Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	ELECTRICAL BUILDING INSTALLATION
COURSE CODE	:	BNE 36003
PROGRAMME CODE	:	BNE
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Prudent and efficient use of electricity is not only kinder to the environment, but also kinder to the business, saving money and bringing more profits to the consumers. Propose **TWO (2)** energy saving methods in lighting system.

(4 marks)

(b) Express the following terms with brief characteristic and equation for a distribution system:

(i) The load factor.

(2 marks)

(ii) The connected load.

(2 marks)

(c) Malaysian Standard MS IEC 60038 state that electrical supply provider must ensure the electricity supply for single phase and three phase within standard supply specification. Highlight that standard supply specification.

(5 marks)

(d) Consumer side of electrical system in residential are under consumer responsibility. These responsisbility includes design, installation and maintenance on distribution box and end circuit. Explain each of the components in distibution box.

(7 marks)

Q2 (a) The main objective for lighting designer is to provide good quality of brightness and quantity of light in the area to be illuminated. Thus, it is crucial for him/her to have a good understanding about the concept behind the illumination technology. Explain in brief the working concept of:

(i) Luminous intensity.

(4 marks)

(ii) Luminous intensity in the light.

(4 marks)

(b) Summarize the electro-atomic illumination principle of florescent light.

(5 marks)

(c) A lecture hall with dimension of 12 m long and 10 m wide is to be illuminated and the illuminance required is 350 Lux. Assuming a depreciation factor of 1.2 and utilisation factor of 0.6 for the lighting scheme design. If 36 W fluorescent lamps (75 lumens / watt) were to be used, calculate the number of fluorescent lamps required.

(7 marks)

Q3 **Table Q3** gives the connected loads for a new constructed single-storey semi-detached house. The incoming supply is taken from 230 V_{LN}, 50 Hz.

(a) Estimate the maximum demand for this domestic installation by consider 70% of diversity factor.

(6 marks)

(b) By referring to **Table Q3(b)**, recommend the proper rating of residual current operated circuit breakers (RCCB) and main switch. Note that two RCCB must be considered, that is for general lighting or fan circuit and power circuit applications.

(6 marks)

(c) Based on your answer in question **Q3(a)** and **Q3(b)**, propose a single line diagram starting from the cut-out fuse to an end circuit including cable size and complete specification for each protection circuit.

(8 marks)

Q4 (a) Voltage drop on electrical power distribution systems is mainly caused by cables, transformers, and motors when load current flows through a conductor or transformer having a finite impedance.

(i) Define the meaning of the voltage drop based on 17th Edition of IEE Wiring Regulations.

(4 marks)

(ii) Identify **TWO (2)** examples of voltage drop situation.

(2 marks)

(b) A lecture hall has been installed with 60 fluorescent lamps, each with 40 Watts capacity output power (inclusive ballast consumption) using a 35 m length of 1.5 mm^2 cable. Single phase 230 $V_{r.m.s}$ voltage is used from the public low distribution system, and consider the voltage drop standard (17^{th} Edition of IEE Wiring Regulations) such as specified in **Table Q4(b)** is generated. Assumed the average power factor for this lighting system is 0.95 lagging.

(i) Analyse the percentage of voltage drop for this installation.

(8 marks)

(ii) Propose the new cable size.

(3 marks)

(iii) Calculate the new voltage drop in percentage for new cable size.

(3 marks)

Q5 (a) Good earthing system is one of the important criteria of good electrical installation system for building.

(i) Outline the definition of earthing.

(3 marks)

(ii) Summarize **THREE (3)** reason for earthing in electrical installation system.

(6 marks)

(iii) Highlight the different between grounding versus bonding.

(4 marks)

(b) A single phase 240 V, 13 kW 50 Hz motor circuit operating at 0.85 power factor lagging is protected by a cartridge fuse having blowing current of 110 A. A fault occurs in the circuit causes a current of 180 A to flow through the earth continuity path. As a result of poor contact due to a lock nut and bush connecting a steel conduit to a metal box, the resistance of this conduit connection alone is 1.35 Ω.

(i) Inspect whether the fuse will be rupture based on **Table Q5(b)(i).**

(4 marks)

(ii) Examine the amount of heat produced at the metal box.

(3 marks)

- END OF QUESTIONS -

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Table Q3

No	Load Type	Quantity (No)
1	Downlight point (Take 70W per Nos)	12
2	Wall light point (Take 60W per Nos)	4
3	Ceiling fan point	5
4	SSO 13A (Take 300W per Nos)	11
5	SSO 15A (Take 500W per Nos)	2
6	1kW water heater point	2
7	AC 1 HP	2
8	AC 2 HP	1

Table Q3(b)

Type of Protective Device	Standard Rating (A)
MCB	1, 3, 6, 10, 16, 20, 25, 32, 40, 50, 63
RCCB/ Main switch	40, 63

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Table Q4(b)

Tabulated Table of Voltage Drop in mV/A/m

(Source: IEE Wiring Regulations (17th Edition, BS7671: 2008, Appendix 4, Table 4D2B)

VOLTAGE DROP (per ampere per metre) Conductor operating temperature: 70°

Conductor cross-sectional area	Two-core cable, d.c.	Two-core cable, single phase a.c.			Three- or four-core cable, three-phase a.c.		
1	2	3			4		
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
1	44	44			38		
1.5	29	29			25		
2.5	18	18			15		
4	11	11			9.5		
6	7.3	7.3			6.4		
10	4.4	4.4			3.8		
16	2.8	2.8			2.4		
		r	x	z	r	x	z
25	1.75	1.75	0.17	1.75	1.5	0.145	1.5
35	1.25	1.25	0.165	1.25	1.1	0.145	1.1
50	0.93	0.93	0.165	0.94	0.8	0.14	0.81
70	0.63	0.63	0.16	0.65	0.55	0.14	0.57
95	0.46	0.47	0.155	0.5	0.41	0.135	0.43
120	0.36	0.38	0.155	0.41	0.33	0.135	0.35
150	0.29	0.3	0.155	0.34	0.26	0.13	0.29
185	0.23	0.25	0.15	0.29	0.21	0.13	0.25
240	0.18	0.19	0.15	0.24	0.165	0.13	0.21
300	0.145	0.155	0.145	0.21	0.135	0.13	0.185
400	0.105	0.115	0.145	0.185	0.1	0.125	0.16

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Table Q5(b)(i)

Regulation D22 (Basic Earthing Requirements)
States that earth leakage protection may be provided by means of fuses or excess current circuit breakers if the earth fault current available to operate the protective device and so make the faulty circuit dead exceeds: 1. 3 times the current rating of any semi enclosed fuse or any cartridge fuse having a fusing factor exceeding 1.5, used to protect the circuit, or 2. 2.4 times the rating of any cartridge fuse having a fusing factor not exceeding 1.5, used to protect the circuit, or 3. 1.5 times the tripping current of any excess current circuit breaker used to protect the circuit.