UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2011/2012

COURSE NAME	:	FLUID MECHANICS
COURSE CODE	:	BFC1043
PROGRAMME	:	1 BFF
EXAMINATION DATE	:	JANUARY 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS PAPER CONSISTS OF **TWELVE (12)** PAGES

Q1 (a) State the following terms:
(i) Relative density
(ii) Specific weight
(iii) Kinematics viscosity
(iv) Surface tension

(4 marks)

(b) The gage pressure of the air in the tank shown in Figure Q1 is recorded to be 65kPa. Determine the height *h*.

(6 marks)

(c) A reservoir of glycerine has mass and volume is 500 kg and 0.315 m^3 respectively. Find the weight, mass density, specific weight and specific gravity of glycerine. Is it floating on the water? Why?

(10 marks)

Q2. (a) What is buoyancy? Explain briefly the Archimedes principle.

(4 marks)

(b) A block of steel (s.g = 7.85) is floating at a mercury-water interface as shown in Figure Q2. What will be the ratio of distances a and b for this condition? (Given: L = length, w = width)

(6 marks)

(c) A door in a tank is in the form of a quadrant of a cylinder of 1.5 m radius and 1.8 m wide as shown in Figure Q2(c). Calculate the resultant force on the door and its location on the gate.

(10 marks)

Q3. (a) What is mass flow rate and ideal fluid.

(2 marks)

(b) 50-mm-diameter siphon was used to draw an oil (SG = 0.82) from the oil reservoir as shown in Figure Q3, the head loss from point 1 to point 2 is 1.50 m and from point 2 to point 3 is 2.40 m. Find the discharge of oil from the siphon and the oil pressure at point 2.

(6 marks)

(c) Water flows through a right-angled bend that has a uniform diameter of 250 mm is under a gage pressure of 350 kPa flows with a velocity of 5 m/s. The bend lies in a horizontal plane and water enters from the west and leaves towards the north. By using a sketch, find the magnitude and direction of the resultant force acting on the bend? Assuming no drop in pressure.

(12 marks)

Q4. (a) Explain briefly, 4 zones in the Moody chart.

(4 markah)

(b) A factory B in Figure Q4 conveys water from a closed tank through a pipe with 150 mm diameter at rate of 0.1 m^3/s. Given that kinematic viscosity of water, υ is 0.113 x 10^{-5} m^2/s, pipe friction factor, f is 0.016. and coefficient of minor losses for inlet and bend of pipe are 0.05 and 0.4 respectively.

(i) Prove that the flow is turbulent
(ii) Calculate energy head losses in pipe
(iii) Determine the tank pressure, P_1.

(16 marks)

Q5 (a) Pipe A is connected in parallel between two points M and N with pipe B. A total discharge of 20 L/s enters the parallel pipes through division at M to join at N as shown in Figure Q5 (a). Estimate the division of discharge in the pipes in L/s if the friction factor, f for pipe A and B are 0.018 and 0.02 respectively

(6 marks)

(b) Determine magnitude and discharge Q in every pipes at every nodes for the water supply system in Figure Q5 (b) by using Hardy-Cross method in 3 trial of corrections. K values (from fluid friction, $h_f = KQ^2$) are given in Table 1 and neglect minor losses in pipes.

Table 1: K Values

Paip	AB	BC	AC	BD	CD
K	2	1	2	4	3

(14 marks)

Q6. (a) Justify the advantages using model in design work.

(3 marks)

(b) An oil of specific gravity 0.92 and viscosity 0.03 poise is to be transported at the rate of 2500 L/s through a 1.2 m diameter pipe. Tests were conducted on a 12 cm diameter pipe using water. If the viscosity of water is 0.01 poise, find velocity and rate of flow for model in L/s. Calculate the ratio of length.
(Given : 1 poise = 0.1 Ns/m^2)

(6 marks)

(c) The velocity V of a hemispherical parachute is found to depend on its diameter D, weight W, acceleration due to gravity g, density of air ρ and viscosity of air μ. By using Buckingham method, prove that

$$V = \sqrt{gD}\, fn\left(\frac{W}{\rho D^3 g}, \frac{\mu}{\rho D\sqrt{gD}}\right)$$

(11 marks)

S1. (a) Nyatakan perkara berikut:

(i) Ketumpatan bandingan
(ii) Berat tentu
(iii) Kelikatan kinematik
(iv) Tegangan permukaan

(4 markah)

(b) Tekanan udara didalam tangki yang ditunjukkan di dalam Rajah S1 telah direkodkan sebanyak 65kPa. Kira ketinggian *h*.

(6 markah)

(c) Takungan glycerin mempunyai jisim dan isipadu masing-masing adalah 500 kg dan 0.315 m^3. Kira berat (N), ketumpatan (kg/m^3), berat tentu (N/m^3) and graviti tentu bagi glycerin. Adakah ia terapung di atas air? Kenapa?

(10 markah)

S2. (a) Apakah yang dimaksudkan dengan keapungan? Terangkan dengan ringkas prinsip Archimedes.

(4 markah)

(b) Bongkah besi (graviti tentu = 7.85) terapung di antara raksa-air yang ditunjukkan di Figure Q2 (b). Apakah nisbah jarak a dan b untuk keadaan ini? (Diberi: L = panjang, w = lebar)

(6 markah)

(c) Sebuah pintu di dalam tangki berbentuk sukuan silinder dengan jejari = 1.5 m dan lebar = 1.8 m ditunjukkan di Rajah S2 (c). Kira daya paduan ke atas pintu dan lokasinya pada pintu tersebut.

(10 markah)

S3. (a) Apa yang dimaksudkan dengan jisim kadar alir dan bendalir ideal.

(2 markah)

(b) Siphon berdiameter 50-mmn telah digunakan untuk menyalurkan minyak (kb = 0.82) daripada takungan minyak seperti di Rajah S3, kehilangan tenaga dari titik 1 ke titik 2 adalah 1.50 m dan dari titik 2 ke titik 3 adalah 2.40 m. Kira kadar alir minyak dan tekanan minyak di titik 2.

(6 marks)

(c) Air yang mengalir melalui liku bersudut tepat mempunyai diameter seragam 250 mm memberikan nilai tekanan tolok 350 kPa dengan halaju 5 m/s. Lenturan paip ini berada pada kendudukan mendatar, dan air memasuki paip dari barat dan keluar ke arah utara. Apakah magnitud dan arah bagi daya yang bertindak pada lenturan paip tersebut? Anggapkan tiada pengurangan tekanan.

(12 markah)

S4. (a) Terangkan dengan ringkas, 4 zon yang terdapat didalam carta Moody.

(4 markah)

(b) Sebuah kilang B di rajah S4 menyalurkan air daripada tangki bertutup melalui paip yang berdiameter 150 mm pada kadar 0.1 m^3/s. Diberi kelikatan kinematik bagi air, υ ialah 0.113 x 10^{-5} m^2/s, faktor geseran paip, f adalah 0.016 dan pekali kehilangan kecil bagi bahagian masuk dan lenturan masing-masing adalah 0.05 dan 0.4.

(i) Buktikan bahawa aliran dalam paip adalah gelora
(ii) Kira kehilangan tenaga dalam paip
(iii) Tentukan tekanan dalam tangki, P_1.

(16 markah)

S5. (a) Paip A bersambung secara selari di antara 2 titik M dan N dengan paip B. Sebanyak 20 L/s kadar alir yang memasukki paip selari berpecah melalui M dan bergabung semula di N seperti di Rajah Q5 (a). Anggarkan pecahan kadar alir di dalam paip tersebut dalam L/s jika faktor geseran, f bagi paip A dan B masing-masing ialah 0.018 and 0.02.

(6 marks)

(b) Tentukan arah aliran dan kadar alir, Q dalam paip di setiap titik untuk sistem bekalan air di Rajah S5 (b) dengan menggunakan kaedah Hardy-Cross hingga 2 kali pembetulan. Diberi nilai K (daripada kehilangan geseran, $h_f = KQ^2$) seperti di Jadual 1 dan menganggap tiada kehilangan kecil dalam paip.

Jadual 1: Nilai K

Paip	**AB**	**BC**	**AC**	**BD**	**CD**
K	2	1	2	4	3

(14 markah)

Q6. (a) Jelaskan kebaikan menggunakan model di dalam kerja rekabentuk.

(3 markah)

(b) Minyak dengan graviti tentu dan kelikatan dinamik masing-masing ialah 0.92 dan 0.03 poise diangkut pada kadar alir 2500 L/s melalui paip berdiameter 1.2 m . Ujian telah dilakukan ke atas paip berdiameter 12 cm dengan menggunakan air. Jika kelikatan dinamik air ialah 0.01 poise, dapatkan

(i) Halaju aliran bagi model
(ii) Kadar alir dalam L/s
(iii) ratio of length.
(Diberi : 1 poise = 0.1 Ns/m^2)

(6 markah)

(c) Halaju V bagi payung terjun berbentuk hemisfera didapati bergantung kepada diameter D, berat W, graviti g, ketumpatan udara ρ dan kelikatan udara μ. Dengan menggunakan kaedah Buckingham, buktikan

$$V = \sqrt{gD}\, fn\left(\frac{W}{\rho D^3 g}, \frac{\mu}{\rho D\sqrt{gD}}\right)$$

(11 markah)

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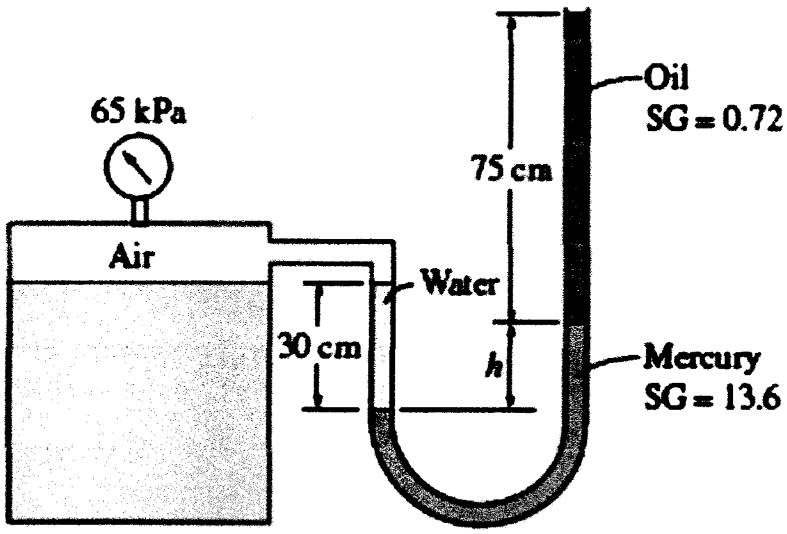

Figure Q1/Rajah S1

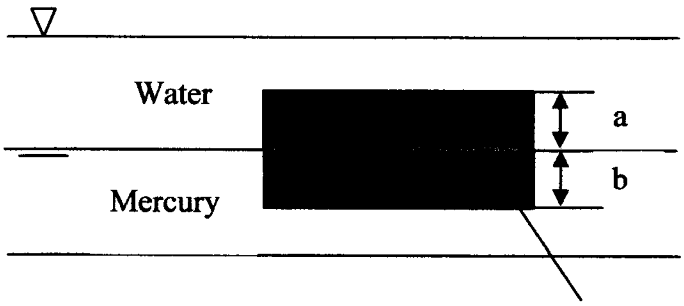

Figure Q2 (b)/ Rajah S2 (b)

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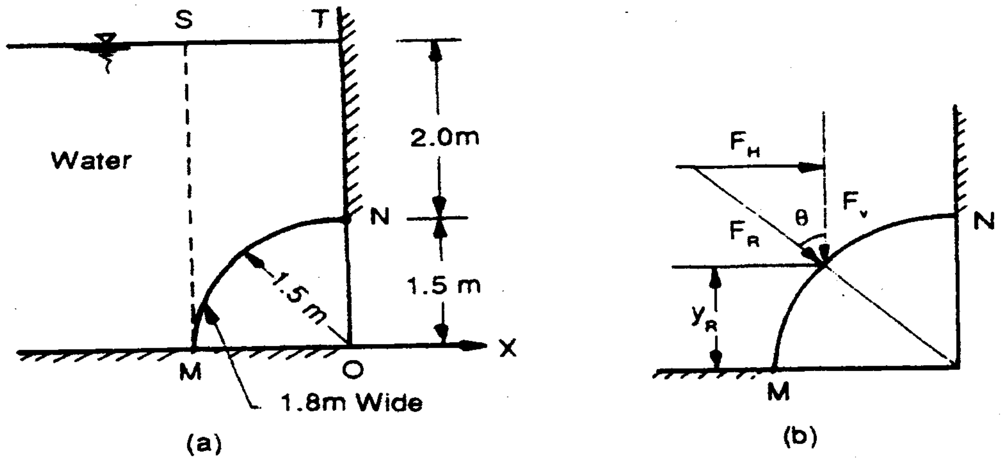

Figure Q2(c)/ Rajah S2 (c)

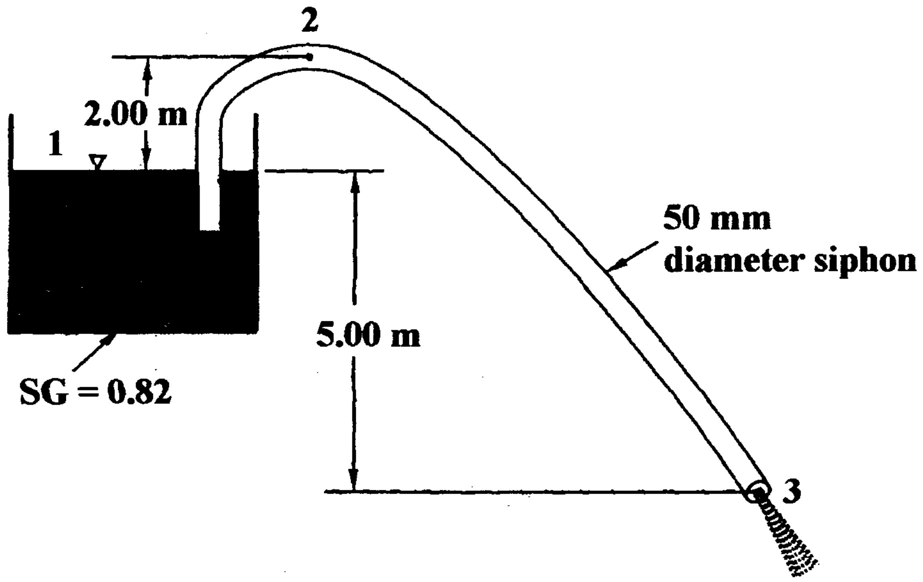

Figure Q3 / Rajah S3

Appendix III

FINAL EXAM

SEMESTER/SESSION	: SEMESTER I/2011/2012	PROGRAM	: 1BFC
COURSE	: FLUID MECHANICS	COURSE CODE	: BFC1043

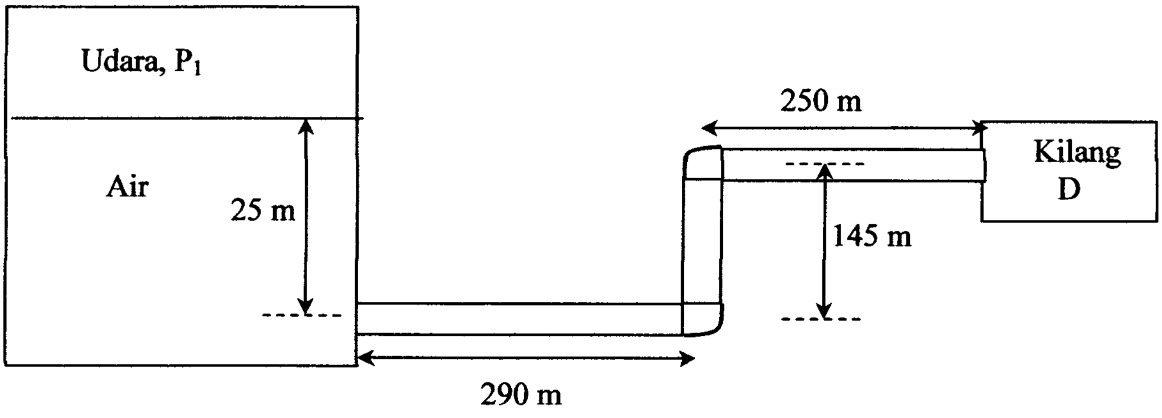

Figure Q4/Rajah S4

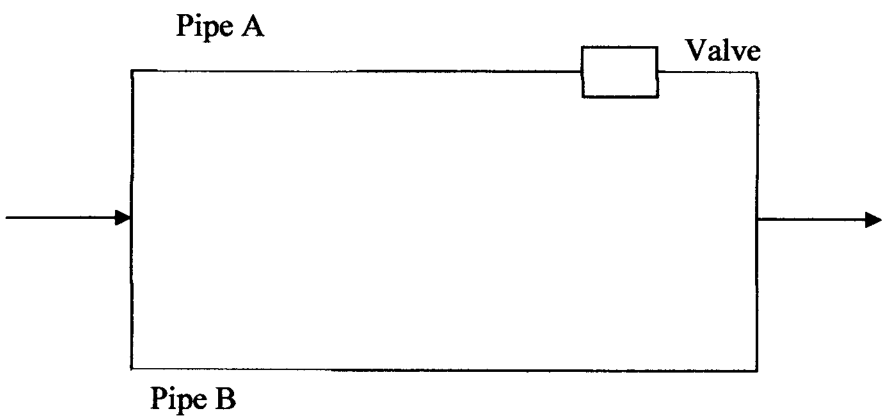

Figure Q5 (a)/Rajah S5 (a)

Appendix IV

FINAL EXAM

SEMESTER/SESSION	: SEMESTER I/2011/2012	PROGRAM	: 1BFC
COURSE	: FLUID MECHANICS	COURSE CODE	: BFC1043

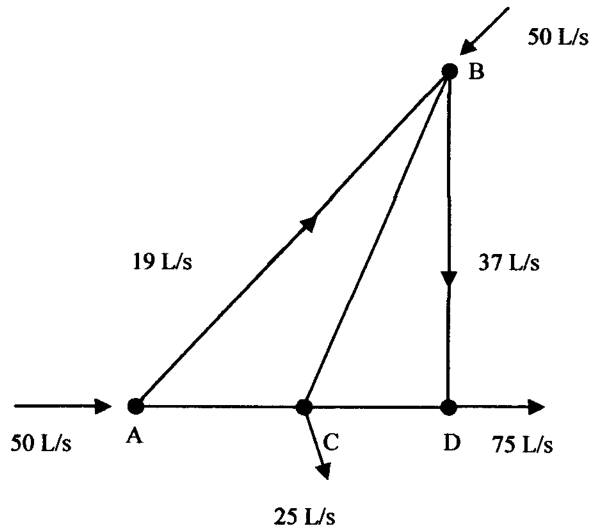

Figure Q5 (b) /Rajah S5 (b)

FINAL EXAM

SEMESTER/SESSION : SEMESTER II/2008/2009 COURSE : 1BFC

SUBJECT : FLUID MECHANICS CODE SUBJECT : BFC1043

Jadual 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}

PEPERIKSAAN AKHIR

SEMESTER/SESSION	: SEMESTER II/2008/2009	COURSE	: 1BFC
SUBJECT	: MEKANIK BENDALIR	SUBJECT CODE	: BFC1043

Formulae:

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

$$H = \frac{P}{\gamma} + z + \frac{V^2}{2g} \qquad F_x = \rho g A \bar{x} \qquad F_y = \rho g V$$

$$F = \sqrt{F_x^{\,2} + F_y^2} \qquad \phi = \tan^{-1}\frac{F_y}{F_x}$$

$$BM = \frac{I}{V} \qquad GM = BM - BG$$

$$S = \frac{h_f}{L} \qquad P = \rho g h$$

$$\mathrm{F_r} = \frac{V}{\sqrt{gL}} \qquad V = \sqrt{2gh} \qquad K = \frac{-\Delta P}{\delta V / V}$$

$$h_k = k\frac{v^2}{2g}$$