Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER I
SESI 2013/2014

NAMA KURSUS	:	MEKANIK BENDALIR & HIDRAULIK
KOD KURSUS	:	DAB 20103
PROGRAM	:	DAB
TARIKH PEPERIKSAAN	:	DISEMBER 2013/JANUARI 2014
MASA	:	3 JAM
ARAHAN	:	JAWAB **LIMA (5)** SOALAN DARIPADA TUJUH (7) SOALAN

KERTAS INI MENGANDUNGI **DUA BELAS (12)** MUKA SURAT

S1 (a) Terang dan takrifkan secara jelas istilah bendalir dan bendalir unggul.

(5 markah)

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

(5 markah)

(c) Satu tangki minyak terdedah kepada permukaan atmosfera di sebelah kiri dan tertutup pada sebelah kanan seperti yang ditunjukan di dalam **Rajah S1**. Tentukan nilai tolok tekanan disetiap titik A,B,C,D,E dan F.
(Ketumpatan bandingan bagi minyak, 0.9)

(10 markah)

S2 (a) Terangkan istilah berikut :-

(i) Tekanan

(ii) Pusat Tekanan

(iii) Tekanan Mutlak

(iv) Tekanan Vakum (4 marks)

(b) Dengan bantuan gambarajah, labelkan kesemua daya yang bertindak ke atas jasad pada sukuan bulatan di dalam penentuan daya hidrostatik pada satah melengkung yang tenggelam.

(5 marks)

(c) Untuk empangan konkrit yang ditunjukkan dalam **Rajah S2**, tentukan daya paduan yang terhasil dibahagian bawah empangan dan arah tekanan paduan bagi per unit lebar empangan tersebut.

(11 marks)

S3 (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 S3)**. Sebuah manometer raksa (KB = 13.6) dipasang kepada paip seperti rajah tersebut. 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)

S4 (a) Terangkan istilah berikut :-

(i) Aliran Likat
(ii) Aliran Gelora
(iii) Aliran Mantap
(iv) Aliran Tak Mantap
(v) Aliran Seragam
(vi) Aliran Tak Seragam

(6 markah)

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

(6 markah)

(c) Air (ρ = 1000 kg/m^3) ditakung dalam sebuah tangki terbuka sedalam 5.7 m. Kerosin (KB= 0.82) terapung 2.8 m di atas air. Dengan mengabaikan tekanan atmosfera, tentukan tekanan di lapisan pertemuan air-kerosin dan di bahagian bawah tangki.

(8 markah)

S5 (a) Merujuk kepada **Rajah S5 (a)**, terangkan dengan ringkas konsep aliran saluran tersebut.

(4 markah)

(b) Dengan menggunakan persamaan Bernoulli, buktikan halaju aliran melalui meter orifis **(Rajah S5 (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)

S6 (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)

S7 (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:-

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

(12 markah)

-SOALAN TAMAT-

Q1 (a) Define and briefly explain the meaning of fluid and ideal fluid.

(5 marks)

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

(5 marks)

(c) Using **Figure Q1**, an oil tank exposed to the atmosphere at left side and concealed at the right side. Determine the gauge pressure at point A, B, C, D, E and F. What is the value of pressure at the right side of the tank. (Assume that s.g for oil is 0.9).

(10 marks)

Q2 (a) Define each of the following :-

(i) Pressure

(ii) Centre of Pressure

(iii) Absolute Pressure

(iv) Vaccum Pressure (4 marks)

(b) With the aid of sketches, label all forces acting in the static fluid at quarter circular surface in the hydrostatic pressure on submerge curve surface.

(5 marks)

(c) For concrete dam shown in **Figure Q2**, 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)

Q3 (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 $0.008 m^3/s$ **(Figure Q3)**. 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)

Q4 (a) Define each of the following :-

(i) Laminar Flow

(ii) Turbulent Flow

(iii) Steady Flow

(iv) Unsteady Flow

(v) Uniform Flow

(vi) Non-Uniform Flow (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)

Q5 (a) Using **Figure Q5 (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 Q5 (b))** is given,

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

(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)

Q6 (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)

Q7 (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 :-

Plot the head-discharge curves for the pumps connected:-
(i) in parallel, and (ii) in series.

(12 marks)

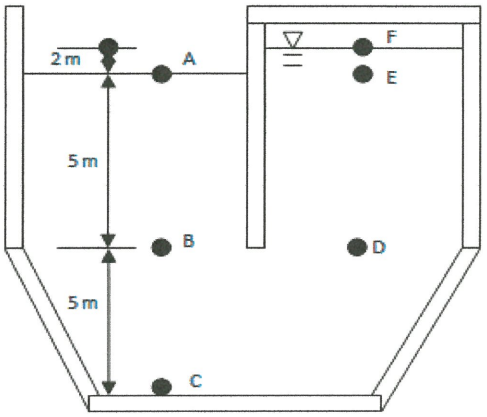
- END OF QUESTION -

Appendix I

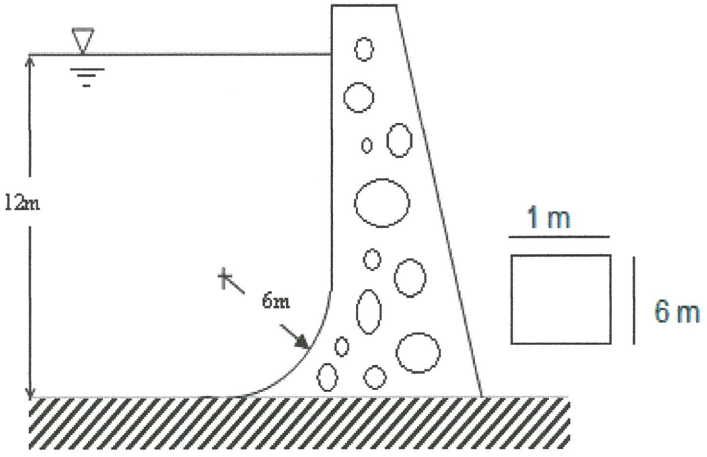
FINAL EXAMINATION

SEMESTER/SESSION: SEM I/2013/2014 PROGRAMME : DAB

COURSE NAME : FLUID MECHANIC & HYDRAULICS COURSE CODE : DAB 20103



Rajah S1 / Figure Q1



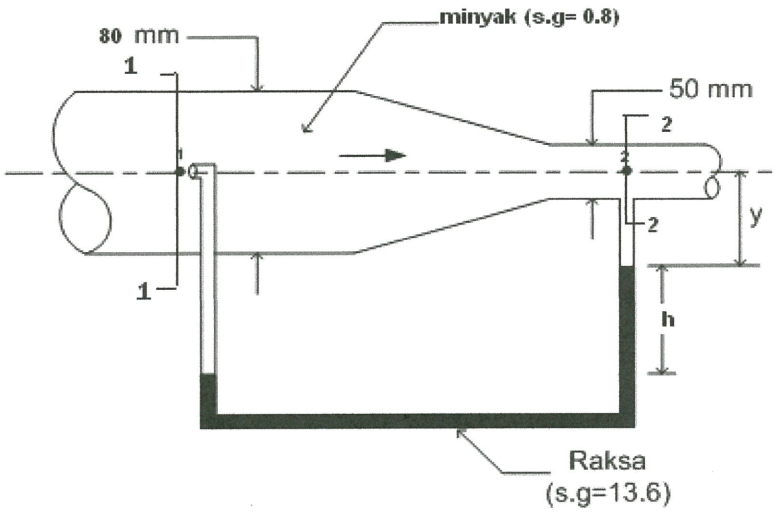
Rajah S2 / Figure Q2

Appendix II

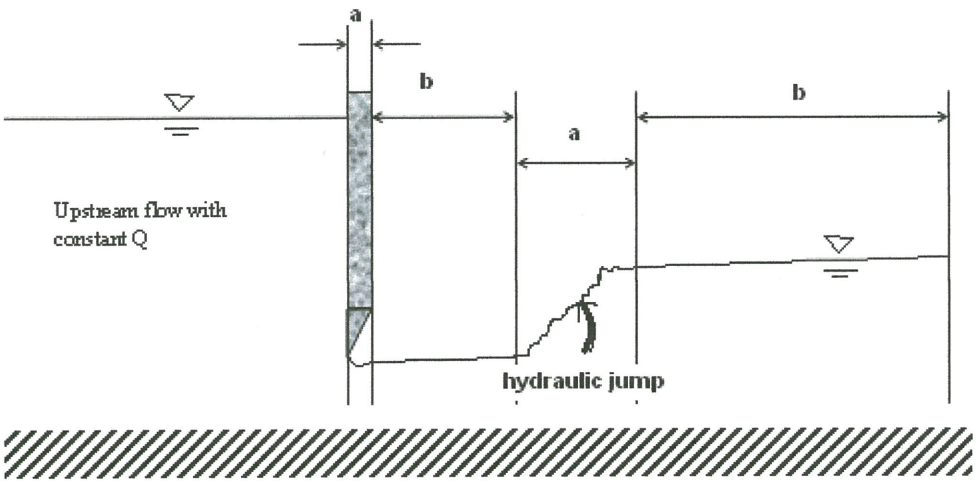
FINAL EXAMINATION

SEMESTER/SESSION: SEM I/2013/2014 PROGRAMME : DAB

COURSE NAME : FLUID MECHANIC & HYDRAULICS COURSE CODE : DAB 20103



Rajah S3 / Figure Q3

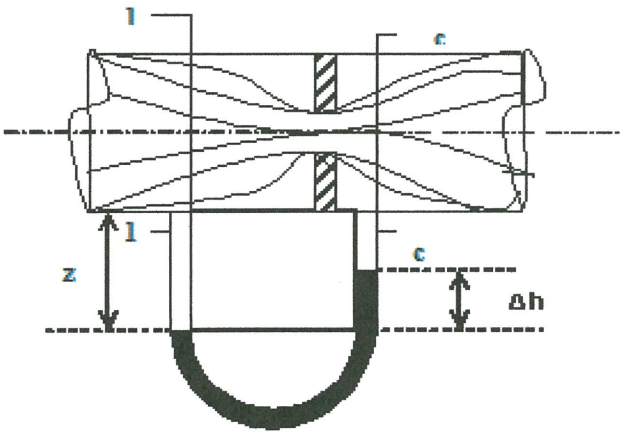


Rajah S5 (a) / Figure Q5 (a)

FINAL EXAMINATION

SEMESTER/SESSION: SEM I/2013/2014 PROGRAMME : DAB

COURSE NAME : FLUID MECHANIC & HYDRAULICS COURSE CODE : DAB 20103



Rajah S5 (b) / Figure Q5 (b)

Jadual 1/Table 1

Pam A

Discharge Q, (m^3/s)	Pressure Head, H (m)
0.0	40.0
0.1	38.0
0.2	29.0
0.25	23.0
0.30	16.0

Jadual 2/Table 2

Pam B

Discharge Q, (m^3/s)	Pressure Head, H (m)
0.0	45.0
0.1	43.0
0.2	38.0
0.3	28.0
0.4	14.0

Appendix IV

FINAL EXAMINATION

SEMESTER/SESSION: SEM I/2013/2014 PROGRAMME : DAB

COURSE NAME : FLUID MECHANIC & HYDRAULICS COURSE CODE : DAB 20103

List of equations:

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

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

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

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

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

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

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

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

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