



**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY  
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING  
CERTIFICATE IV IN ELECTRICAL ENGINEERING-STAGE 5  
EEE451-ELECTRICAL MEASUREMENTS AND MACHINES**

**FINAL EXAMINATION – TRIMESTER 3, 2015**

**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 QUESTION 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.**

**BRIEFLY ANSWER ALL QUESTIONS (100 Marks)****Question 1. (2 marks)**

List two types of connections that can be used to synchronize smaller alternators.

**Question 2. (3 marks)**

Briefly describe the situation when two alternators have their excitation increased and their load and power factor are fixed.

**Question 3. (4 marks)**

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

**Question 4. (5 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 5. (4 marks)**

Describe, draw, and label two main windings for a three phase synchronous machines.

**Question 6. (4 marks)**

List four advantages of having the a.c. windings stationary and with a rotating d.c. rotor for an alternator.

**Question 7. (4 marks)**

A what speed would a governor of a eight pole diesel driven alternator have to be set to enable a frequency of 50 Hz to be generated?

**Question 8. (4 marks)**

Describe alternator low speed and high speed cooling.

**Question 9. (4 marks)**

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

- $\phi = 0.70$  Wb/pole
- $k_d = 0.80$
- $k_p = 0.97$
- $N = 42$  turns/phase

**Question 10. (6 marks)**

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

**Question 11. (4 marks)**

Draw an equivalent circuit of an alternator; label all components showing and show three series components.

**Question 12.** (9 marks)

Explain phasor diagrams for unity p.f., lagging p.f. and leading p.f. loads on an alternator with the aid of sketches.

**Question 13.** (3 marks)

List three factors that determine the alternator ratings.

**Question 14.** (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 15.** (6 marks)

Briefly explain Iron losses and copper losses of a transformer.

**Question 16.** (9 marks)

Explain three types of single-phase transformer winding arrangements.

**Question 17.** (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 18.** (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 19.** (8 marks)

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

**END**