

SULIT



**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 I : 2025/2026

DCB20292: BUILDING ELECTRICAL SERVICES

TARIKH : 4 DISEMBER 2025

MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Lampiran 1 sehingga 4

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **FOUR (4)** subjective questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1**SOALAN 1**

- CLO1 (a) Describe the types of wiring as follows:
Huraikan jenis pendawaian berikut:
- i. Conduit system / *Sistem pembuluh*
 - ii. Concealed wiring / *Pendawaian tertutup*
 - iii. Trunking system / *Sistem sesalur*
- [9 marks]
[9 markah]
- CLO1 (b) Power plants generate electricity through various technologies that use fossil fuels, nuclear fuels, or renewable energy. With the aid of a diagram, explain the coal power plant.
Loji kuasa menjana tenaga elektrik melalui pelbagai teknologi yang menggunakan bahan api fosil, bahan api nuklear, atau tenaga boleh diperbaharui. Dengan bantuan gambarajah, terangkan penjana kuasa arang batu.
- [6 marks]
[6 markah]

- CLO1 (c) In modern electrical installations, proper wiring configurations are essential to ensure safety, functionality, and compliance with Energy Commission (EC) regulations and MS IEC wiring standards in Malaysia. As an aspiring building technician, you are responsible for designing efficient and safe electrical systems for residential and commercial buildings. Sketch a complete wiring diagram for the following installations while adhering to standard electrical practices in Malaysia.

Dalam pemasangan elektrik moden, konfigurasi pendawaian yang betul adalah penting untuk memastikan keselamatan, kefungsiannya, dan pematuhan kepada peraturan Suruhanjaya Tenaga (ST) serta piawaian pendawaian MS IEC di Malaysia. Sebagai juruteknik bangunan, anda bertanggungjawab untuk mereka bentuk sistem elektrik yang cekap dan selamat bagi bangunan kediaman serta komersial. Lakarkan rajah pendawaian yang lengkap bagi pemasangan berikut demi memastikan pematuhan kepada amalan pendawaian standard di Malaysia.

- i. Single light point controlled by two-way switch.

Satu lampu dikawal oleh suis dua hala.

- ii. 6 unit of 13A switch socket outlet (ring circuit).

6 unit 13A soket alir keluar (litar gelang).

[10 marks]

[10 markah]

QUESTION 2**SOALAN 2**

- CLO1 (a) Describe the function of the following devices that comprise in earthing system:
Jelaskan fungsi peralatan-peralatan berikut yang merupakan sebahagian daripada sistem pembumian:
- i. Earthing conductor / *Pengalir bumi.*
 - ii. Earth terminal / *Terminal pembumian.*
 - iii. Earth electrode / *Elektrod bumi.*
- [9 marks]
[9 markah]
- CLO1 (b) Earth resistance is the resistance of the earth to the flow of current into it. It is measured by comparing the potential of the earth electrode to the current it loses. Explain **TWO (2)** methods used to reduce earthing resistance.
*Rintangan bumi ialah rintangan bumi terhadap pengaliran arus ke dalamnya. Ia diukur dengan membandingkan potensi elektrod bumi dengan arus yang hilang. Terangkan **DUA (2)** kaedah yang digunakan untuk mengurangkan rintangan bumi.*
- [6 marks]
[6 markah]
- CLO1 (c) The types of electrical tests cover a broad spectrum designed to ensure safety, functionality, and reliability in various electrical components and systems. With the aid of a diagram, explain the Live and Neutral Conductor Continuity Test.
Jenis ujian elektrik meliputi spektrum luas yang direka bentuk untuk memastikan keselamatan, kefungsi dan kebolehpercayaan dalam pelbagai komponen dan sistem elektrik. Dengan bantuan rajah lakarkan Ujian Keterusan Pengalir Hidup dan Neutral.
- [10 marks]
[10 markah]

QUESTION 3**SOALAN 3**

- CLO2 (a) A new bungalow requires 12 incandescent lamps of 100 watt, 1 unit water heater of 3.0 kilo-watt and 2 unit air conditioners of 2.0 horse power. As a wireman, estimate the load current of each circuit. Assume the power factor is 1.
- Sebuah rumah banglow yang baharu memerlukan 12 lampu pijar 100 watt, 1 unit pemanas air 3.0 kilo-watt and 2 unit penyaman udara 2.0 kuasa kuda. Sebagai pendawai anggarkan arus beban bagi setiap litar tersebut. Anggap faktor kuasa adalah 1.*

[9 marks]

[9 markah]

- CLO2 (b) Mr. Amran wanted to install a new unit water heater of 4.0 kW and a new unit of 2.5 horse power air conditioner in his house. The house is supplied by single phase of 230V. As an electrical contractor, determine the appropriate size of miniature circuit breaker (MCB) for the new circuit for both water heaters and air conditioners.
- En. Amran ingin memasang sebuah pemanas air 4.0kW dan sebuah penyaman udara 2.5 kuasa kuda yang baru di rumahnya. Rumah tersebut dibekalkan dengan bekalan satu fasa 230V. Sebagai kontraktor elektrik, tentukan saiz pemutus litar yang sesuai untuk litar baru tersebut bagi kedua-dua pemanas air dan penyaman udara.*

[6 marks]

[6 markah]

CLO2

- (c) An air conditioner is supplied with 230 V voltage through PVC coated single core cable in 90 meter long conduit. If the air conditioner is 3.0 HP, determine the appropriate cable size for that installation. Assume the power factor is 1.

Sebuah pendingin hawa dibekalkan dengan 230V voltan melalui kabel PVC teras tunggal sepanjang 90 meter panjang. Jika penyaman udara tersebut berkuasa 3.0 kuasa kuda, tentukan saiz kabel yang sesuai bagi pemasangan tersebut. Anggap faktor kuasa adalah 1.

[10 marks]

[10 markah]

QUESTION 4**SOALAN 4**

CLO2

- (a) As an electrical contractor, estimate the value of voltage drop (VD) for the following installation:

Sebagai kontraktor elektrik, anggarkan nilai susut voltan (VD) untuk pemasangan berikut:

- i. 10kW powered oven which is supplied by 230V through a 10 mm² PVC insulated single core cable in 30 meter long conduit.

Ketuhar berkuasa 10kW yang dibekalkan oleh 230V melalui kabel teras tunggal berpenebat PVC 10 mm² dalam saluran sepanjang 30 meter.

- ii. 2.0 horse power split unit air conditioner which is supplied by 230V through a 6 mm² PVC insulated single core cable in 50 meter long conduit.

Penyaman udara unit split berkuasa kuda 2.0 yang dibekalkan oleh 230V melalui kabel teras tunggal berpenebat PVC 6 mm² dalam saluran sepanjang 50 meter.

- iii. 6.0 kW powered water heater which is supplied by 230V through a 6 mm² PVC insulated single core cable in 30 meter long conduit.

Pemanas air berkuasa 6.0 kW yang dibekalkan oleh 230V melalui kabel teras tunggal berpenebat PVC 6 mm² dalam saluran sepanjang 30 meter.

[9 marks]

[9 markah]

- CLO2 (b) By referring to Electrical Design Technique Guideline 4th Edition Year 2011, calculate total connected load (TCL) for all items as listed in Table 4(b):

Dengan merujuk kepada Panduan Teknik Rekabentuk Elektrik Edisi 4 Tahun 2011, kira jumlah beban tersambung bagi semua item seperti yang di senaraikan dalam Jadual 4(b):

Table 4(b) / Jadual 4(b)

Electrical appliances / Kelengkapan elektrik	Number / Bilangan
36 W fluorescent <i>36 W lampu kalimantang</i>	10
60 W tungsten <i>60 W lampu pijar</i>	10
1500 mm ceiling fan <i>1500 mm kipas siling</i>	2
13A 3P Switched Socket Outlet <i>13A 3P soket alir keluar</i>	4
1.0 HP Air-conditioner <i>1.0 HP penyaman udara</i>	2

[6 marks]

[6 markah]

- CLO2 (c) A mosque is to be built in Sentosa Village. The electrical equipment that will be installed in the mosque is as listed in the Table 4(c). As an electrical contractor, calculate the total connected load (TCL) and the maximum demand (MD) for the installation by referring to Electrical Design Technique Guideline 4th Edition Year 2011. The supply voltage for the mosque is 230V.

Sebuah masjid akan dibina di Kampung Sentosa. Peralatan elektrik yang akan dipasang di masjid adalah seperti yang disenaraikan dalam Jadual 4(c). Sebagai kontraktor elektrik, kira jumlah beban bersambung (TCL) dan permintaan maksimum (MD) bagi pemasangan dengan merujuk Garis Panduan Teknik Reka Bentuk Elektrik Edisi Ke-4 Tahun 2011. Voltan bekalan masjid ialah 230V.

Table 4(c) / Jadual 4(c)

Electrical appliances <i>Kelengkapan elektrik</i>	Numbers <i>Bilangan</i>
36W fluorescent light <i>36W lampu kalimantang</i>	20
1500mm ceiling fan <i>1500mm kipas siling</i>	10
13A 3P switched socket outlet <i>13A 3P soket alir keluar</i>	6
3.0 HP air-conditioner <i>3.0 HP penyaman udara</i>	3

[10 marks]

[10 markah]

SOALAN TAMAT

APPENDIX 1/ LAMPIRAN 1

Appendix 1: TCL Guide (updated: 15.5.2006)

NO	DESCRIPTION	ESTIMATED LOAD
1	18W Fluorescent	24W
2	36W Fluorescent	42W
3	60W Tungsten	60W
4	100W Tungsten	100W
5	1 x 8W(F) EL	10W
6	2 X 8W(F) LAMPU 'K' SIGN	20W
7	9W PLC	15W
8	11W PLC	17W
9	13W PLC	19W
10	18W PLC	24W
11	9W PLCE	10W
12	11W PLCE	12W
13	13W PLCE	14W
14	18W PLCE	20W
15	50W Halogen Bulb	50W
16	70W Metal Halide/SON	80W
17	150W Metal Halide/SON	170W
18	250W Metal Halide/SON	280W
19	400W Metal Halide/SON	440W
20	Obstruction Light	100W
21	Electric Bell	Ignore
22	2 x 8W(F) Insect Killer	20W
23	1500mm Ceiling Fan	80W
24	1200 Ceiling Fan	60W
25	400mm Wall Fan	60W
26	500 Wall Fan	80W
27	400mm Automatic Fan	80W
28	200mm Exhaust Fan	15W
29	250mm Exhaust Fan	25W
30	300mm Exhaust Fan	40W
31	13A 3P Switched Socket Outlet	250W
32	15A Switched Socket Outlet	500W
33	15A SPN Isolator	Motor H.P. rating
34	20A SPN Isolator	Motor H.P. rating
35	30A SPN Isolator	Motor H.P. rating
36	15A TPN Isolator	Motor H.P. rating
37	20A TPN Isolator	Motor H.P. rating
38	30A TPN Isolator	Motor H.P. rating
39	45A TPN Isolator	Motor H.P. rating
40	60A TPN Isolator	Motor H.P. rating
41	1 HP Air-Cond	746W
42	1.5 HP Air-Cond	1119W
43	2 HP Air-Cond	1492W
44	2.5 HP Air-Cond	1865W
45	3 HP Air-Cond	2238W
46	Water Heater	3kW
47	Cooker	7.5kW
48	Booster Pump	Motor H.P. rating
49	Fire Fighting Pump	Motor H.P. rating
50	Fire Fighting Panel	250W
51	CO2 Point	500W
52	SATS System	500W
53	HI KLEEN System	Motor H.P. rating

APPENDIX 2/ LAMPIRAN 2

Fuse rate for MCCB, MCB and RCCB

Molded Case Circuit Breaker (MCCB)	
Voltage rating	: 230V/400V
Current rating	: 16A, 20A, 30A, 40A, 50A, 60A, 80A, 100A until 2000A
Double Pole/ TPN/4 Pole	

Miniature Circuit Breaker (MCB)	
Voltage rating	: 230V/400V
Current rating	: 2A, 4A, 6A, 10A, 16A, 20A, 25A, 32A, 40A, 50A, 63A
Single Pole/Double Pole/ 3 Pole/4 Pole	

Residual Current Circuit Breaker (RCCB)	
Voltage rating	: 230V/400V
Current rating	: 16A, 25A, 40A, 63A, 80A
Sensitivity ($I_{\Delta n}$)	: 10mA, 30mA, 100mA, 300mA, 500mA
Single Pole/Double Pole/ 3 Pole/4 Pole	

APPENDIX 3/ LAMPIRAN 3

TABLE 4D1A
Single-core pvc-insulated cables, non-armoured, with or without sheath
(COPPER CONDUCTORS)

BS 6004

BS 6231

Ambient temperature : 30 °C

CURRENT-CARRYING CAPACITY (amperes):

BS 6346

Conductor operating temperature : 70°C

Conductor cross-sectional area	Reference Method 4 (Enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc.)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 12 (free air)		
	2 cables, single-phase a.c or d.c	3 or 4 cables, three-phase a.c	2 cables, single-phase a.c or d.c	3 or 4 cables, three-phase a.c	2 cables, single-phase a.c or d.c flat and touching	3 or 4 cables, three-phase a.c flat and touching or trefoil	2 cables, single-phase a.c or d.c flat and touching	3 or 4 cables, three-phase a.c flat and touching or trefoil	Horizontal flat spaced	Vertical flat spaced	Trefoil
									2 cables, single-phase a.c or d.c or 3 cables three-phase a.c	2 cables, single-phase a.c or d.c or 3 cables three-phase a.c	3 cables trefoil, three-phase a.c
1 (mm ²)	2	3	4	5	6	7	8	9	10	11	12
1	11	10.5	13.5	12	15.5	14	-	-	-	-	-
1.5	14.5	13.5	17.5	15.5	20	18	-	-	-	-	-
2.5	19.5	18	24	21	27	25	-	-	-	-	-
4	26	24	32	28	37	33	-	-	-	-	-
6	34	31	41	36	47	43	-	-	-	-	-
10	46	42	57	50	65	59	-	-	-	-	-
16	61	56	76	68	87	79	-	-	-	-	-
25	80	73	101	89	114	104	126	112	146	130	110
35	99	89	125	110	141	129	156	141	181	162	137
50	119	108	151	134	182	167	191	172	219	197	167
70	151	136	192	171	234	214	246	223	281	254	216
95	182	164	232	207	284	261	300	273	341	311	264

TABLE 4D1B

VOLTAGE DROP (per ampere per metre):

Conductor operating temperature : 70°C

Conductor cross-sectional area	2 cables d.c	2 cables, single-phase a.c									3 or 4 cables, three-phase a.c											
		Reference Method 3 & 4 (Enclosed in conduit etc. in or on a wall)			Reference Method 1 & 11 (clipped direct or on trays, touching)			Reference Method 12 (spaced*)			Reference Method 3 & 4 (Enclosed in conduit etc. in or on a wall)			Reference Method 1, 11 & 12 (in trefoil)			Reference Method 1 & 11 (flat and touching)			Reference Method 12 (spaced*)		
1	2	3			4			5			6			7			8			9		
(mm ²)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)		
1	44	44			44			44			38			38			38			38		
1.5	29	29			29			29			25			25			25			25		
2.5	18	18			18			18			15			15			15			15		
4	11	11			11			11			9.5			9.5			9.5			9.5		
6	7.3	7.3			7.3			7.3			6.4			6.4			6.4			6.4		
10	4.4	4.4			4.4			4.4			3.8			3.8			3.8			3.8		
16	2.8	2.8			2.8			2.8			2.4			2.4			2.4			2.4		
25	1.75	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
		1.80	0.33	1.80	1.75	0.20	1.75	1.75	0.29	1.80	1.50	0.29	1.55	1.50	0.175	1.50	1.50	0.25	1.55	1.50	0.32	1.55
35	1.25	1.30	0.31	1.30	1.25	0.195	1.25	1.25	0.28	1.30	1.10	0.27	1.10	1.10	0.170	1.10	1.10	0.24	1.10	1.10	0.32	1.15
50	0.93	0.95	0.30	1.00	0.93	0.190	0.95	0.93	0.28	0.97	0.81	0.26	0.85	0.80	0.165	0.82	0.80	0.24	0.84	0.80	0.32	0.86
70	0.63	0.65	0.29	0.72	0.63	0.185	0.66	0.63	0.27	0.69	0.56	0.25	0.61	0.55	0.160	0.57	0.55	0.24	0.60	0.55	0.31	0.63
95	0.46	0.49	0.28	0.56	0.47	0.180	0.50	0.47	0.27	0.54	0.42	0.24	0.48	0.41	0.155	0.43	0.41	0.23	0.47	0.40	0.31	0.51

Note : * Spacings larger than those specified in Method 12 (see Table 4A1) will result in larger voltage drop

Appendix 4: Diversity Factor (DF)

Updated: 21st March 2008

Building	School	Health		Mosque	Hall	Hostel		Dining Hall/ Canteen	Office	Lab		Quarters
		Essential	Non-Essential			School	Executive			Computer	Science	
Lamp/Fan	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
13A S/S/O	0.1	0.4	0.4	0.4	0.4	0.1	0.4	0.4	0.4	0.6	0.6	0.5
15A S/S/O	1	1	1	1	1	1	1	1	1	1	1	1
AC Motor Pump	1	1	1	1	1	-	1	1	1	1	1	1
Outdoor Lighting	1	1	1	1	-	-	-	-	1	1	1	1
Water Heater	-	-	-	-	-	-	1	1	-	-	-	1
Cooker Unit	1	1	1	-	-	-	-	-	-	-	-	-
Isolator	1	1	1	1	1	1	1	1	1	-	-	-

Note: * DF may be relook based on the day and night profile usage.