



**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING
CERTIFICATE IV IN ELECTRICAL ENGINEERING-STAGE 4
EEE447 ELECTRICAL MACHINES**

FINAL EXAMINATION – PENSTER 4, 2013

DATE: FRIDAY/11/10/2013 ROOM: JNC/BA TIME: 9:00 – 11:10 AM

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. Show all working where necessary.
9. ANSWER ALL QUESTIONS
10. ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM.

QUESTION 1**DC MACHINES****(25 MARKS)**

1.1 Motors and generators generally operate on the same principle where magnetism and current effects take place. Using a diagram explain how the effect of magnet and current carrying conductor can be used in the construction of an electrical motor.

(10 marks)

1.2 Briefly explain the functions of the following parts including the material the part is made up of in reference to a motor :

- (a) Brushes (3 marks)
- (b) Yoke (3 marks)
- (c) Armature (3 marks)

1.2 A 25 kW shunt-connected generator operates with a terminal voltage of 240 V. The armature has an effective resistance (R_a) of 0.18Ω and the shunt field (R_{sh}) has a resistance of 100Ω . Calculate:

- (a) The full load current. (1 mark)
- (b) The field current. (1 mark)
- (c) The total armature current (1 mark)

1.4 Draw a diagram showing the method of reversing the rotation of a shunt motor.

(3 marks)

QUESTION 2**THREE PHASE INDUCTION MOTORS****(25 MARKS)**

2.1 Outline four (4) advantages of three phase induction motors. (4 marks)

2.2 What does the rotor of an induction motor consists of? (3 marks)

2.3 Creating a rotating magnetic field is an utmost necessity in motors. Explain with the aid of diagram the difference between a rotating magnetic field in 3 phase motor and a pulsating magnetic field in a single phase motor.

(10 marks).

2.4 Induction motors are available in many different enclosures, depending on the task allotted to them. List any three different types of enclosures used in the above motors.

(3 marks)

2.5 Determine the slip four pole induction motor running at 1420 rpm when connected to a 50 Hz supply.

(5 marks)

QUESTION 3 **SINGLE PHASE INDUCTION MOTORS** **(25 MARKS)**

3.1 Compare the characteristics of a single phase motor with a three phase motor.

(6 marks)

3.2 Draw the circuit connections and label your diagram of the following single phase motors:

a) capacitor motor (3 marks)

b) capacitor start, capacitor run motor (3 marks)

c) series motor (3 marks)

3.3 List down the functions of the run capacitor in a capacitor start- capacitor run motor.

(4 marks)

3.4 Explain the method of reversing the rotation of shaded pole motors.

(3 marks)

3.5 Outline the essential differences between the two sets of stator windings (start and run) in a single phase split phase motor.

(3 marks)

QUESTION 4 MOTOR STARTERS & SOFT STARTER (25MARKS)

- 4.1 Outline the factors to be considered when selecting motor starters. (6 marks)
- 4.2 List four (4) applications for star – delta starters. (4 marks)
- 4.3 What are the major characteristics autotransformer starters? (5 marks)
- 4.4 Draw a single line diagram of a DOL starter and briefly explain its operation. (8 marks)
- 4.5 Name two typical soft start applications. (2 marks)

End of Paper