



# **MURANG'A UNIVERSITY OF TECHNOLOGY**

## **SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS  
ENGINEERING**

**UNIVERSITY ORDINARY EXAMINATION**

**2023/2024 ACADEMIC YEAR**

**FIRST YEAR SECOND SEMESTER EXAMINATION DIPLOMA IN  
ELECTRICAL AND ELECTRONICS**

**CODE : ENG/OS/PO/CC/03/6**

**UNIT – APPLY ELECTRICAL PRINCIPLES**

**DURATION: 3 HOURS**

### **INSTRUCTIONS TO CANDIDATES:**

1. Answer question **ALL** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

## SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

### QUESTION ONE (40 MARKS)

- a. State any three properties of refrigerants. (3marks)
- b. State any two causes and two remedy of the following faults in DC generator.
  - i. No voltage at the terminal.
  - ii. Sparking brushes. (4marks)
- c. Derive the e.m.f generated equation in DC generator. (4marks)
- d. Outline any three application of DC shunt motor. (3marks)
- e. State three method of cooling transformer. (3marks)
- f. With an aid of diagram explain capacitor start capacitor run single phase Induction motor. (5marks)
- g. State four advantages of using three phase transformer over single phase transformer. (4marks)
- h. A pure inductance of 150mH is connected in parallel with a  $40\mu F$  capacitor across a 50v, variable frequency supply. Calculate:
  - i. The resonance frequency of the circuit.
  - ii. The current circulating in the capacitor and inductance at resonance. (6marks)
- i. Explain three methods of measuring power in three phase systems. (6marks)
- j. State any two methods of power factor improvement. (2marks)

## SECTION B – ANSWER ALL QUESTIONS IN THIS SECTION

### QUESTION TWO (20 MARKS)

- a. Define the following terms: (4marks)
  - i. Refrigeration
  - ii. Air conditioning
- b. With the labelled diagram, describe construction and operation of vapour absorption type refrigeration system. (6marks)
- c. Explain three factors to be considered when calculating cooling load. (6marks)
- d. A refrigeration system has got temperatures of  $10^{\circ}\text{C}$  and  $-10^{\circ}\text{C}$  for the compressor and the evaporator sides, respectively. Its cooling load is 7ton. Calculate.
  - i. Coefficient of Performance (COP)
  - ii. Power required to drive the compressor. (4marks)

### QUESTION THREE (20 MARKS)

- a. State two methods of minimizing Armature reaction. (2marks)
- b. Proof  $T_a = 0.159 \frac{\phi Z I_a P}{A}$  (6marks)
- c. With a well labelled diagram, describe the construction of a D.C machines. (6marks)
- d. A D.C series motor having a resistance of  $1\Omega$  drives a fan which the torque varies as the square of the speed. At 220V, the set king at 350 rpm and takes 25A/ the speed are to be raised to 500rpm by increasing the voltage. Calculate the necessary voltage. Calculate the necessary voltage and the corresponding current assuming the field to be unsaturated. (6marks)

### QUESTION FOUR (20 MARKS)

- a. Outline three advantages of three phase induction motor over single phase induction motor. (3marks)
- b. Three load each of resistance  $30\Omega$  are connected in star to a 415V, 3 phase supply, calculate:
  - i. The system phase voltage.
  - ii. The phase current.
  - iii. The line current. (6marks)
- c. At 440V,  $3\phi$ , 50Hz, 4 poles, stars connected induction motor has a full-load speed of 1425rpm. The motor has an impedance of  $(0.4, + j4)$  ohm and rotor/stator, turn ratio of 0.8. Calculate.
  - i. Full-load torque
  - ii. Rotor current and full-load rotor Cu loss.
  - iii. Power output if windage and friction losses amount to 500W.
  - iv. Maximum torque and the speed at which it occurs.
  - v. Starting current
  - vi. Starting torque

(11marks)