



**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY**  
**SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**  
**TRADE DIPLOMA IN ELECTRICAL ENGINEERING (ELECTRICAL & RENEWABLE) -**  
**STAGE 5**

**EEE575 ELECTRICAL POWER UTILISATION AND DESIGN**

**FINAL EXAMINATION – TRIMESTER 2, 2016**

**Duration: 2 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:****Tariff****(25 marks)**

1. List down the five [5] requirements of a Tariff. (5 marks)
2. List and elaborate on any three characteristics of a Tariff. (6 marks)
3. There are different Tariff structures been followed all throughout the world. Choose any two types of Tariff structure. Explain and state one advantage and one disadvantage of using such type of tariffs. (6 marks)
4. In a Domestic installation where Residential Tariff is used, a kWh meter established 500 765kWh. The previous monthly reading was 500 670 kWh. (Refer to Table 1)
  - a. Calculate the cost of energy for the current month. (2 marks)
  - b. If the current monthly reading was 500 745 kWh, than what will be charge for that month. (2 marks)
5. A commercial business whose maximum demand for a month was 100kW, you as an owner was given the following bill for a month:

Tariff Description	Present	Previous	Billed Days
Com Step 1	8385	5685	32
Reactive Units	4720	3040	32

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

**SECTION B:****Lighting****(25 marks)**

1. In a factory bench as shown in Drawing 2 in last page, where good lighting is required, a 900 lux light source is recommended. A lighting system is chosen where 2 x 60W daylight fluorescent lamp fittings are to be used. Each 60W lamp emits 3600lm. The fitting provide direct lighting. The illumination area of factory is: Length – 20m, Width – 10m, Height – 6m.  
The working area is 600mm above the floor.  
The Utilization factor is 64%, the lamp lumen factor is 80%, Luminaire MF = 85% and Room Surface MF = 90%.  
Using Zonal Cavity Method for Indoor Lighting, calculate the following:
  - a. Height of direct lighting (1 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. Using a simple calculation elaborate on the **Inverse Square Law**. (3 marks)
3. Energy efficiency in lighting systems is very important. List down three primary considerations which support the statement. (6 marks)
4. Explain the following basic parameters and terms in lighting system
  - a. Luminous Flux
  - b. Illuminance [E]
  - c. Installed Load Efficacy
  - d. Color Rendering Index
  - e. Luminaire (5 marks)
5. Explain the following control gear, state its function/s and its application/s
  - a. Ignitors
  - b. Ballast (4 marks)

**SECTION C:                      AC and Refrigeration                      (25 marks)**

1. The Heating, Ventilation and Air Conditioning (HVAC) and refrigeration system transfers the heat energy from or to the products or building environment. Draw and elaborate on the different heat transfer loops in refrigeration cycle. (7 marks)
2. List and further elaborate on any two types of Refrigeration System (4 marks)
3. List any two types of compressors and state its application (4 marks)
4. List down the 4 major components of an Air Conditioner and explain its function. (5 marks)
5. Explain what Refrigeration is and list down 3 safety precautions while using a refrigerator. (5 marks)

**SECTION D:                      Heat Energy and Energy Management                      (25 marks)**

1. List down four [4] energy efficiency measures in Buildings for **Lighting System**. (4 marks)
2. Explain the term "Building Management System (BMS)". (2 marks)
3. Sketch and describe the operating cycle of a " **Combined Cycle Power Plant [CCPP]** (4 marks)
4. A metal plate 1.5cm thick and 250cm<sup>2</sup> 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)
5. Explain what is Indirect Resistance heating and list down two advantages of electric resistance furnaces. (4 marks)
6. List down three energy saving opportunities in terms of light design. (3 marks)

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

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

Demands between 75kW – 500kW	Tariff Price – VAT Exclusive
Demand Charge – dollars per kW per month	\$34.39
Energy Charge cents per kWh per month	27.07 cents
Excess Reactive Energy – cents per kVarh per month	41.80 cents

Drawing 2

