

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	:	BET 2022
COURSE	:	UTILIZATION OF ELECTRICAL ENERGY
SEMESTER / SESSION	:	02 – 2023/2024
DURATION	:	2 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL**.
2. All answers should be written in the answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hand and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

UTILIZATION OF ELECTRICAL ENERGY (BET 2022)

QUESTION 1

- a) The Figure 1 below show the bill of TNB tariff rates for En Muhammad Uwais house. Calculate the real amount of bill for this Domestic Tariff A.

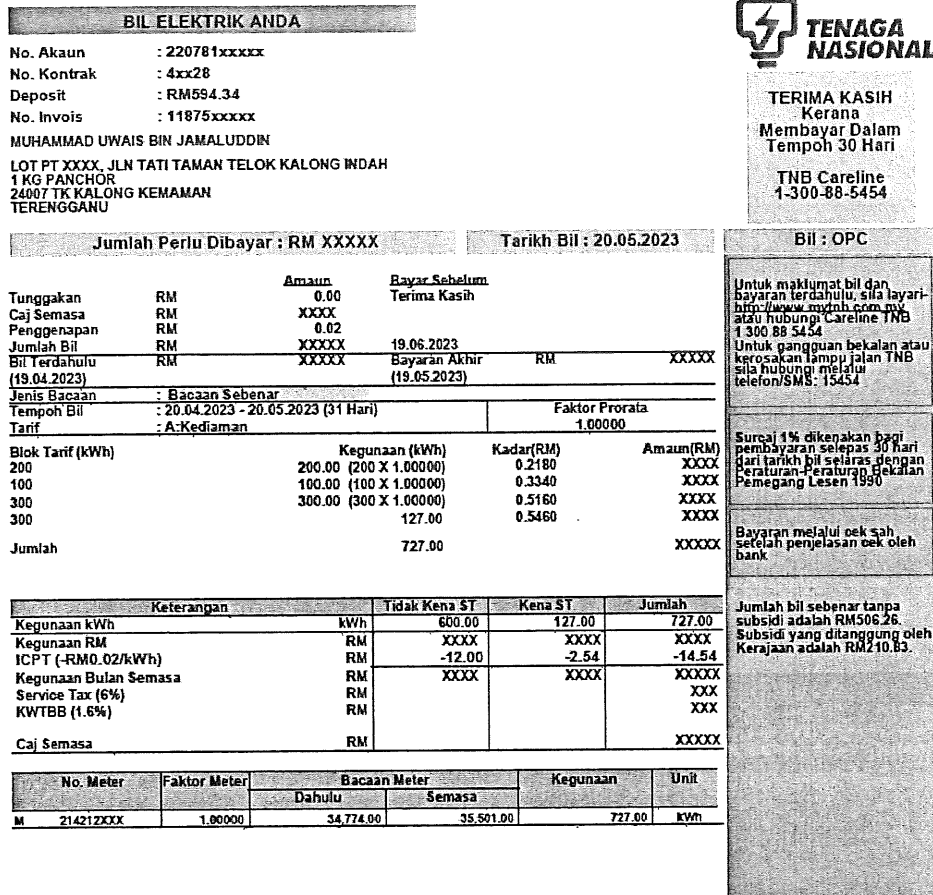


Figure 1

(10 marks)

UTILIZATION OF ELECTRICAL ENERGY (BET 2022)

QUESTION 2

- a) A 415/240 panel board serves the following loads. Calculate the total Connected Load (CL) and the Demand Load (DL) in **Table 1** below. Refer the Industrial Electrical System design panel board and switchboards timetable in **Appendix 1**.

Table 1

No.	Load	Rating
1.	Water Heating	4.8 kW
2.	Spare capacity	10.0 kVA with PF = 0.87
3.	Air Conditioning	12.0 kVA with PF = 0.80
4.	Lighting	14.0 kVA with PF = 0.90
5.	Receptacles	16.0 kVA with PF = 0.93
6.	Resistance Heat	12.0 kW
7.	Motors Gate	8.0 kVA with PF 0.85

(10 marks)

UTILIZATION OF ELECTRICAL ENERGY (BET 2022)

QUESTION 3

- a) List **four (4)** sources of short circuit current. (4 marks)
- b) Determine the percentage voltage drop along a 415V, three phase feeder, 80 feet in length, consisting of one 400 THW (Thermoplastic Heat and Water Resistant Insulated Wire) copper conductor per phase. The current is 280A at 0.90 PF lagging. Assume steel conduit. from the table of 600V cables; resistance = $0.035\Omega/1000\text{ft}$ and reactance = $0.049\Omega/1000\text{ft}$ (6 marks)

QUESTION 4

- a) Classify between bonding and grounding. (4 marks)
- b) Write down the **three (3)** reasons for earthing. (3 marks)
- c) Describe the earth continuity conductor impedance as an indicator of improper earthing. (3 marks)

.....*End of question*.....

UTILIZATION OF ELECTRICAL ENERGY (BET 2022)

APPENDIX 1

Industrial Electrical System Design Panelboards and Switchboards		
No.	Connected Load	Demand Factor
1.	Lighting	1.25
2.	Receptacles	1.00
	1 st 10 kVA@100%	0.50
	Remainder@50%	
3.	Resistance Heat	1.00 or 0.00
4.	Heat Motor	1.00 or 0.00
5.	Air Conditioning Motors	1.00 or 0.00
6.	Motors	1.00
7.	Other Loads	1.00 or 1.25*
8.	Water Heating	1.00
9.	Kitchen	0.65 to 1.00
10.	Spare Capacity	1.00
11.	Largest Motor	0.25

APPENDIX 2

FORMULA SHEET

$$|V_{\text{drop}}| \approx |I_b| \times [(R_L \times \cos \theta) - (X_L \times \sin \theta)]$$

R_L = circuit resistance in Ohms

X_L = circuit reactance in Ohms

I_b = design current/ line current

θ = phase angle of line current

if V_A = system voltage

$$\%V_{\text{drop}} = \frac{|V_{\text{drop}}|}{|V_A|} \times 100\%$$

Motor Starting Voltage Drop (Constant Impedance Method)

$$\text{kVA} = (\text{kVA}/\text{Hp}) \times (\text{Hp})$$

$$I_{LR} = \frac{\text{kVA}}{\sqrt{3} \times 415V}$$

$$P = (\text{kVA})(\%pf)$$

$$Q = (\text{kVA})(\sin(\cos^{-1}\%pf))$$

$$R = \frac{1}{3} \times \left(\frac{PkW}{I_{LR}^2} \right)$$

$$X = \frac{1}{3} \times \left(\frac{QkVAr}{I_{LR}^2} \right)$$

$$V_M = 240 \angle 0^\circ \left(\frac{R + jX}{R + jX + Z} \right)$$

$$\%V_{\text{drop}} = \frac{240V - V_M}{240V} \times 100\%$$

➤ Constant Current Method; $I_M = I_{LR} \angle -pf$

$$|V_{\text{drop}}| = I_M \times [R\Omega \times \cos(-pf) - x\Omega \times \sin(-pf)]$$

$$\%V_{\text{drop}} = \frac{V_{\text{drop}}}{240V} \times 100\%$$