_{y1} - v_{y2})$$