Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	FLUID MECHANICS
COURSE CODE	:	BFC 10403
PROGRAMME	:	1 BFF
EXAMINATION DATE	:	DECEMBER 2014 / JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Determine the specific weight, density, specific volume and specific gravity of certain liquid. Given, the volume is 6.5 m^3 and weight is 55 kN.

(12 marks)

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

(8 marks)

(c) Calculate the minimum diameter of a glass tube if a capillary rise is not more than 0.25 mm. Given, the surface tension,σ = 0.075 N/m and specific weight of water , γ = 9810 kg/m^3 .

(5 marks)

Q2 (a) Determine the absolute pressure in unit kPa if barometer reads 60 kPa.Given, barometer height at sea level is 740 mmHg and $SG_{merkuri}$ = 13.6

(8 marks)

(b) Calculate the pressure difference (P_B-P_A) in double–fluid manometer as shown in Figure **Q2(b)**.

(13 marks)

(c) Explain why the pressure in fluid increases with depth.

(4 marks)

Q3 (a) State **TWO (2)** differences between laminar and turbulent flow,and function of the Reynolds number in the pipe.If the Reynolds number of fluid A is 1.789 x 10^5, what type of flow can you classify and why?

(6 marks)

(b) Fluid B flows with discharge 5.630 L/s, through a galvanised iron pipe with length and diameter are 45 m and 150 mm respectively for Calculate the head loss due to fluid friction of pipe.
(Given ρ = 869 kg/m^3, μ = 8.14 x 10^{-2} Pa.s, 1 m^3 = 1000 L).

(8 marks)

(c) Pressurized tank of water has a 10-cm-diameter orifice at the bottom, where water discharges to the atmosphere as shown in **Figure Q3(c)**.The water level is 3 m above the outlet. The tank air pressure above the water level is 300 kPa while the atmospheric pressure is 100 kPa. Determine the initial discharge rate of water from the tank and neglect frictional effects.

(11 marks)

Q4 (a) Briefly explain the characteristics of discharge Q and head loss h_f of flow in pipes installed as follows;

(i) Series
(ii) Parallel

(8 marks)

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

(4 marks)

(c) 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)

Q5 (a) Differentiate between model and prototype in similarity laws.

(4 marks)

(b) Clearly explain what is geometry and kinematics similitude.

(7 marks)

(c) Derived an equation of non-dimension group Using Buckingham Theorem 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)

(14 marks)

END OF QUESTION

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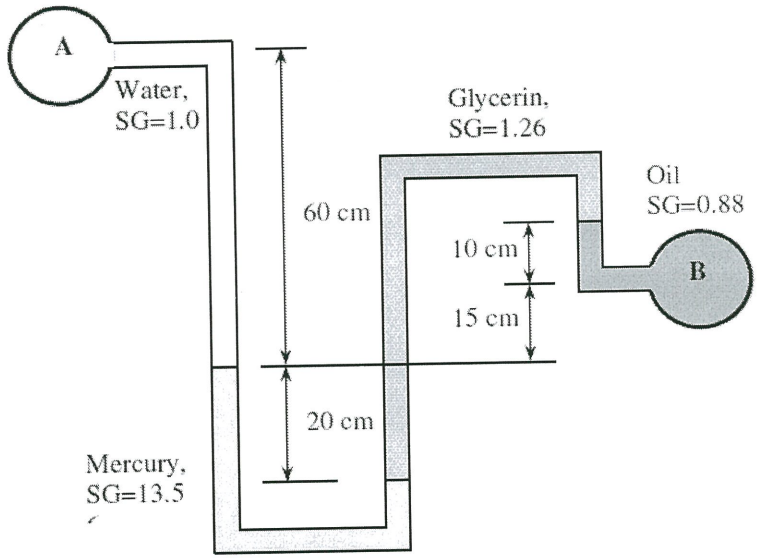

Figure Q2(b)

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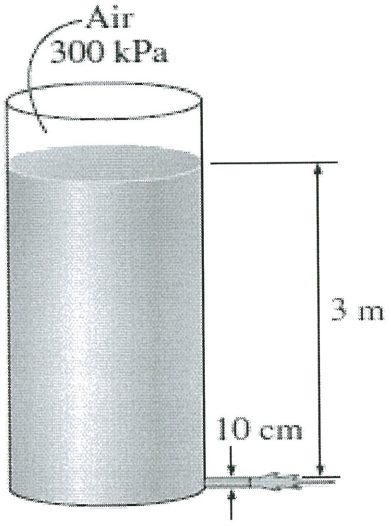

Figure Q3(c)

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Table 1: Dimensionless and Quantity for Fluid Mechanics

Kuantiti	Quantity	Symbol	Dimensional
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

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

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

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

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

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

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

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