

TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

Department of Electrical and Electronic engineering

Diploma in Electrical Power Engineering

Electrical Machines I

EEP 2204

TIME: 2 HOURS

SERIES: AUGUST 2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions;. Attempt any **THREE** Questions.

Do not write on the question paper.

Question ONE

- (a) (i) State faradays laws of electromagnetic induction
(ii) State Lenz law
(6 marks)
- (b) Describe with the aid of a diagram the construction of a D.C machine
(6 marks)
- (c) (i) A 4-pole generator has a lap-wound armature with 50 slots with 16 conductors per slot. The useful flux per pole is 30mWb. Determine the speed at which the machine must be driven to generate an e.m.f. of 240 V.
(8 marks)

Question TWO

- (a) (i) State the DC machine classifications
(ii) Draw the characteristic curves of terminal voltage versus load current for the different classifications of D.C generators
(iii) Draw the characteristic curves of speed versus load torque for the different classifications of D.C motors
(10 marks)
- (b) Explain how speed control is achieved in DC machines
(4 marks)
- (c) An 8-pole, lap-wound armature has 1200 conductors and a flux per pole of 0.03Wb. Determine the e.m.f. generated when running at 500 rev/min when it has a
(i) Lap winding
(ii) Wave Winding
(6 marks)

Question THREE

- (a) (i) With the aid a diagram and waveforms show that a three phase winding connected to a three-phase supply produces a rotating magnetic field.
(ii) State two characteristics of the field in 3 (a) (i) above
(10 marks)
- (b) Explain how torque is produced in an induction motor
(6 marks)
- (c) (i) Explain why an induction motor takes a high starting current
(ii) Explain why an induction motor cannot run at synchronous speed
(4 marks)

Question FOUR

- (a) Explain why single phase motors are not self-starting (3 marks)
- (b) With the aid of diagrams explain three methods of starting single phase induction motors (9 marks)
- (c) Draw the equivalent circuit diagram of a single-phase induction motor at standstill (4 marks)
- (d) Explain the operation of the shaded pole motor (4 marks)

Question FIVE

- (a) Define slip in induction machines (2 marks)
- (b) Draw the torque speed characteristics of an induction motor (4 marks)
- (c) (i) Explain why the three phase induction motor draws heavy current at starting
(ii) State why a starter is necessary for an induction motor name the types of starters used. (8 marks)
- (d) A three-phase induction motor is supplied from a 50 Hz supply and runs at 1200 rev/min when the slip is 4%. Determine its synchronous speed. (6 marks)