



**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING
CERTIFICATE IV IN ELECTRICAL ENGINEERING - Stage 2
EEE447- ELECTRICAL MACHINES
FINAL EXAMINATION – TRIMESTER-2, 2015**

Day/Date: As per timetable Time: As per timetable Room: As per timetable

INSTRUCTIONS TO STUDENTS

- 1. You are allowed 10 minutes Extra reading time during which you are NOT to write.*
- 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 paper, 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 though and you MUST ATTACH to your answer scripts.*
- 6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
- 7. ANSWER ALL QUESTIONS.*
- 8. Show all workings where necessary.*
- 9. Do not use programmable calculators, especially the ones that does the conversions of number systems.*

SECTION A**MULTIPLE CHOICE****(20 MARKS)**

In each of the following statements one of the suggested answers is correct. Write the identifying letters beside the question numbering in your answer sheet.

1. One of the advantages of single phase motors is that it:
 - a. Requires less current
 - b. Runs faster
 - c. Can be used in three phase
 - d. Has only two windings

2. In a capacitor start capacitor run motor during starting a second capacitor is connected in:
 - a. Series with the run winding
 - b. Parallel with run capacitor
 - c. Parallel with run winding
 - d. Series with capacitor

3. Which of the following motor has a cage rotor with salient poles in the stator?
 - a. Split phase motor
 - b. Induction motor
 - c. Capacitor start motor
 - d. Shaded pole motor

4. The direction of rotation of single phase motors are achieved by:
 - a. Reversing the polarity of both windings
 - b. Reversing the polarity of any one winding
 - c. Changing to three phase
 - d. All of the above

5. Capacitor start motors are used in general purpose heavy duty applications such as:
 - a. molecule
 - b. solids
 - c. refrigerators and air conditioners
 - d. gas

6. Which of the following is the most common type of dc motor?
 - a. Permanent magnet.
 - b. Shaded pole.
 - c. Capacitor start.
 - d. Capacitor- start capacitor run.

7. Which of the following procedure reverses the direction of rotation of a dc motor?
 - a. Reverse the polarity of armature.
 - b. Change the connections of the armature
 - c. Reverse the polarity of either field or armature
 - d. All of the above.

8. What happens when the voltage applied to the field of a separately excited motor is reversed:
 - a. Motor speed increases
 - b. Motor speed decreases
 - c. Motor torque increases
 - d. Motor torque decreases.

9. Which of the following types of motor have the field winding connected in parallel with the armature?
 - a. Series motor
 - b. Shunt motor
 - c. Split phase motor
 - d. Universal motor

10. Which of the following motors has the series field winding assisting the shunt field winding:
 - a. Cumulative compound motor
 - b. Series motor
 - c. Shunt-field motor
 - d. Capacitor start motor.

11. The majority of motors used in industry are of the:
 - a. Single phase type
 - b. Capacitor start capacitor run
 - c. Split phase motor
 - d. Ac induction type

12. The no-load current of an induction motor exhibit:
 - a. A very low power factor
 - b. High power factor
 - c. High torque
 - d. Low torque

13. If the conductors are solid bars formed into a cage the rotor is referred to as.
 - a. Squirrel cage rotor
 - b. Universal motor
 - c. Shunt motor
 - d. Split phase motor.

14. The method of cooling a motor is determined by the type of::
- loads
 - motor
 - Motor enclosure
 - application
15. Low starting torque rotors have a starting torque of approximately:
- 1.5 times rated torque
 - 2.5 times rated torque
 - 2 times rated torque
 - 3.5 times rated torque
16. The purpose of having motors starters is to:
- Start the motor
 - Protect the motor
 - Switch on the motor
 - Start and protect the motor.
17. The resistors in primary resistance starter may be:
- Solid or liquid resistors
 - Hard resistors
 - Small resistors
 - Power resistors
18. _____ are usually provided on transformers to enable selection of required starting voltage:
- Selector
 - switch
 - buttons
 - taps
19. _____ method of starting is suitable for small motors:
- star delta starter
 - primary resistance starter
 - secondary resistance starter
 - DOL starter
20. The most common application for wound rotor motors is in:
- Overhead cranes
 - Air conditioners
 - Lathes
 - Refrigerators.

SECTION B-----SHORT ANSWERS -----50 MARKS

1. Name 6 parts of a motor. (3 marks)

2. Outline the advantages of a single phase motor. (4 marks)

3. Why do single phase motors have problem with starting compared to three phase motors. (3 marks)

4. What is the purpose of a run capacitor in a capacitor –start capacitor run motor? (3 marks)

5. List four (4) observations made as load is added to a three phase induction motor. (4 marks)

6. Draw the circuit diagram, the load/speed and load/torque graphs of a shunt-field motor. (6 marks)

7. Show with aid of a circuit diagram the method of reversing the rotation of a compound motor. (5 marks)

8. Outline the specific uses \ application of the following types of generators:
 - a) separately excited permanent magnet (1 mark)
 - b) wound field (1 mark)

9. List two advantages of autotransformers (3 marks)

10. Draw the control part of a DOL starter and state its operation. (6 marks)

11. Outline the factors to be considered when selecting the type of starters. (5 marks)

12. Show the circuit connections of star and delta connected system. (6 marks)

SECTION C-----CALCULATIONS-----30 MARKS

1. A 20 kW shunt-connected generator operates with a terminal voltage of 240 V. The armature has an effective resistance (R_a) of 0.16Ω and the shunt field (R_{sh}) has a resistance of 110Ω .

Calculate:

- (a) The full load current. (2 marks)
(b) The field current. (2 marks)
(c) The total armature current (2 marks)
(d) The induced armature volt (3 marks)
2. A transformer has 500 primary turns and 3200 secondary turns. If the primary voltage is 240V, determine the secondary voltage, assuming an ideal transformer. (3 marks)
3. An ideal transformer has a turn's ratio of 8:1 and the primary current is 3A when it is supplied at 240V. Calculate the secondary voltage and current. (4 marks)
4. A 415 volt Three phase induction motor draws a current of 155 Amps when connected to a DOL starter.If a primary resistance starter is connected to the motor so that the voltage to the motor is reduced to 285 V for starting ,determine the :
- (a) Percent of rated voltage applied to the motor during starting.
(b) Starting current taken by the motor.
(c) Percentage of DOL starting torque produced. (6 marks)
5. The armature of a 4-pole armature contains a total of 320 effective conductors. Given the magnetic flux as 0.02 Webers per pole and the speed rotation 1440 rpm,find the value of generated voltage, for both ,lap and wave wound. (4 marks)
6. A three-phase two-pole induction motor is connected to a 50 Hz supply. Determine the synchronous speed of the motor in rev/min (4 marks)

.....THE END.....