



FNU FIJI NATIONAL UNIVERSITY

**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY.
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING.**

**PROGRAMME: C4EL 1 - CERTIFICATE IV IN ELECTRICAL
ENGINEERING-STAGE 3**

**UNIT CODE: EEE451 - ELECTRICAL MEASUREMENTS AND
MACHINES.**

FINAL EXAMINATION

TRIMESTER 1, 2017 ROOM: AS PER TIMETABLE

TIME: 2 HOURS & 10 MINUTES

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.**

| ANSWER ALL QUESTIONS | TOTAL: 100 MARKS. |

Question 1. (6 Marks)

Determine the application of “*three dark*” and “*two bright one dark*” types of connection procedures that can be used to synchronize smaller alternators.

Question 2. (3 Marks)

Interpret three applications for three-phase synchronous motors?

Question 3. (4 Marks)

What are the constructional differences between low-speed and high-speed alternators?

Question 4. (4 marks)

Specify four advantages of having the A.C. windings stationary and with a rotating D.C. rotor for an alternator.

Question 5. (3 marks)

A transformer has 2000 turns on the primary winding and 600 turns on the secondary. The applied voltage is 240 V. Calculate the output voltage.

Question 6. (6 marks)

Briefly interpret Iron losses and copper losses of a transformer.

Question 7. (9 marks)

Describe three types of single-phase transformer winding arrangements.

Question 8. (10 marks)

If a 415 V three phase transformer has 400 turns per phase on the primary windings and 80 turns on the secondaries. Determine the output line voltages for Star-star and Delta-delta types of connections.

Question 9. (8 marks)

A voltmeter, ammeter and wattmeter are connected to single-phase circuit, by means of the appropriate instrument transformers, and the following results are obtained:

CT ratio	100:5
PT ratio	11,000:110
Voltmeter reading	10,800 V
Ammeter reading	95 A
Wattmeter reading	872 kW

Calculate the followings:

- Actual voltage
- Current
- Volt-amperes
- Power in secondary circuit.

Question 10. (8 marks)

Briefly explain three requirements that have to be fulfilled when connecting two transformers in parallel.

Question 11. (10 Marks)

Sketch diagrams to show the metering methods of connecting current transformers and potential transformers to high-voltage a. c. circuits and label all components.

Question 12. (2 Marks)

How many poles a synchronous machine must have to be able to operate at 250 rpm at a frequency of 50 Hz?

Question 13. (2 marks)

Determine the line voltage of a 50 Hz star-connected alternator given the following details:

- a. $\phi = 0.70$ Wb/pole
- b. $k_a = 0.80$
- c. $k_p = 0.97$
- d. $N = 42$ turns/phase

Question 14. (7 marks)

Determine the capacitor size required to improve the power factor to 0.9 lagging if the motor specification is:

Line Voltage: 240V
Full load current: 10A
Power factor: 0.65 lagging.

Question 15. (10 Marks)

A 100 kVA, 4000 V/200 V, 50 Hz single-phase transformer has 100 secondary turns. Determine (a) the primary and secondary current, (b) the number of primary turns, and (c) the maximum value of the flux

Question 16. (6 Marks)

A 4500 V/225 V, 50 Hz single-phase transformer is to have an approximate e.m.f. per turn of 15 V and operate with a maximum flu of 1.4 T. Calculate (a) the number of primary and secondary turns and (b) the cross-sectional area of the core.

Question 17. (6 marks)

Draw a diagram of a brushless excitation three-phase alternator and label all its components.

THE END