UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2009/10

SUBJECT NAME	:	HIDRAULIK
SUBJECT CODE	:	DFC 2053
COURSE	:	2 DFA / 2 DFT
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER FIVE (5) QUESTIONS ONLY

THIS PAPER CONSIST OF TEN (10) PAGES

Q1 (a) Define each of the following :-

(i) Pressure
(ii) Centre of Pressure

(4 marks)

(b) With the aid of sketches, explain the design concept of a dam.

(5 marks)

(c) For the concrete dam shown in Figure **Q1**, calculate the resultant force exerted on the lower surface of the dam and determine the direction and angle of the force for each unit breadth of the dam.

(11 marks)

Q2 (a) What are the types of energy for flow in pipe (closed conduit) and with the aid of sketch, show the Energy Line (EL) and Hydraulic Grade Line (HGL).

(5 marks)

(b) Oil (SG = 0.8) flows in a pipe at a flow rate 0.008m^3/s (Figure **Q2**). A mercury (SG=13.6) manometer is fitted to the pipe as shown. Assuming the density of water is 1000 kg/m^3 and neglecting all losses in the pipe, calculate. -

(i) The difference of pressure between point 1 and point 2
(ii) value of h (in meter).

(15 marks)

Q3 (a) By way of examples, explain briefly, the concept of hydraulics and fluid mechanics as applied in engineering.

(6 marks)

(b) With the aid of sketches, explain briefly the difference between piezometer and simple manometer.

(6 marks)

(c) Water (ρ=1000 kg/m^3) is contained in an open tank at a depth of 5.7 m. Kerosene (SG = 0.82) floats 2.8 m above the water. Neglecting the atmospheric pressure, calculate the pressure at the water-kerosene interface and also at the bottom of the tank.

(8 marks)

Q4 (a) Using Figure **Q4 (a)**, explain briefly the concept of flow in channel.

(4 marks)

(b) Using the Bernoulli Equation, prove that the flow velocity through an orifice meter (Figure **Q4(b)**) is given,

(16 marks)

$$v_c = \sqrt{\frac{2g\left(\frac{\rho_m}{\rho}-1\right)\Delta H}{\left(1-\frac{Ac^2}{A_1^2}\right)}}$$

(8 marks)

(c) Water in an open tank is released through an orifice (50mm diameter) located at the bottom of the tank. If the coeficient of velocity (c_v) and coeficient of contraction (c_c) are 0.96 and 0.62 respectively, and the depth of water in the tank is 10 m, calculate the actual velocity (V actual) of flow and the flow rate through the orifice.

(8 marks)

Q5 (a) Explain the factors that influence the roughness factor, n of an open channel, natural and man-made.

(5 marks)

(b) A rectangular channel 6.1m wide with the coeficient of roughness n =0.013 is laid on a slope of 0.0001. Determine graphically the normal depth in the channel, assuming a uniform flow of 11.3 m^3/s.

(15 marks)

Q6 (a) Explain why two similar pumps are arranged in series or in parallel in a pipe flow system.

(5 marks)

(b) A pump delivers 0.019 m^3/s of water against a head of 15.0 m with a rotative speed of 2000 rpm. If the inflow power is 3000 kW, calculate the outflow power and efficiency of the pump.

(3 marks)

(c) Two centrifugal pumps A (**Table 1**) and B (**Table 2**), are available for use in a pipeflow system and their characteristics are as follows :-

Table 1: Characteristics of Pump A

Discharge Q, (m3/s)	Pressure Head, H (m)
0	40
0.1	38
0.2	29
0.25	23
0.3	16

Table 2: Characteristics of Pump B

Discharge Q, (m3/s)	Pressure Head, H (m)
0	45
0.1	43
0.2	38
0.3	28
0.4	14

Plot the head-discharge curves for the pumps connected:-

(i) in parallel, and (ii) in series.

(12 marks)

S1 (a) Terangkan istilah berikut:-
(i) Tekanan
(ii) Pusat Tekanan

(4 markah)

(b) Dengan bantuan gambarajah, jelaskan dengan ringkas konsep rekabentuk empangan.

(5 markah)

(c) Untuk empangan konkrit yang ditunjukkan dalam Rajah **Q1**, tentukan daya paduan yang terhasil dibahagian bawah empangan dan arah tekanan paduan bagi per unit lebar empangan tersebut.

(11 markah)

S2 (a) Apakah jenis tenaga bagi aliran dalam sebuah paip (saliran tertutup) dan lakarkan kedudukan garisan tenaga (EL) dan garisan hidraulik (HGL).

(5 markah)

(b) Minyak (KB = 0.8) mengalir dalam paip dengan kadar alir 0.008 m^3/s (Rajah **Q2**). Sebuah manometer raksa (KB = 13.6) dipasang kepada paip seperti rajah. Dengan beranggapan ketumpatan air ialah 1000 kg/m^3 dan abaikan semua kehilangan dalam paip, tentukan:-

(i) Perbezaan tekanan bagi titik 1 dan 2
(ii) ketinggian h (dalam unit meter)

(15 markah)

S3 (a) Terangkan dengan ringkas beserta contoh yang sesuai, konsep hidraulik dan mekanik bendalir yang digunakan dalam kejuruteraan.

(6 markah)

(b) Dengan bantuan gambarajah, terangkan perbezaan antara piezometer dan manometer ringkas.

(6 markah)

(c) Air (ρ = 1000 kg/m3) ditakung dalam sebuah tangki terbuka sedalam 5.7 m. Kerosin (KB= 0.82) terapung 2.8 m diatas air. Dengan mengabaikan tekanan atmosfera, tentukan tekanan di lapisan pertemuan air-kerosin dan dibahagian bawah tangki.

(8 markah)

S4 (a) Merujuk kepada gambarajah **Q4 (a)**, terangkan dengan ringkas konsep aliran saluran tersebut.

(4 markah)

(b) Dengan menggunakan persamaan Bernoulli, buktikan halaju aliran melalui meter orifis (Rajah **Q4 (b)**) adalah:

$$v_c = \sqrt{\frac{2g\left(\frac{\rho_m}{\rho}-1\right)\Delta H}{\left(1-\frac{Ac^2}{A_1^2}\right)}}$$

(8 markah)

(c) Air dalam sebuah tangki dilepaskan keluar melalui sebuah orifis (diameter 50 mm). Jika pekali halaju (c_v) dan pekali pengecutan (c_c) masing-masing adalah 0.96 dan 0.62 serta kedalaman air dalam tangki ialah 10 m, kira halaju sebenar dan kadar alir air yang melalui orifis.

(8 markah)

S5 (a) Terangkan faktor-faktor yang mempengaruhi faktor kekasaran, n bagi saluran terbuka, semulajadi dan buatan manusia.

(5 markah)

(b) Sebuah saluran segiempat 6.1m lebar dengan pekali rintangan n = 0.013 terletak di atas cerun 0.0001. Dengan menggunakan graf, tentukan kedalaman normal dalam saluran, anggap aliran seragam 11.3 m^3/s.

(15 markah)

S6 (a) Terangkan mengapa dua pam yang sama disusun secara siri atau selari dalam sesebuah sistem perpaipan.

(5 markah)

(b) Sebuah pam menghantar 0.019 m^3/s air pada ketinggian 15.0 m dengan kelajuan putar 2000 rpm. Jika kuasa masukan pam ialah 3000kW, hitung kuasa keluaran dan kecekapan pam tersebut.

(3 markah)

(c) Dua buah pam empar A **(Jadual 1)** dan B **(Jadual 2)** digunakan bagi sebuah sistem perpaipan. Keupayaan bagi kedua-dua pam tersebut adalah seperti berikut:-

Jadual 1: Keupayaan Pam A

Discharge Q, (m^3/s)	Pressure Head, H (m)
0	40
0.1	38
0.2	29
0.25	23
0.3	16

Jadual 2: Keupayaan Pam B

Discharge Q, (m^3/s)	Pressure Head, H (m)
0	45
0.1	43
0.2	38
0.3	28
0.4	14

Plot lengkok turus-kadaralir bagi pam tersebut jika disambungkan secara (i) bersiri, dan (ii) selari.

(12 markah)

Appendix I

FINAL EXAMINATION

SEMESTER/SESSION : SEMESTER II/2009/2010 COURSE : 2 DFA / 2 DFT

SUBJECT : HYDRAULICS SUBJECT CODE : DFC 2053

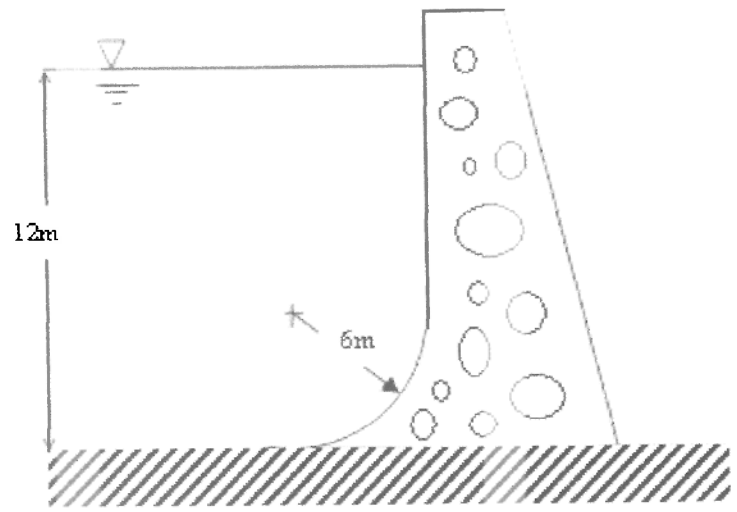

Figure Q1

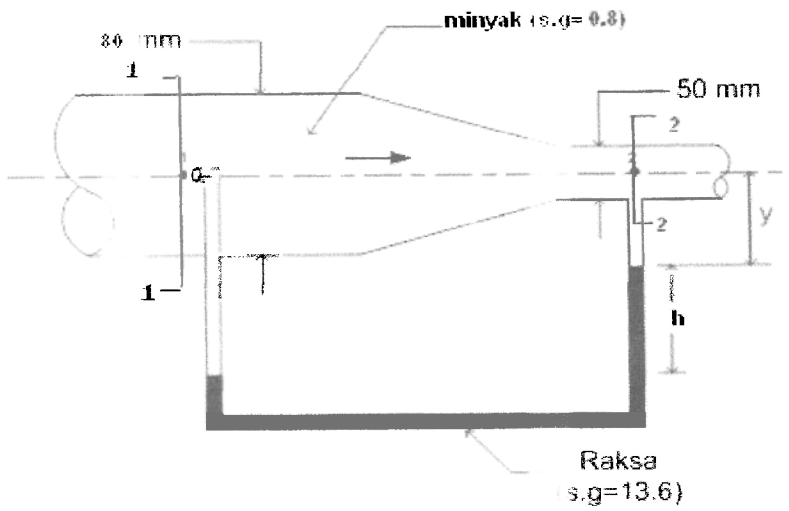

Figure Q2

Appendix II

FINAL EXAMINATION

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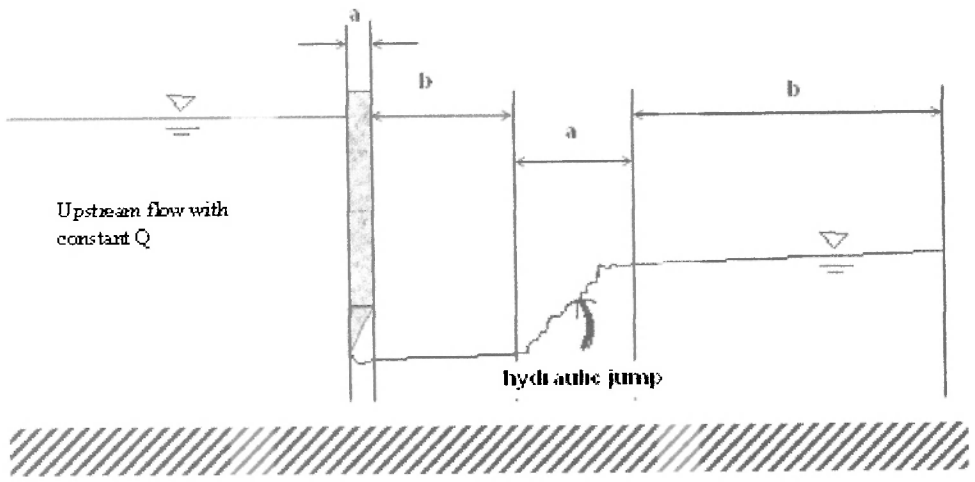

Figure Q4 (a)

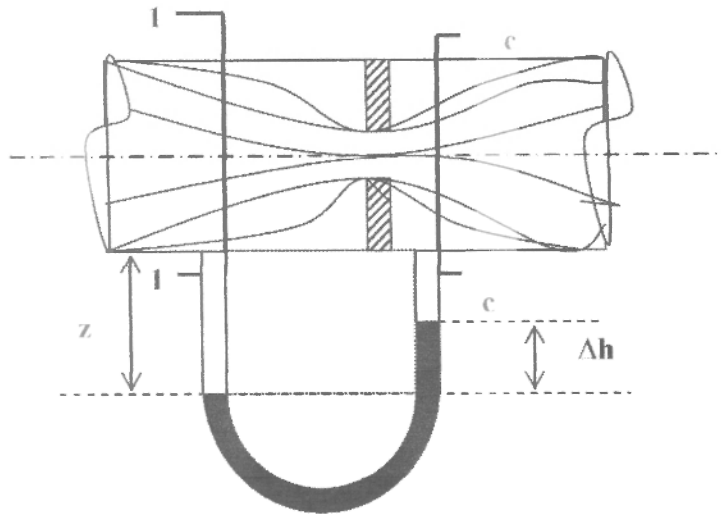

Figure Q4 (b)

Appendix III

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List of equations:

$$P = \rho g h \qquad Q = \frac{1}{n} A R^{2/3} \sqrt{S_o} \qquad Q = Av$$

$$F_R = \rho g h_c A \qquad y_R = \frac{I_{xc}}{y_c A} + y_c \qquad x_R = \frac{I_{xyc}}{y_c A} + x_c$$

$$I_{xc} = \frac{1}{12} b h^3 \qquad \frac{P_1}{\rho g} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + z_2 + \Sigma h_L$$

$$Cc = a_c / a_o \qquad A = By_o \qquad P = B + 2y_o$$

$$R = \frac{A}{P} \qquad T = B + 2zy \qquad Q = \frac{1}{n} A R^{2/3} \sqrt{S_o}$$

$$P = B + 2y\sqrt{1 + z^2} \qquad A = By + zy^2 \qquad h_f = \frac{fLv^2}{2gD}$$

$$R_e = \frac{vD}{\nu} \qquad \eta = \frac{P_d}{P_s} \times 100\% \qquad R_e = \frac{vR}{\nu}$$

$$Q = \frac{8}{15} C_d \sqrt{2g} \tan\theta H^{5/2} \qquad Q = C_d \left[\frac{A_2}{\sqrt{1 - \left[\frac{A_2}{A_1}\right]^2}} \sqrt{2g\left[\frac{P_1 - P_2}{\gamma_w}\right]} \right]$$

$$Q = \frac{2}{3} C_d B \sqrt{2g}\, H^{3/2} \qquad P_d = \rho g H Q$$