



FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

**TRADE DIPLOMA IN ELECTRICAL ENGINEERING (ELECTRICAL & RENEWABLE) -
STAGE 5**

**EEE575/EED511 ELECTRICAL POWER UTILISATION AND
DESIGN**

FINAL EXAMINATION – TRIMESTER 2, 2019

Duration: 3 hours and 10 minutes

Total Marks: 100

Total No. of Pages: 5

DATE/DAY: TBA

TIME: TBA

ROOM: AS PER TIMETABLE

INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes extra reading time during which you are NOT to write.
2. Begin each SECTION on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. ANSWER ALL QUESTIONS
9. Show all working where necessary.
10. ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM

SECTION A:

(25 marks)

1. What is Tariff? List and elaborate on any three characteristics of a Tariff. (7 marks)
2. Choose any two types of Tariff structure. Explain and state one advantage and one disadvantage of using such type of tariffs. (6 marks)
3. In a Poultry business whose demand is less than 75kWh, you as an owner was given the following bill for a month:

TARIFF DESCRIPTION	READING TYPE	METER NUMBER	READING		USAGE KWHs	BILLED DAYS
			PRESENT	PREVIOUS		
COM Step1	Normal Reading	50158977:1	00006673	00005685	988	32
Reactive Unts	Normal Reading	50158977:2	00003495	00003040	455	32

Calculate the charge for the month. (Refer to Table 2). (4 marks)

4. In a typical rural installation where Residential Tariff is used, a kWh meter established 310 755kWh. The previous monthly reading was 310 670 kWh. (Refer to Table 1)
 - a. Calculate the cost of energy for the current month. (4 marks)
 - b. If the current monthly reading was as follows:

Electricity usage and service calculation

TARIFF DESCRIPTION	READING TYPE	METER NUMBER	READING		USAGE KWHs	BILLED DAYS
			PRESENT	PREVIOUS		
Domestic	Estimated	SD028100:1	010279	010139	140	29

Then what will be charge for that month. (4 marks)

SECTION B:

(25 marks)

1. In a factory bench as shown in Drawing 2 in last page, where good lighting is required, a 750 lux light source is recommended. A lighting system is chosen where 3 x 60W warm white fluorescent lamp fittings are to be used. Each 60W lamp emits 3600lm. The fitting provides direct lighting. The illumination area of factory is: Length – 20m, Width – 10m, Height – 6m.

The working area is 0.6m above the floor.

The Utilisation factor is 0.64, the lamp lumen factor is 0.8, Luminaire MF = 0.85 and Room Surface MF = 0.9.

Using Zonal Cavity Method for Indoor Lighting, calculate the following:

- a. Height of direct lighting (2 mark)
- b. Room Index (2 marks)
- c. Number of light fittings (2 marks)
- d. The illumination level when the lights have been recently installed and all brand new. (maintenance factor M= 1) (2 marks)

2. Energy efficiency in lighting systems is very important. List down three primary considerations which support the statement. (6 marks)
3. Explain the following basic parameters and terms in lighting system
 - a. Illuminance
 - b. Installed Load Efficacy
 - c. Color Rendering Index(3 marks)
4. Explain Ignitors, state its function/s and its application/s (2 marks)
5. List and elaborate on any three methods [3] of energy saving opportunities that you know of. (6 marks)

SECTION C:

(25 marks)

1. Explain what Air Conditioning is and list down three conditions where AC is used? (5 mark)
2. List down the 4 major components of an Air Conditioner and explain its function. (8 marks)
3. Calculate the overall size of the Air conditioning unit required for a room. [Refer to drawing #1 and Sheet #1]. (8 marks)
 - Number of people in the room 4
 - Height of building 2.5m
 - 4 by 20 watts of lights present in the room
 - Window area for each is 1.5m by 1m with clear glasses only
 - Door are being 2.0m by 0.6m
 - Normal flat ceiling [non insulated]
 - Normal floor [un carpeted]
 - Concrete walls
4. Explain what Refrigeration is and list down 3 safety precautions while using a refrigerator. (4 marks)

SECTION D:

(25 marks)

1. With the aid of a diagram, explain what is Induction Heating? (5 marks)
2. A metal plate 15mm thick and 250cm² in area, having a relative permittivity of 2 and power factor of 0.1 is to be heated using dielectric heating. The power required is 500W and a frequency of 20MHz is used. Determine
 - a. The voltage required
 - b. The current flow through the material.(8 marks)
3. Explain what is Indirect Resistance heating and list down two advantages of electric resistance furnaces. (4 marks)
4. Draw and explain the Refrigeration cycle. (8 marks)

ROOM AIR CONDITIONER HEAT LOAD ESTIMATE

STEP	HEAT SOURCE	“A” m ²	“B” Multiplying factor (Watts per square metre)				“C” Watts Cooling Load = “A” x “B”	
1.	Area of Glass Window. Select the window which gives the largest value of A x B facing:		No Awnings, Curtains and Blinds	No Awnings Yes Curtains Yes Blinds	Yes Awnings, Curtains and Blinds	Fully Shaded eg. Patio, Carport		
	Window No 1.							
	South		120	95	65	60		
	Sth East or Sth West		380	260	130	60		
	East or West		430	300	145	60		
	North		270	190	100	60		
	Nth East or Nth West		370	260	130	60		
	Window No 2.							
	South		120	95	65	60		
	Sth East or Sth West		380	260	130	60		
	East or West		430	300	145	60		
	North		270	190	100	60		
	Nth East or Nth West		370	260	130	60		
	2.	Outside Wall Area less window						
		Wall No. 1		Brick, brick veneer	Exposed to sun		35	
			Weatherboard, fibro	Exposed to sun		40		
			Brick, brick veneer weatherboard, fibro	Not exposed to sun		15		
Wall No. 2			Brick, brick veneer	Exposed to sun		35		
			Weatherboard, fibro	Exposed to sun		40		
			Brick, brick veneer weatherboard, fibro	Not exposed to sun		15		
Wall No. 3			Brick, brick veneer	Exposed to sun		35		
			Weatherboard, fibro	Exposed to sun		40		
		Brick, brick veneer Weatherboard, fibro	Not exposed to sun		15			
3.	Door Area		Closed when not in use			100		
4.	Internal Wall Area							
	Wall No. 1					8		
	Wall No. 2					8		
	Wall No. 3					8		
5.	Floor Area		Uncarpeted			12		
			Carpeted			6		
6.	Ceiling Area (same measurement as floor area)		Uninsulated			50		
			Insulated			8		
7.	Number of People Living in household		Sitting or Sleeping			120 per person		
			Active			250 per person		
8.	Lights and Appliances Eg. Television, Audio System, Fridge, lighting		Calculate total power in watts					
9.	SENSIBLE COOLING LOAD (WATTS)		TOTAL “C” =					
10.	Required Thermal Cooling Capacity		Sensible total x 1.3 ÷ 1000 =					

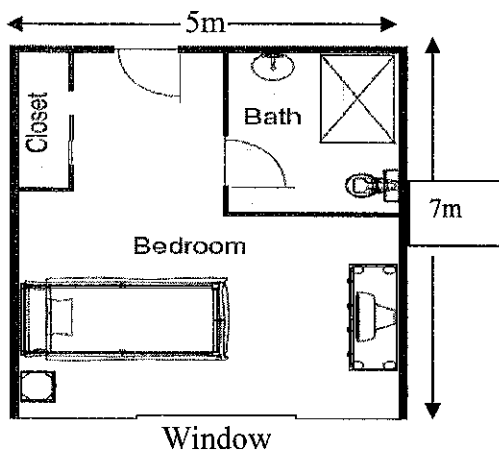
Table 1

Residential Tariff	Tariff Price – VAT Exclusive
Monthly usage \leq 85 kWh – cents per kWh per month	17.20 cents
Monthly usage $>$ 85 kWh – cents per kWh per month	33.1 cents

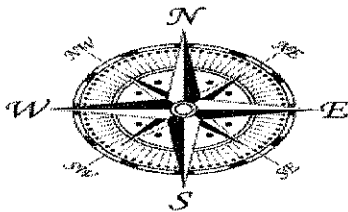
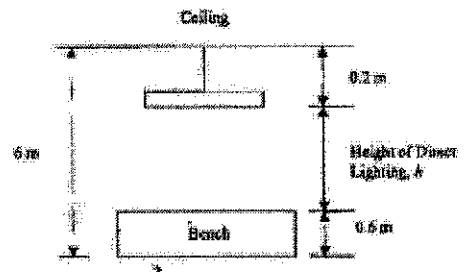
Table 2

Commercial Tariff	Tariff Price – VAT Exclusive
Units up to 14,999kWh – cents per kWh per month	39.90 cents
Units over 14,999kWh – cents per kWh per month	41.80 cents
Excess Reactive Energy – cents per kVarh per month	41.80 cents

Drawing 1



Drawing 2



-----THE END-----