FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERIFICATE IV IN ELECTRICAL ENGINEERING STAGE 4
EEE447 ELECTRICAL MACHINES 1

DATE OF EXAM : 31/07/14 TIME : 9.00 to 11:10 am VENUE : JNC

INSTRUCTIONS TO CANDIDATES

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1. You are allowed an extra ten (10) minutes of reading time during which you are not allowed to write.

2. Write your answers in the answer sheet booklet provided.

3. Write your Student Identification Number at the top of each attached sheet.

4. You may use calculators provided the calculators are non programmable and silent.

5. Clearly number the questions in your answer booklet in their correct sequence and write legibly.

6. Show all working.

7. Any extra paper used whether for working or answers, must be attached to the answer booklet with the string provided.

8. There are 11 questions in this paper and answer ALL questions.

9. Total Mark is 100

1. Apply the Fleming's Left Hand Rule in the creation of a torque in a motor. Illustrate using a basic motor diagram and explaining clearly the effects of the current carrying conductor and magnetic fields.

(10 marks)

2. 2.1 Illustrate the difference between a *DC shunt motor* and *DC series motor* by drawing its circuit diagram.

(5 marks)

2.2 Determine the difference between *induction motors* and *non induction motors*. Use diagrams if possible.

(5 marks)

3. Briefly explain the following :

3.1	Squirrel Cage	(3 marks)
3.2	Rotating magnetic field	(3 marks)
3.3	Synchronous speed	(3 marks)
3.4	Slip	(3 marks)
3.5	Rotor speed	(3 marks)

4. Illustrate using vector diagram how running a motor at no load produces a very low power factor in the system and explain how you can improve this power factor?

(5 marks)

5. Field current control is the best method of speed control in separately excited motors and similarly other motors. Apply your understanding of *back emf* by explaining why you should gradually reduce speed slowly.

(5 marks)

6. A six pole induction motor runs at 1000 rpm when connected to a 60 Hz supply. Calculate the following:

6.1	synchronous speed in rpm	(1.5 marks)
6.2	slip speed in rpm	(1 mark)
6.3	percentage slip	(1.5 marks)
6.4	how do you change the rotation of a 3 phase induction motor?	(1 mark)

7. Auto transformer starters uses two auto transformer to provide reduced-voltage starting.

    7.1 Sketch a basic diagram of how these two auto-transformers are connected in an open delta configuration. (2 marks)

    7.2 How will you select any required starting voltage? (2 marks)

    7.3 With your knowledge of auto transformer starters, determine five major characteristics of it? (5 marks)

8. How is the switching over from a *start winding* to *run winding* happen in a single phase motor? Explain in terms of the mechanism in place and at what time does the changeover happen during the rotation of the motor?

    (5 marks)

9. How does a *single phase split phase motor* work? Explain in terms of a diagram, its operation, phasor diagram of the start current and run current, characteristic curve between speed and torque.

    (10 marks)

10. How does a *single phase capacitor start* motor work? Explain in terms of a diagram, its operation, phasor diagram of the start current and run current, characteristic curve between speed and torque.

    (10 marks)

11. Soft start motor starters use electronic circuitry to control the operation of induction motors.

    11.1 Demonstrate the basic speed switching sequence of soft starters in a flow Diagram and label fully. (6 marks)

    11.2 Using a *Torque vs Time* characteristic graph, illustrate by explaining how motor currents are controlled to ensure that the current never exceeds a predetermined maximum value.

    (10 marks)

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End of Examination