



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

**CERTIFICATE IV IN ELECTRICAL ENGINEERING
EEC424 ELECTRICAL MOTORS AND STARTERS**

DATE OF EXAM : 27/03/19 TIME : 2.00 to 4:10 pm VENUE : As per ETT

INSTRUCTIONS TO CANDIDATES

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 12 questions in this paper and answer ALL questions.
9. Total Mark is 100

1. Motors and generators generally operate on the same principle where magnetism and current effects take place. Using a single loop diagram, relate how the motor works and how the Fleming's Left Hand Rule can be used in the creation of an electrical motor movement.

(10 marks)

2. (a) Relate by drawing the circuit diagram of a *DC shunt motor* and *DC series motor*.

(5 marks)

(b) Explain the effects of increasing the rotor bar cross sectional area and double caging the squirrel cage rotors.

(5 marks)

3. Briefly explain the following :

(a) Squirrel Cage (3 marks)

(b) Synchronous speed (3 marks)

(c) Slip (3 marks)

4. A shunt-connected motor draws 20A on a 100V DC supply. If the motor field has a current of 0.5A and the armature resistance is 0.25Ω .

(a) Draw the diagram of the set up showing the details given on the diagram.

(2 marks)

(b) Find the value of the back EMF

(3 marks)

5. 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)

6. A four pole induction motor runs at 1300 rpm when connected to a 50 Hz supply.

Calculate the following:

(a) synchronous speed in rpm (1.5 marks)

(b) slip speed in rpm (1 mark)

(c) percentage slip (1.5 marks)

(d) what is *slip speed* defined as? (1 mark)

7. Alternators on load can be analysed through its circuit diagrams. Illustrate by drawing the circuit diagram of an alternator on load and draw its V_{output} vs I_{load} graph to show its characteristic at leading power factor (pf), unit pf and lagging pf.

(6 marks)

8. Specify 5 factors that determine the selection of a particular type of soft starter and illustrate by drawing the block diagram of soft starter.

(10 marks)

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

(5 marks)

10. Illustrate by explaining the operation and drawing the circuit of a star delta motor starter.

(10 marks)

11. 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)

12. How does a *single phase shaded pole* 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)

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End of Examination