FNU FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRICAL ENGINEERING-STAGE 5

EEE451 ELECTRICAL MEASUREMENTS AND MACHINES

FINAL EXAMINATION PENSTER 1, 2016

DATE/DAY: TBA **TIME**: TBA

ROOM: AS PER TIMETABLE **DURATION:** 2HRS, 10MINS

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 (35 MARKS)

1. Draw and label clearly:

   (i) A basic alternator circuit (4 marks)

   (ii) A block diagram for an engine-driven standby alternator. (4 marks)

2. Draw the connection diagram for two-wattmeter 3 wire system for measurement of power and write down the formula to calculate total power. (4 marks)

3. What are the advantages and disadvantages three wattmeter 3wire system for measurement of power? (4 marks)

4. State the advantages and disadvantages of one wattmeter 4 wire system. (5 marks)

5. Explain the two types of alternator rotors used in synchronous machines. (4 marks)

6. Draw the circuit diagram showing the connection of instrument transformers. (3 marks)

7. Explain the two different methods of cooling transformers. (4 marks)

8. With aid for diagrams show the standard winding terminal polarity identification of a three phase transformer. (3 marks)

SECTION B (35 MARKS)

1. Explain with aid of a diagram the principle operation of a transformer. (3 marks)

2. An ideal transformer with a turns ratio of 2:7 is fed from a 240 V supply. Determine its output voltage. What is an ideal transformer? (2 marks)

3. What are the three factors are required for the production of voltage in a transformer. (3 marks)

4. Specify the purpose of having tap changers on transformers? (2 marks)

5. What are the advisable colors to be used on a transformer tank and state the reason for using the indicated colors? (3 marks)

6. Explain **Regulation of the Transformer** and also write down the Percentage regulation formula. (4 marks)

7. State the three requirements for connecting three phase transformers in parallel and explain the effects of each requirement. (8 marks)

8. Name two types of instrument transformers and state the reason for their use. (3 marks)

9. The secondary circuit of a transformer must never be opened when current is flowing in the primary. Briefly explain what could happen if this occurs. (3 marks)

10. What is an auto transformer? (4 marks)

SECTION C (30 MARKS)

Each Question is worth five (5) marks

1. A single-phase 500 V/100 V, 50 Hz transformer has a maximum core flux density of 1.5 T and an effective core cross-sectional area of 50 cm^2. Determine the number of primary and secondary turns.

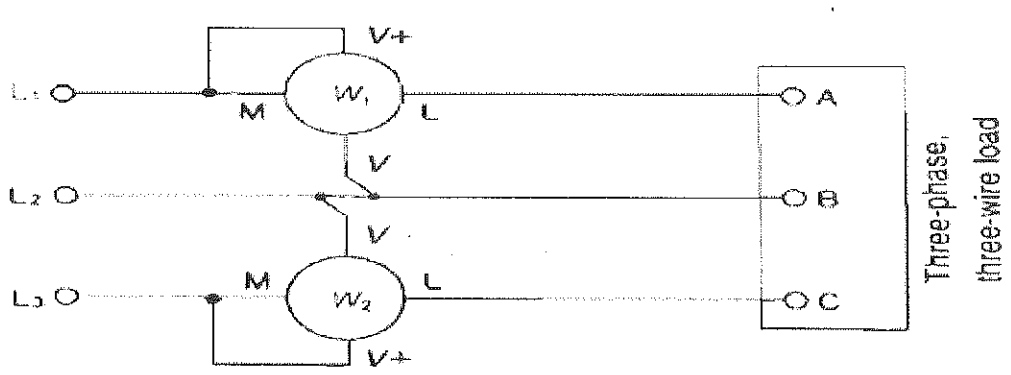
2. A single-phase transformer has 2000 turns on the primary and 800 turns on the secondary. Its no-load current is 5 A at a power factor of 0.20 lagging. Assuming the volt drop in the windings is negligible, determine the primary current and power factor when the secondary current is 100 A at a power factor of 0.85 lagging. (Use phasor diagram method)

3. A 5 kVA, 200 V/400 V, single-phase transformer has a secondary terminal voltage of 387.6 volts when loaded. Determine the regulation of the transformer.

4. A 200 kVA rated transformer has a full-load copper loss of 1.5 kW and an iron loss of 1 kW. Determine the transformer efficiency y at full load and 0.85 power factor.

5. Calculate the line voltage of a 50 Hz star-connected alternator given the following details:
   ϕ = 0.67 Wb/pole, k_d = 0.85, k_p = 0.98, N = 36 turns/phase.

6. Two watt meter 3wire system when connected to a three-phase motor, two watt meters gave readings of 5 kW and -1 kW. Find:
   (a) The total power being consumed
   (b) The power factor of the motor.



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