



**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY**  
**SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**  
**CERTIFICATE IV IN ELECTRICAL ENGINEERING – STAGE 3**  
**EEE451-ELECTRICAL MEASUREMENTS AND MACHINES**  
**FINAL EXAMINATION PAPER**

**TRIMESTER 3, 2016**

***INSTRUCTIONS TO STUDENTS***

*You are allowed 10 minutes Extra reading time during which you are NOT to write* □

*1. Two hours only is the time allocated for candidates to do this examination paper* □

*2. Begin each answer 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, etc. in their correct sequence and secure with string.* □

*5. For all sheets of paper on which rough/draft work has been done, cross it through and you MUST ATTACH to your answer scripts.* □

*6. Write clearly the number(s) of the question(s) attempted on top of each sheet.* □

*7. Show all workings where necessary.* □

*8. Do not use programmable calculators, especially the ones that do the conversion of number systems.* □□□

***11. ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM.***

***12. ANSWER ALL QUESTIONS.***

**TOTAL MARKS (100 MARKS)**Question 1. (3 Marks)

Sketch an ideal transformer and label all components.

Question 2. (5 Marks)

What are the major losses of a transformer and how does the load affect them?

Question 3. (2 Marks)

What is meant by the term primary and secondary windings of a transformer?

Question 4. (4 Marks)

Describe how a transformer regulates the amount of primary current required to supply a given secondary load.

Question 5. (8 Marks)

What is meant by the term leakage flux and how is it kept to a minimum.

Question 6. (4 Marks)

In your own words describe the term "rating of a transformer.

Question 7. (12 Marks)

A 120 kVA, 4800 V/240 V, 50 HZ single-phase transformer has 120 secondary turns. Determine: a) Primary current, b) secondary current, c) the number of primary turns, and d) the maximum value of the flux.

Question 8. (8 Marks)

A single-phase, 50 Hz transformer has 40 primary turns and 520 secondary turns. The cross-sectional area of the core is  $270 \text{ cm}^2$ . When the primary winding is connected to a 300-volt supply, determine, the maximum value of flux density in the core, and b) the voltage induced in the secondary winding.

Question 9. (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 10. (8 Marks)

Briefly describe a function of a voltage transformer and the primary winding and secondary winding connections when it is used for metering.

Question 11. (8 Marks)

Briefly describe the function and connection of a current transformer when it is used for metering.

Question 12. (2 Marks)

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

Question 13. (8 Marks)

Briefly explain the difference between the synchronous motor and induction motor in their principle of operations.

Question 14. (5 Marks)

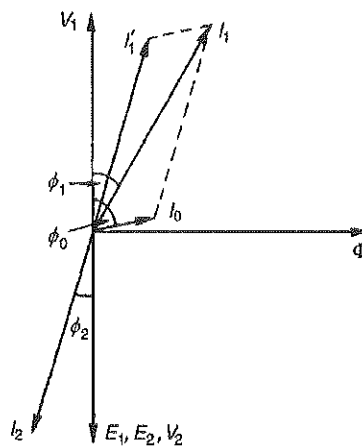
Calculate the line voltage of a 50 Hz star connected alternator given the following details: a) flux per pole in weber = 0.55 Wb/pole, b) 0.75 - a constant, dependent on winding distribution, c) 0.88 - a constant, dependent on coil pitch, d) 30 - number of turns per phase.

Question 15. (3 Marks)

What are the three basic factors that determine the rating of an alternator?

Question 16. (5 Marks)

In the diagram provided below, briefly explain the load condition of an ideal transformer



Ideal transformer on no-load.

Question 17. (5 Marks)

State five (5) conditions that must be satisfied before an alternator can be synchronized with an existing supply.

**THE END**