



**COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING**

TRADE DIPLOMA IN ELECTRICAL ENGINEERING, STAGE 5

EEE576 ELECTRICAL CIRCUIT DESIGN AND APPLICATION

EXAMINATION (TRIMESTER 2, 2016)

DATE/TIME/ROOM – Refer to Exam Timetable

INSTRUCTIONS TO CANDIDATES

1. You are allowed 10 minutes extra time during which you are not to write.
2. Write all your answers in the allocated Answer Booklet.
3. Begin each answer on a fresh new page and use both sides of the sheets.
4. Write your identification number on the top of each attached sheet.
5. Insert all written foolscaps, graph paper, drawing paper, etc in their correct sequence and secure with string provided.
6. For all sheets of paper in which has been done, cross it through and you must attach to your answer script.
7. Write clearly the number(s) of the question(s) attempted on the top of each sheet and in the back flap of your answer booklet.
8. There are 6 Compulsory Questions in this Exam Paper.

Q1	Electrical Supply Networks	15 Marks
Q2	Maximum Demand Calculation	21 Marks
Q3	Circuit Designing/Protection	20 Marks
Q4	Circuit Protection	15 Marks
Q5	Alarms	12 Marks
Q6	Measurement in Power System	17 Marks
		100 Total Marks

QUESTION 1 - ELECTRICAL SUPPLY NETWORKS (15 MARKS)

- 1.1 An eight storey commercial building requires a transformer supplying each levels. Each levels require 2 distribution boards. Design by sketching a typical *Single Rising Main* for this application. State 2 advantages of the *single rising main* type of supply. (5 marks)
- 1.2 In Fiji, our supply is generated and distributed in AC (alternating current), discuss the three reasons why this is so. (5 marks)
- 1.3 Discuss upon three main advantages of three phase supply over single phase ones. (5 marks)

QUESTION 2 - MAXIMUM DEMAND CALCULATION (21 MARKS)

- 2.1 Determine the maximum demand and the mains aerial cable size if connected through a circuit breaker for a single phase, domestic installation that comprises :
 - 30 x lighting points
 - 3 x 15A plug socket outlets
 - 8 x single and 4 x double 10A socket outlets
 - 1 x 4kW range
 - 4.8 kW controlled-load water heater
 - 8 x 300W floodlights in swimming pool area. (16 marks)

Tabulate your answer using the header as shown below :

Load ref	Load Group Description	Calculation	Demand (A)
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- 2.2 You are to install a 240V/4kW motor 120 metres from the nearest distribution board. Using Table C7, determine the correct cable size necessary to carry this motor current with a maximum voltage drop of 2.5%. Use Table C5 to determine the correct circuit breaker rating that must be used if the cable is to be put in a conduit (thermal insulation completely surrounded). (5 marks)

QUESTION 3 - CIRCUIT DESIGNING/PROTECTION (20 MARKS)

3.1 The five main factors affecting an electrical installation are *External Influence, Intended Use, Maximum Demand, Sources of Harmonic Current* and *Circuit Arrangements*. Briefly discuss how these five factors determine the success of an installation.

(10 marks)

3.2 Distinguish the features of a *ring main* and a *radial main* system. Use sketches to elaborate your discussion.

(10 marks)

QUESTION 4 - CIRCUIT PROTECTION (15 MARKS)

4.1 Discuss the reasons for an earthing system in any electrical network. What are the features of a TT System (Directly Earthed Neutral).

(5 marks)

4.2 Discuss the difference between a Current ELCB and a voltage ELCB. Use diagram to show the difference.

(10 marks)

QUESTION 5 - ALARM SYSTEMS (12 MARKS)

5.1 Briefly discuss the reasons for having alarm systems in homes and the concept behind the best places to install alarms in homes.

(4 marks)

5.2 Discuss the principles of an ionization type of smoke detector.

(8 marks)

QUESTION 6 - MEASUREMENTS IN POWER CIRCUITS (17 MARKS)

6.1 *Instrument transformers* play a vital role in the display of data/measurement in electrical networks. State the three main tasks of *instrument transformers*.

(3 marks)

- 6.2 A bar type current transformer which has 1 turn on its primary and 200 turns on its secondary is to be used with a standard range ammeter that has an internal resistance of 0.5Ω . The ammeter is required to give a full scale deflection when the primary current is 600 A.

Determine :

- (a) the secondary current (1.5 marks)
 - (b) the voltage across the ammeter (1.5 marks)
 - (c) the secondary voltage if the CT is used on a 415V three phase power line. (2 marks)
 - (d) Comment on your answer in (c) , what does it tell you about CTs and what can be done to minimize the danger, if any? (2 marks)
- 6.3 (a) Show using diagram how you can ground a CT for metering on both sides of a transformer . (5 marks)
- (b) How do you distinguish grounding for relays and meters/instruments? (2 marks)