Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	FLUID MECHANICS
COURSE CODE	:	BFC 10403
PROGRAMME	:	1 BFF
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** FROM **FIVE (5)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) Define the following:

(i) Specific weight, γ
(ii) Specific volume ,v
(iii) Specific gravity, SG
(iv) Density, ρ
(v) Kinematic viscosity, v

(5 marks)

(b) Explain briefly and sketch a capillarity effect and surface tension.

(8 marks)

(c) A closed tank has two piezometer A and B which located on the side of the tank. The tank contains two liquids that do not mix, as shown in Figure **Q1(c)**. The air pressure at the top of the atmosphere is 50.7 kN/m^2 and Pa = 101.4 kN/m^2.Calculate;

(i) Surface level of a liquid in piezometer A
(ii) Surface level of a liquid in piezometer B
(iii) The overall pressure of liquid in the bottom of the tank

(12 marks)

Q2 (a) Define the hydrostatic principle and specify the Archimedes and Pascal's Law accordingly.

(4 marks)

(b) A block of wood 72 cm x 96 cm floats on the oil of specific gravity 0.751 and tilted as shown in Figure **Q2(b).** Determine the buoyant force acting on the block and its position.

(7 marks)

(c) A 40 m length canal has a cross section as shown in Figure **Q2(c).** Determine :

(i) The horizontal and vertical components of hydrostatic force against the quarter-circle wall,

(ii) The center of pressure (c .p), where the resultant force strikes the wall

(14 marks)

Q3 (a) (i) State **TWO (2)** differences between laminar and turbulent flow, and function of the Reynolds number in the pipe.

(3 marks)

(ii) If the Reynolds number of mercury is 1.789×10^3, what type of flow can you classify and why?

(3 marks)

(b) An oil flows through a pipe of diameter 40 cm , length 1000 km at rate of 50 L/s having a density, $\rho = 850$ kg/m^3 and viscosity , $\mu = 0.18$ Ns/m^2 . Find the head loss due to friction in this pipe.

(8 marks)

(c) A horizontal pipe of diameter 30 cm carrying water is abruptly reduced to a diameter of 20 cm. If the discharge through the pipe is 40 L/s, find the loss of head due to contraction and the pressure loss across the contraction.Assume the coefficient of contraction as 0.62.

(11 marks)

Q4 (a) Briefly explain between hydraulic grade line (HGL) and energy line (EL). Sketch the hydraulic grade line and the energy grade line when water flows through 2 types of diameter pipes.

(8 marks)

(b) A flow of water has been discharge through a horizontal pipeline to the atmosphere. The pipeline is connected in series and consisted of two pipes which are 10 cm diameter and 25 m long and 12 cm diameter and 35 m long. The friction factor is 0.002 for both pipes. The water level in the tank is 10 m above the centre-line of the pipe at the entrance. Considering all the head losses, calculate the discharge when the 10 cm diameter pipe is connected to the tank.

(13 marks)

(c) List **ONE (1)** major head loss and **THREE (3)** minor head losses incurred in a water distribution system.

(4 marks)

Q5 (a) Briefly explain geometric similarity

(2 marks)

(b) State **THREE (3)** advantages using similarity

(6 marks)

(c) Using Buckingham Theorem derived an equation of non-dimension group to describe the resistance force *(F)*. The resistance force *(F)* for a ship influenced by the function length *L,* velocity *V*, acceleration gravity *g*, density flow ρ and dynamic viscosity μ.
(Repeating variables : L, V and ρ)

(13 marks)

(d) Differentiate between model and prototype?

(4 marks)

- END OF QUESTION -

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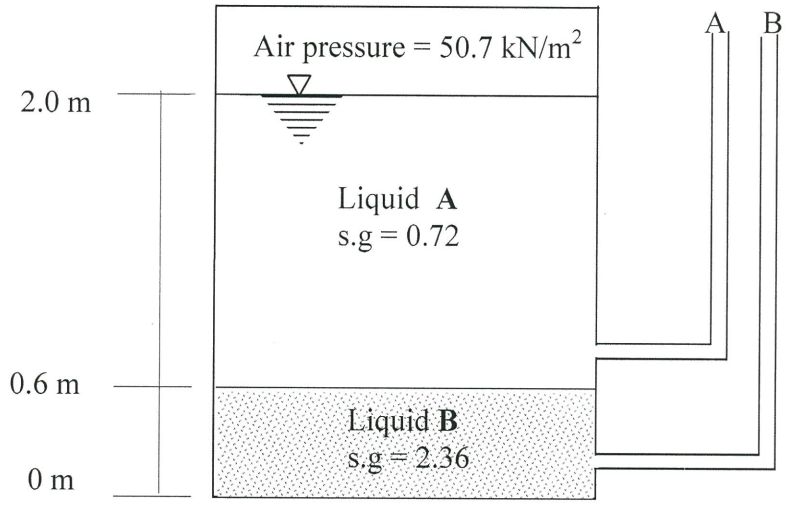

FIGURE Q1(c)

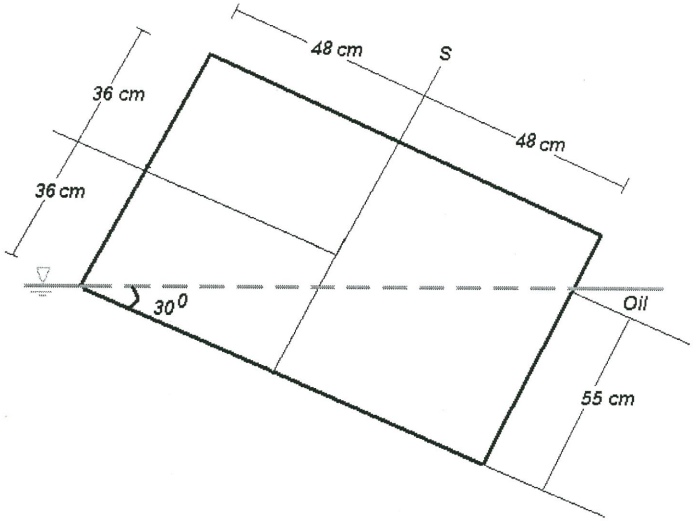

FIGURE Q2 (b)

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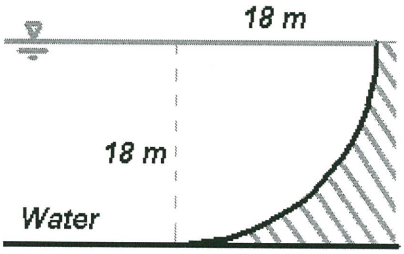

FIGURE Q2 (c)

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Table 1: Dimensionless and Quantity for Fluid Mechanics

Kuantiti	Quantity	Simbol	Dimensi
ASAS	**FUNDAMENTAL**		
Jisim	Mass	m	M
Panjang	Length	L	L
Masa	Time	t	T
GEOMETRI	**GEOMETRIC**		
Luas	Area	A	L^2
Isipadu	Volume	V	L^3
Sudut	Angle	θ	$M^0L^0T^0$
Momen luas pertama	First area moment	Ax	L^3
Momen luar kedua	Second area moment	Ax^2	L^4
Keterikan	Strain	e	L^0
DINAMIK	**DINAMIC**		
Daya	Force	F	MLT^{-2}
Berat	Weight	W	MLT^{-2}
Berat tentu	Specific weight	γ	$ML^{-2}T^{-2}$
Ketumpatan	Density	ρ	ML^{-3}
Tekanan	Pressure	P	$ML^{-1}T^{-2}$
Tegasan ricih	Shear stress	τ	$ML^{-1}T^{-2}$
Modulus keanjalan	Modulus of elasticity	E, K	$ML^{-1}T^{-2}$
Momentum	Momentum	M	MLT^{-1}
Momentum sudut	Angular momentum		ML^2T^{-1}
Momen momentum	Moment of momentum		ML^2T^{-1}
Momen daya	Force moment	T	ML^2T^{-2}
Daya kilas	Torque	T	ML^2T^{-2}
Tenaga	Energy	E	L
Kerja	Work	W	ML^2T^{-2}
Kuasa	Power	P	ML^2T^{-3}
Kelikatan dinamik	Dynamic viscocity	μ	$ML^{-1}T^{-1}$
Tegangan permukaan	Surface tension	σ	MT^{-2}
KINEMATIK	**KINEMATIC**		
Halaju lelurus	Linear velocity	U,v,u	LT^{-1}
Halaju sudut	Angular velocity	ω	T^{-1}
Halaju putaran	Rotational speed	N	T^{-1}
Pecutan	Acceleration	a	LT^{-2}
Pecutan sudut	Angular acceleration	α	T^{-2}
Graviti	Gravity	g	LT^{-2}
Kadar alir	Discharge	Q	L^3T^{-1}
Kelikatan kinematik	Kinematic viscosity	υ	L^2T^{-1}
Fungsi arus	Stream function	ψ	L^2T^{-1}
Putaran	Circulation	Γ	L^2T^{-1}
Pusaran	Vorticity	Ω	T^{-1}

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EQUATIONS

$$\mathrm{Re} = \frac{\rho VD}{\mu} = \frac{DV}{\nu} \qquad f = \frac{64}{\mathrm{Re}} \qquad \mathrm{F_r} = \frac{V}{\sqrt{gL}} \qquad h_f = f\left(\frac{L}{D}\right)\frac{V^2}{2g}$$

$$H = \frac{P}{\gamma} + z + \frac{V^2}{2g} \qquad h_k = k\frac{v^2}{2g} \qquad F = \sqrt{F_x{}^2 + F_y^2} \qquad F_y = \rho g V$$

$$F_x = \rho g A\bar{x} \qquad \phi = \tan^{-1}\frac{F_y}{F_x} \qquad BM = \frac{I}{V} \qquad \mathrm{W = mg}$$

$$\mathrm{R = \rho gV} \qquad \rho = \frac{M}{V} \qquad P = \rho gh \qquad \gamma = \rho g$$

$$V = \sqrt{2gh} \qquad h_L = H - \frac{V_a}{2g} \qquad \mathrm{F_r} = \frac{V}{\sqrt{gL}} \qquad C_d = C_c x C_V$$

$$Q = C_d a\sqrt{2gH} \qquad C_v = \frac{x}{\sqrt{4yH}} \qquad \dot{m} = \rho AV \qquad C_V = \frac{V_a}{V}$$

$$\mathrm{R_X} = \dot{m}(V_{X1} - V_{X2}) \qquad \mathrm{R_Y} = \dot{m}(V_{Y1} - V_{Y2}) \qquad R = \sqrt{R_X{}^2 + R_Y{}^2}$$