UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	UTILISATION OF ELECTRICAL ENERGY
COURSE CODE	:	BEF 33203 / BEV 30803
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	JULY 2020
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) State ideal electrical protection in terms of resistance and voltage.

(4 marks)

(b) Explain the difference between grounding and bonding with an appropriate diagram.

(4 marks)

(c) Identify the sensitive points of/in places as given in **Table Q1(c)** where protection is unavoidable.

(10 marks)

(d) Explain the working principles of the protection schemes of TT, TN, TN-C-S.

(12 marks)

(e) Identify the necessary protection schemes for the points identified at **Q1 (c)** by using your critical thinking as a power system protection engineer.
Note: You are allowed to use any of the techniques of identification i.e. through tagging (numbering, markings, naming etc).

(20 marks)

Q2 (a) Justify numerically that, illuminance is the, "number of lumens/m^2 or number of lux".

(4 marks)

(b) Suppose:

N	=	No. of lamps
W	=	Wattage of each lamp
η	=	Efficiency of each lamp (lm/watt)
UF	=	Utilization Factor
DF	=	Depreciation Factor
MF	=	Maintenance Factor

By using Lumen method prove that DF is the reciprocal of MF.

(4 marks)

(c) Show that 1 lux = 0.0929 lm/ft^2.

(4 marks)

(d) **Figure Q2(d)** shows a typical unit for an affordable home. As an M&E consultant, you are required to plan and design lighting and electrical system for its development. This house is to be illuminated and the illuminance required is 200 Lux. Assuming a standard maintenance factor and utilisation factor of 0.6 for the lighting scheme. If 36 W fluorescent lamps (75 lumens/watt) are used, suggest and determine the number of fluorescent lamps required for the whole house.

(10 marks)

(e) A squared exhibition hall with the width of 12 m is to be illuminated to a level of 350 Lux. The utilisation and the maintenance factors are to be taken as 0.60 and 0.80, respectively. Estimate:

(i) The power required to illuminate the hall if using energy-saving T5 fluorescent lamp, having an efficacy of 65 lm/W.

(3 marks)

(ii) The efficacy of LED lighting, when the power required to illuminate the hall is 1167 W.

(3 marks)

(f) A windowless office is to be illuminated for 15 hours per day, for 6 days per week, for 50 weeks per year. The floor is 20 m long and 12 m wide. An overall illumination of 450 Lux is to be maintained over the whole floor. The total light loss factor for the installation is 70 %. The designers have the choice of using 100 W tungsten filament lamps, which have an efficacy of 12 lm/W and need replacing every 3000 hours, or 65 W tubular fluorescent warm white lamps, which have an initial output of 5400 lm and are expected to provide 12000 hours of service. The room layout requires an even number of lamps. Electricity costs RM 0.22/kWh. The tungsten lamps cost RM1.00 each while the fluorescent tubes cost RM10.00 each.

(i) Determine the total costs per year for lighting system which is designed with tungsten lamps.

(11 marks)

(ii) Determine the total costs per year for lighting system which is designed with fluorescent lamps.

(7 marks)

(iii) Based on **Q2(e)(i)** and **Q2(e)(ii)** above, make a recommendation as to which is preferable by stating your reasons.

(4 marks)

– END OF QUESTION PAPER –

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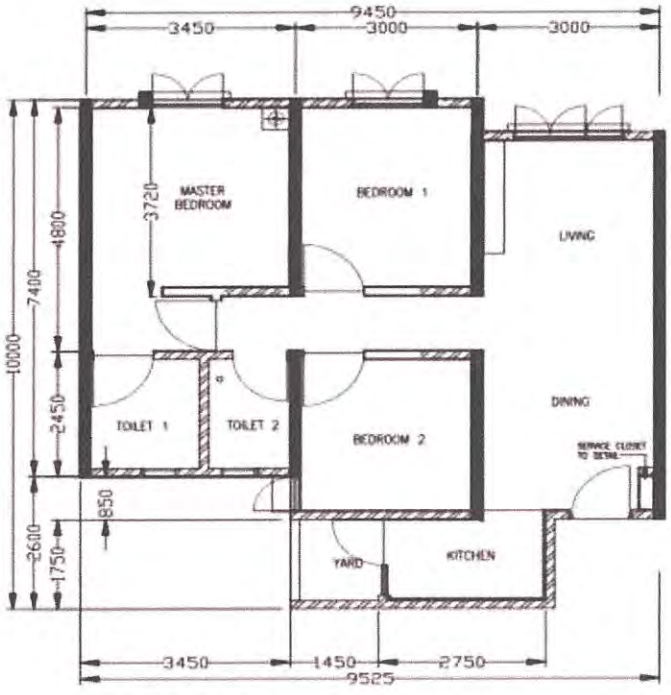
Table Q1(c)

Places where electrical protection is needed	Sensitive points of/in places where electrical protection is unavoidable
Power supply ends	
Building protection	
Leakage current	
High powered gadgets	
Light power loads	
Water areas	
Sensitive loads	
CNC machines	
Electric wiring in sharp tools and rough surface areas	
Unconscious people under treatment	



UNIT FLOOR PLAN
(AREA : 850 sqft, 79.00 sq meter)

Figure Q2(d)