KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2022/2023

DCB20053: PLUMBING SERVICES

TARIKH   : 13 JUN 2023
MASA   : 8.30 PG – 10.30 PG (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.

Bahagian A: Subjektif (2 soalan)
Bahagian B: Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Lampiran

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** structured questions. Answer **ALL** questions**.**

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO2

(a) By using the Thomas Box Formula method, estimate the diameter of the pipe from Figure A1(a) below.
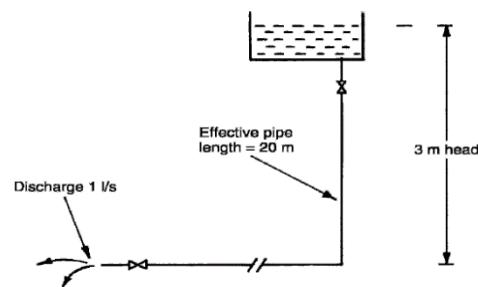*Dengan menggunakan kaedah Thomas Box, anggarkan diameter paip dari Rajah A1(a) di bawah.*

Figure A1(a)
Rajah A1(a)

[5 marks]
[5 *markah*]

CLO2

(b) You are required to design pipe size with the data given below. By using the Thomas Box Formula, calculate the pipe diameter for the tank.

Actual pipe length = 40 m (with 20% allowance)

Discharge = 1.25 liter/seconds, Head = 5 m

Anda telah diminta untuk merekabentuk saiz paip berpandukan data yang diberi di bawah. Dengan menggunakan Formula Thomas Box, kirakan diameter paip yang digunakan untuk tangki.

Panjang paip sebenar = 40 m (dengan 20% lebih dibenarkan)

Kadar alir = 1.25 liter/saat , Aras dari kepala paip = 5 m
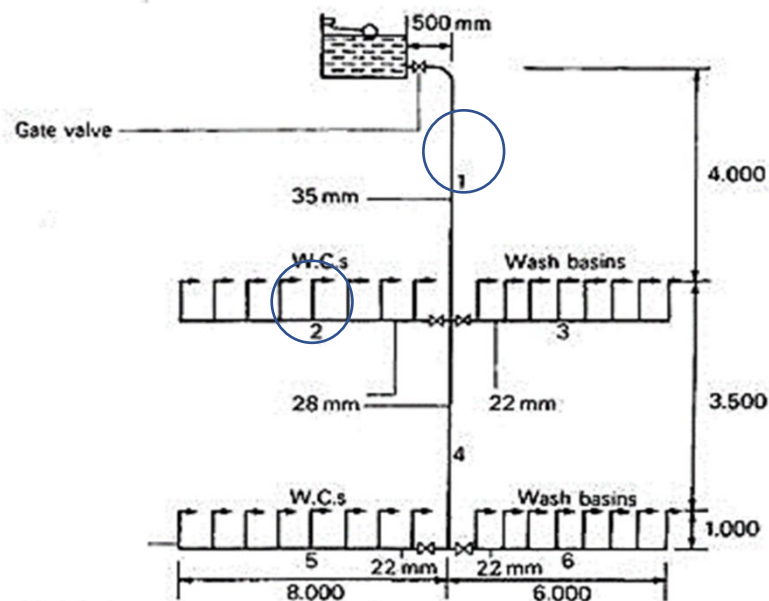
[10 marks]

[10 *markah*]

CLO2

(c)

Figure A1(c) : Pipe Sizing of Cold Water for two-storey office building
Rajah A1(c): Ukuran Paip Air Sejuk Untuk Bangunan Pejabat 2 Tingkat

Referring to Figure A1(c) above, determine the diameter of copper pipes numbered 1 and 2 using the tabulation method.

Merujuk Rajah A1(c) di atas, tentukan diameter paip kuprum nombor 1 dan 2 dengan menggunakan kaedah tabular.

[10 marks]

[10 *markah*]

QUESTION 2

SOALAN 2

CLO2

(a)   Estimate the diameter for the discharge stack and ventilating pipe if the total (DU) is 1200 DUs.

Anggarkan diameter paip tumpu dan paip pengudaraan jika jumlah (DU) adalah 1200 DU.
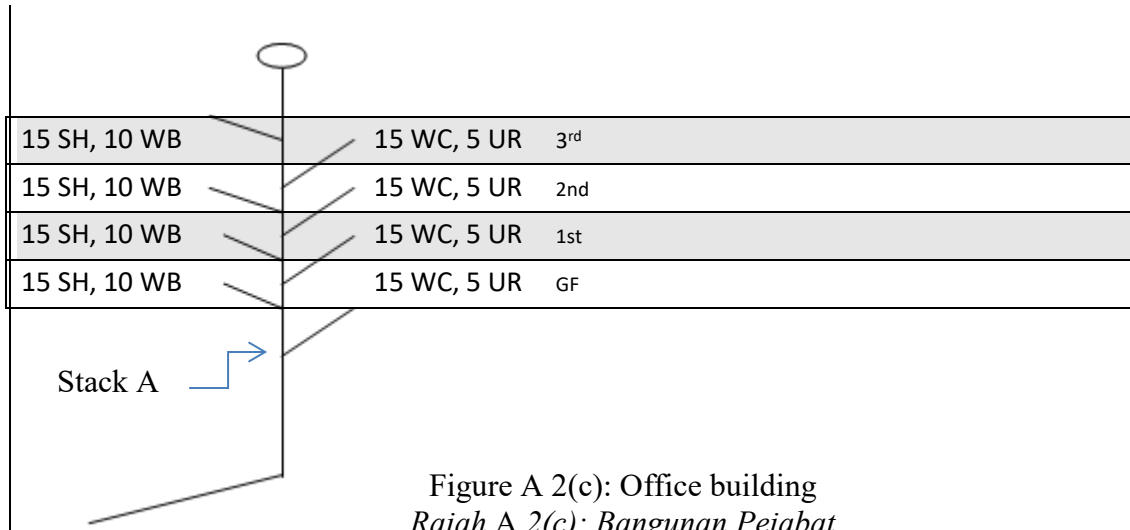
[5marks]

[5 *markah*]

CLO2

(b)   The total of sanitary appliances in an 8-floor commercial building is 280 and the p-value is 0.02. Calculate the simultaneous demand factor if given $m = np + 1.8 [2np (1-p)]^{0.5}$.

Jumlah peralatan sanitari di bangunan komersial 8 tingkat adalah 280 dan nilai p ialah 0.02. Kirakan faktor permintaan serentak jika diberi $m = np+1.8[2np (1-p)]^{0.5}$.

[10 marks]

[10 *markah*]

CLO2

(c)   Using the office building diagram in Figure A2(c), determine:

Menggunakan diagram bangunan pejabat pada Rajah A2(c), tentukan

   i.   Total DU value for branch discharge pipe.

           Jumlah nilai (DU) bagi paip cabang luahan.

   ii.   Diameter discharge for soil pipe.

           Diameter paip najis.

   iii.   Diameter discharge for waste pipe.

           Diameter paip air sisa.

   iv.   Diameter discharge for stack A.

           Diameter paip tumpu A.

15 SH, 10 WB	15 WC, 5 UR	3rd
15 SH, 10 WB	15 WC, 5 UR	2nd
15 SH, 10 WB	15 WC, 5 UR	1st
15 SH, 10 WB	15 WC, 5 UR	GF

Stack A

Figure A 2(c): Office building
Rajah A *2(c): Bangunan Pejabat*

[10 marks]
[10 *markah*]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only**.**

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4))** soalan berstruktur. Jawab **DUA (2)** soalan*

sahaja.

QUESTION 1
SOALAN 1

CLO1

(a)   Describe the delivery system of water supply from the water mains to the control valve using grid method sketches.

Jelaskan sistem penghantaran bekalan air dari saluran air ke injap kawalan menggunakan lakaran kaedah grid.

[5 marks]
[5 *markah*]

CLO1

(b)   Illustrate the piping layout of the direct and indirect system for multistorey buildings.

Ilustrasikan susun atur paip bagi sistem secara langsung dan tidak langsung bagi bangunan bertingkat.

[8 marks]
[8 *markah*]

CLO1

(c)   A cold water storage tank is used to store large amounts of water for the building where the water is supplied. Referring to the picture in Figure B1(c), explain the components of a water storage tank with the aid of a diagram.

Tangki simpanan air sejuk digunakan untuk menyimpan sejumlah besar air dari mana bangunan itu dibekalkan dengan air. Merujuk kepada gambar seperti yang ditunjukkan dalam Rajah B1(c), terangkan dengan bantuan gambar rajah komponen tangki simpanan air.

Figure B1(c) / *Rajah B1(c)*

[12 marks]

[12 *markah*]

QUESTION 2

SOALAN 2

CLO1

(a)   Explain **FIVE (5)** requirements of hot water supply design.

Terangkan LIMA (5) keperluan rekabentuk bekalan air panas.

[5 marks]

[5 *markah*]

CLO1 (b) Heat up period is the time taken to change the cold water to hot water. Explain **TWO (2)** importance of the regeneration period or heat-up period when a boiler is brought on line, and done in slow, safe, and controlled conditions.
Tempoh pemanasan ialah masa yang diambil untuk menukar air sejuk kepada air panas. Huraikan DUA (2) kepentingan tempoh penjanaan semula atau tempoh memanaskan apabila dandang dibawa ke atas talian, dan ia dilakukan dalam keadaan perlahan, selamat dan terkawal.

[8 marks]

[8 *markah*]

CLO1 (c) A direct water supply system is one where the raising main feeds directly raise the cold water taps and a multi-point water heater. Sketch a direct system of hot water supply systems for a domestic building.
Sistem bekalan air terus ialah sistem di mana suapan utama menaikkan terus paip air sejuk dan pemanas air berbilang punca. Lakar kan sistem bekalan air panas secara langsung bagi bangunan kediaman.

[12 marks]

[*12 markah*]

QUESTION 3
SOALAN 3

CLO1 (a) Explain **FIVE (5)** requirements to design and construct sanitary appliances.
Terangkan LIMA (5) keperluan untuk merekabentuk dan pembinaan peralatan kebersihan.

[5 marks]

[5 *markah*]

CLO1

(b)   Explain the factors of water losses seal in the following sanitary appliances: -
Terangkan faktor-faktor kehilangan kedap air dalam peralatan kebersihan berikut:-

    i.   Self-siphonage / *Persifonan Kendiri*

    ii.   Induced siphonage / *Persifonan Teraruh*

    iii.   Evaporation / *Penyejatan*

    iv.   Capillary Attraction / *Tindakan Kapilari*

[8 marks]
[8 *markah*]

CLO1

(c)   Figure B3(c) below shows the plumbing system in a building. The plumbing system installed in the building has two main objectives to be served. It supplies water for human use and gets rid of human waste. Illustrate the two-pipe system in the building.
Rajah B3(c) di bawah menunjukkan sistem paip dalam bangunan yang dipasang di dalam bangunan mempunyai dua objektif utama yang perlu dilaksanakan. Ia adalah bekalan air untuk kegunaan manusia dan untuk menyingkirkan najis manusia. Ilustrasikan sistem dua paip dalam bangunan.

Figure B3(c) / *Rajah B3(c)*

[12 marks]
[12 *markah*]

QUESTION 4
SOALAN 4

CLO1

(a)   Explain **TWO (2)** main purposes of a manhole.

Terangkan DUA (2) tujuan utama lurang.

[5 marks]

[*5 markah*]

CLO1

(b)   Explain the water test of the drainage system with the aid of a diagram.

Terangkan dengan bantuan gambarajah ujian air sistem saliran.

[8 marks]

[*8 markah*]

CLO1

(c)   The main objective of a drainage system is to collect and remove waste matter systematically to maintain healthy conditions in a building. Sketch and label a diagram of the following: -

i.   Combined Drainage System

ii.   Separate Drainage System

Objektif utama sistem perparitan adalah untuk mengumpul dan membuang bahan buangan secara sistematik untuk mengekalkan keadaan sihat di dalam sesebuah bangunan Lakarkan dan labelkan gambarajah berikut:-

i.   Sistem Saliran Bergabung

ii.   Sistem Saliran Berasingan

[12 marks]

[*12 markah*]

SOALAN TAMAT

LAMPIRAN

Thomas Box Formula

$$\bullet \; d = \sqrt[5]{\frac{q^2 \, x \, 25 \, x \, L \, x \, 10^5}{H}}$$

Table 1.1 gives the 'loading unit' rating for various appliances.

Table 1.1

	Loading unit rating
Dwellings and flats	
W.C. flushing cistern	2
Wash basin	1½
Bath	10
Sink	3—5
Offices	
W.C. flushing cistern	2
Wash basin (distributed use)	1½
Wash basin (concentrated use)	3
Schools and industrial buildings	
W.C. flushing cistern	2
Wash basin	3
Shower (with nozzle)	3
Public bath	22

Note: Certain sanitary appliances require a continuous flow of water throughout the whole of the time that they are being used. These include: ablution appliances fitted with spray taps, umbrella sprays, shower nozzles or similar fittings.

In buildings where high peak demands occur, a loading unit rating for such appliances is not applicable and 100 per cent of the flow rate for these appliances is required as shown in Table 1.2. The same applies to automatic flushing cisterns and for urinals.

Table 1.2 Recommended minimum rate of flow at various appliances

Type of appliance	Rate of flow (litre/s)
W.C. flushing cistern	0.12
Wash basin	0.15
Wash basin with spray taps	0.04
Bath (private)	0.30
Bath (public)	0.60
Shower (with nozzle)	0.12
Sink with 13 mm taps	0.20
Sink with 19 mm taps	0.30
Sink with 25 mm taps	0.60

Table 1.3 Frictional resistances of fittings expressed in equivalent pipe lengths

Copper			Galvanised steel			
Nominal outside diameter (mm)	Metre run of pipe		Nominal outside diameter (mm)	Metre run of pipe		
	Elbow	Tee		Elbow	Bend	Tee
15	0.5	0.6	15	0.5	0.4	1.2
22	0.8	1.0	20	0.6	0.5	1.4
28	1.0	1.5	25	0.7	0.6	1.8
35	1.4	2.0	32	1.0	0.7	2.3
42	1.7	2.5	40	1.2	1.0	2.7
54	2.3	3.5	50	1.4	1.2	3.4
62	3.0	4.5	65	1.7	1.3	4.2
76	3.4	5.8	80	2.0	1.6	5.3
108	4.5	8.0	100	2.7	2.0	6.8

In calculating the diameter of a pipe to supply individual fittings, the loss of head through the draw-off tap should also be taken into account. Table 1.4 gives the allowances for draw-off taps expressed in equivalent pipe lengths.

Table 1.4 Frictional resistances of draw-off taps expressed as equivalent pipe lengths

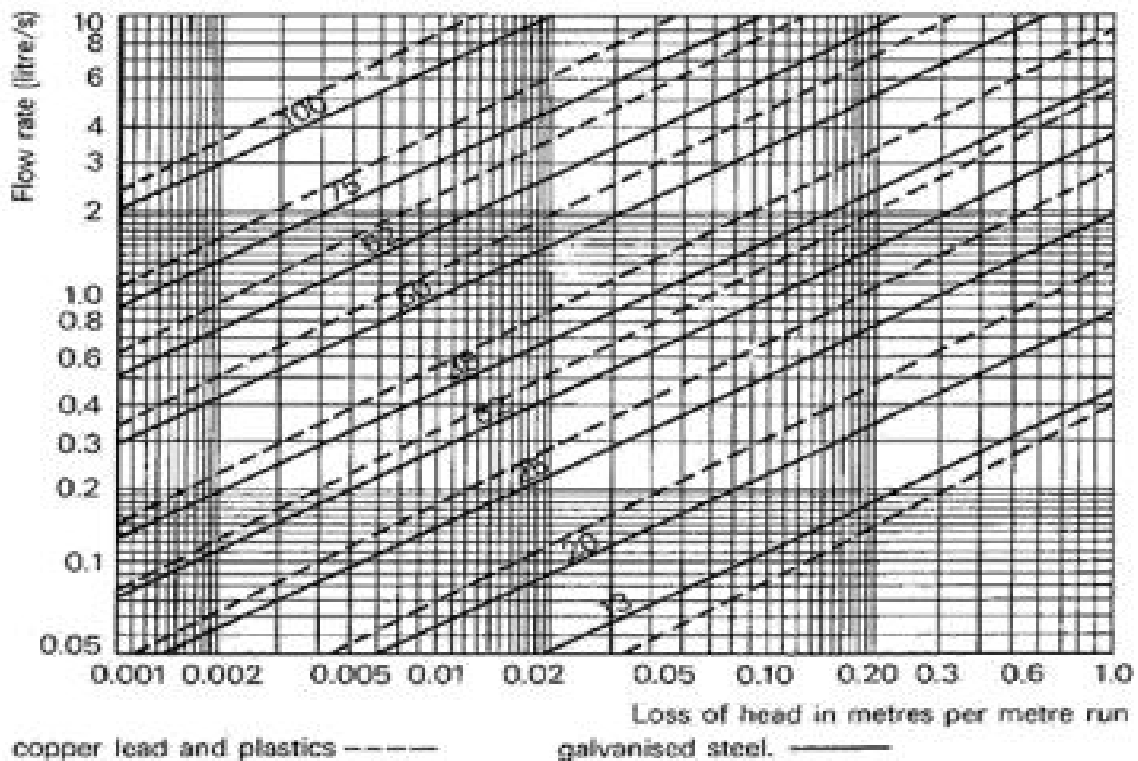| Fitting (BS 1010)	Discharge rate tap fully open (litre/s)	Equivalent length of pipe of same diameter as tap (m)	
		Copper	Galvanised steel
15 mm diameter bib-tap or pillar tap	0.20	2.70	4.00
20 mm diameter bib-tap or pillar tap	0.30	8.50	5.75
25 mm diameter bib-tap or pillar tap	0.60	20.00	13.00

copper lead and plastics ———   galvanised steel. ———

Fig.1.2 Pipe-sizing chart

Table 1: Discharge unit values

Appliance	Application	Discharge unit value
WC	Domestic Commercial Congested/public	7 14 28
Basin	Domestic Commercial Congested/public	1 3 6
Bath	Domestic Commercial	7 18
Sink	Domestic Commercial Congested/public	6 14 27
Shower	Domestic Commercial	1 2
Urinal	-	0.3
Washing machine	-	4
1 group of WC, bath and basin	-	14

Table 2: Discharge unit and stack diameter

Nominal bore (mm)	Approximate no. of DUs.
50	10
65	60
75	200
100	750
125	2500
150	5500

Table 3:Discharge unit and branch discharge pipe

Nominal bore (mm)	Approximate no. of DUs.		
	Gradient		
	$1//2^0$ (9mm/m)	$11/4^0$ (22mm/m)	$21/2^0$ (45mm/m)
32	-	1	1
40	-	2	8
50	-	10	26
65	-	35	95
75	-	100	230
90	120	230	460
100	230	430	1050
125	780	1500	3000
150	2000	3500	7500

Table 4 : General guide for sizes of ventilating pipes

Branch or stack diameter (D)	Ventilating pipe min. diameter
Up to 75 mm bore	2/3 D (min. 25mm)
Over 75 mm bore	½ D

Table 5 : Discharge Flow Rate

Fitment	Capacity (l)	Discharge flow rate (l/s)
Basin	6	0.6
Basin – spray tap	-	0.06
Bath	80	1.1
Shower	-	0.1
Sink	23	0.9
Urinal	4.5	0.15
Washing machine	180	0.7
Water closet	6	2.3