

SULIT



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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022 / 2023

DCB20042: BUILDING ELECTRICAL SERVICES

TARIKH : 21 DISEMBER 2022

MASA : 2.30 PM – 4.30 PM (2 JAM)

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

Bahagian A: Esei (2 soalan)

Bahagian B: Esei (4 soalan)

Dokumen sokongan yang disertakan : Appendix

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 50 MARKS**BAHAGIAN A : 50 MARKAH****INSTRUCTION:**

This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

ARAHAN :

Bahagian ini mengandungi **DUA (2)** soalan esei. Jawab **SEMUA** soalan.

QUESTION 1**SOALAN 1**

CLO2
C2

- (a) Estimate the rate of the circuit breaker (MCB) used for a circuit consisting of 2 units of 180 watt ceiling fan and 3 units of 100 watt fluorescent light.

Anggarkan kadaran pemutus litar (MCB) yang digunakan bagi litar yang mengandungi 2 unit kipas siling 180 watt dan 3 unit lampu kalimantang 100 watt.

[5 marks]

[5 markah]

CLO2
C2

- (b) Identify the circuit breaker (MCB) rating and the cable size for the following installation as shown in Figure A1(b).

Kenalpasti kadaran pemutus litar (MCB) dan saiz kabel bagi pemasangan seperti Rajah A1(b).

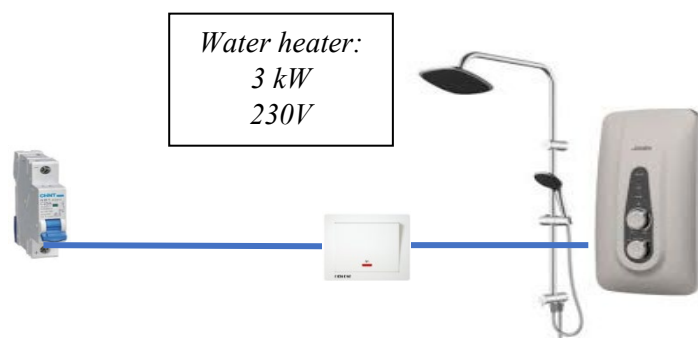


Figure A1(b) / Rajah A1(b)

[10 marks]

[10 markah]

CLO2
C3

- (c) PVC single-core cable will be used in surface wiring systems for the installation of load 3kW power. The source distance from the supply is 30 meters with 230V supply. Calculate the appropriate wire size.

Kabel PVK teras-tunggal akan digunakan bagi pemasangan sistem pendawaian permukaan dengan kuasa 3kW. Jarak antara punca daripada bekalan ialah 30 meter dengan bekalan 230V. Kirakan saiz wayar yang sesuai.

[10 marks]

[10 markah]

QUESTION 2**SOALAN 2**CLO2
C2

- (a) Identify the estimated load for the following items based on the **Schematic Design of JKR Electrical Engineering Branch Technique Guideline Edition 4:**

- i. 5 units of 18W fluorescent
- ii. 4 units of 13A switch socket outlet
- iii. 10 units of 400mm wall fan
- iv. 6 units of 100W tungsten
- v. 2 units of 1.5 HP air-conditioner

*Kenalpasti beban anggaran bagi item berikut berdasarkan **Rekabentuk Skematik Panduan Teknik JKR Cawangan Kejuruteraan Elektrik Edisi 4:***

- i. 5 unit of 18W fluorescent
- ii. 4 unit of 13A switch socket outlet
- iii. 10 unit of 400mm wall fan
- iv. 6 unit of 100W tungsten
- v. 2 unit of 1.5 HP Air-cond

[5 marks]

[5 markah]

CLO2
C2

(b) Estimate the total connected load (TCL) and maximum demand (MD) for the following electrical appliances for an office by referring to the **Schematic Design of JKR Electrical Engineering Branch Technique Guideline Edition 4**.

*Anggarkan jumlah beban tersambung bagi semua kelengkapan elektrik bagi sebuah pejabat berikut dengan merujuk **Rekabentuk Skematik Panduan Teknik JKR Cawangan Kejuruteraan Elektrik Edisi 4**.*

Table A2(b)/Jadual A2(b)

Electrical appliances/Perkakasan elektrik	Number / Bilangan
50W halogen bulb	10
300 mm exhaust fan	2
13A 3P Switched Socket Outlet	2
3 HP Air-cond	3

[10 marks]

[10 markah]

CLO2
C3

(c) By using the data in Table A2(c), calculate the current for Total Connected Load, (I_{TCL}) and the current for total Maximum Demand (I_{MD}) for the classroom. Assume Diversity Factor (DF) for lamp and fan as 0.8; 13A switch socket outlet as 0.1 and 0.85 for power factor. Refer to Appendix 3 for the connected load value.

Menggunakan data pada Jadual A2(c), kirakan arus Jumlah Beban Sambungan (A_{JBS}) dan arus Jumlah Permintaan Maksimum (I_{JPM}) untuk bilik darjah tersebut. Anggarkan Faktor Diversiti (FD) untuk lampu dan kipas sebagai 0.8; soket alur keluaran 13A sebagai 0.1 dan 0.85 untuk faktor kuasa. Rujuk Lampiran 3 untuk nilai beban sambungan.

Table A2(c)/ *Jadual A2(c)*

CIRCUIT/ <i>LITAR</i>	LOADS/ <i>BEBAN</i>	NUMBER/ <i>BILANGAN</i>
Circuit 1/ <i>Litar 1</i>	1 X 36W Fluorescent Lamp/ <i>Lampu Kalimantan</i> 400mm Wall Fan/ <i>Kipas Dinding</i>	8 2
Circuit 2/ <i>Litar 2</i>	1 X 18W Fluorescent Lamp/ <i>Lampu Kalimantan</i> 1200mm Ceiling Fan/ <i>Kipas Siling</i>	8 2
Circuit 3/ <i>Litar 3</i>	13A Switch Socket Outlet/ <i>Soket</i> <i>Alur Keluaran</i>	2
Circuit 4/ <i>Litar 4</i>	13A Switch Socket Outlet/ <i>Soket</i> <i>Alur Keluaran</i>	2

[10 marks]

[10 markah]

SECTION B : 50 MARKS***BAHAGIAN B : 50 MARKAH*****INSTRUCTION:**

This section consists of **FOUR (4)** essay questions. Answer **TWO (2)** questions.

ARAHAN :

Bahagian ini mengandungi EMPAT (4) soalan esei. Jawab DUA (2) soalan.

QUESTION 1***SOALAN 1***CLO1
C2

(a) Identify **FIVE (5)** types of electric generator.

Kenalpasti LIMA (5) jenis penjana elektrik.

[5 marks]

[5 markah]

CLO1
C3

(b) Explain each generator that identified in **Q B1(a)**.

Terangkan setiap penjana yang dikenalpasti pada S B1(a).

[10 marks]

[10 markah]

CLO1
C3

(c) Explain the following:

- i. Generation
- ii. Transmission
- iii. Distribution
- iv. Single-phase supply
- v. Three-phase supply

Terangkan perkara-perkara berikut:

- i. *Penjanaan*
- ii. *Pengantaran*
- iii. *Pengagihan*
- iv. *Bekalan satu-fasa*
- v. *tiga-fasa*

[10 marks]

[10 markah]

QUESTION 2**SOALAN 2**CLO1
C2(a) Identify **FIVE (5)** examples of final circuit.*Kenalpasti **LIMA (5)** contoh litar akhir.*

[5 marks]

[5 markah]

CLO1
C3

(b) Explain the components for the consumer circuit as follows:

- i. Main fuse
- ii. KWh meter
- iii. Main switch
- iv. Residual current device
- v. Miniature circuit breaker

Terangkan komponen kawalan berturutan litar pengguna seperti berikut:

- i. Fius utama*
- ii. Meter kilowattjam*
- iii. Suis utama*
- iv. Peranti arus baki*
- v. Pemutus litar kenit*

[10 marks]

[10 markah]

(c) Sketch with label the wiring diagram for the following installations:

- i. Three lamps control by single switch.*
- ii. Ring circuit for 3 unit of switch socket outlet*

Lakar dan label gambar rajah bagi pemasangan berikut:

- i. Tiga lampu dikawal oleh dua suis*
- ii. Litar gelang bagi 3-unit suis soket keluaran*

[10 marks]

[10 markah]

QUESTION 3

SOALAN 3

(a) The conduit wiring is done by using a conduit, which is simply the channels or tubes that provide path and protection to the electrical wiring. Identify **FIVE (5)** factors in selecting a conduit type wiring.

*Pendawaian conduit dilakukan dengan menggunakan conduit iaitu saluran atau tiub yang memberi laluan dan perlindungan kepada pendawaian elektrik. Kenal pasti **LIMA (5)** faktor dalam pemilihan pendawaian jenis conduit.*

[5 marks]

[5 markah]

CLO1
C3

CLO1
C2

CLO1
C3

- (b) Temporary wiring often includes all the elements of permanent wiring systems such as the service, feeders, branch circuit wiring for power and lighting outlets. Explain **FIVE (5)** disadvantages of temporary wiring.

*Pendawaian sementara selalunya merangkumi semua elemen sistem pendawaian kekal seperti perkhidmatan, penyuiap, pendawaian litar cawangan untuk alur keluar kuasa dan lampu. Terangkan **LIMA (5)** keburukan pendawaian sementara.*

[10 marks]

[10 markah]

CLO1
C3

- (c) After completing a wiring work, some testing of the wiring installation must be done. According to Regulation 13(1) and (2), the Electricity Regulations 1994 state that the installation must be tested by a Wireman with a Single Phase Blockage and Three Phase Blockage who is authorized to test any installation. With the aid of a diagram, explain the insulation resistance test on single phase wiring installation.

Setelah selesai sesuatu pendawaian, beberapa pengujian terhadap pemasangan pendawaian perlu dilakukan. Mengikut Peraturan 13(1) dan (2), Peraturan-peraturan Elektrik 1994 menyatakan bahawa pemasangan itu hendaklah diuji oleh Pendawai dengan Sekatan Fasa Tunggal atau pendawai dengan Sekatan Fasa Tiga yang diberikuasa untuk menguji mana-mana pemasangan. Dengan bantuan gambarajah, terangkan ujian rintangan penebatan pada pemasangan pendawaian satu fasa.

[10 marks]

[10 markah]

QUESTION 4**SOALAN 4**CLO1
C2

- (a) Describe the earthing system in a building.

Huraikan system pbumian dalam sesebuah bangunan.

[5 marks]

[5 markah]

CLO1
C3

(b) Sketch and label an earthing system of a house

Lakarkan dan label system pembumian sebuah rumah

[10 marks]

[10 markah]

CLO1
C3

(c) Explain the function of the devices in the earthing system as follows:

- i. Residual current device
- ii. Earth terminal
- iii. Earth conductor
- iv. Earth electrode
- v. Earth chamber

Terangkan fungsi peralatan-peralatan yang terlibat dalam sistem pembumian seperti berikut:

- i. *Pemutus arus baki*
- ii. *Terminal bumi*
- iii. *Pengalir bumi*
- iv. *Rod bumi*
- v. *Rumah bumi*

[10 marks]

[10 markah]

Notes

Assessment item for this course have covered elements of the Dublin Problem: DP1, DP2, DP4 and DP5 as mentioned in FEIST.

SOALAN TAMAT

**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

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
1	2	3	4	5	6	7	8	9	10	11	12
(mm ²)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
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


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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 × 8W (F) EL	10W
6	2 × 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 × 8W (F) Insect Killer	20W
23	1500mm Ceiling Fan	80W
24	1200mm Ceiling Fan	60W
25	400mm Wall Fan	60W
26	500mm 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

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NO	DESCRIPTION	ESTIMATED LOAD
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

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Appendix 2: 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.