

TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Engineering and Technology
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
DIPLOMA IN ELECTRICAL POWER ENGINEERING (DEPE4)

EEP 2204
ELECTRICAL MACHINES I

END OF SEMESTER EXAMINATIONS

SERIES: APRIL, 2016

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

- 1. You should have the following for this examination:**
 - **Answer Booklet**
 - **A Non-programmable Scientific Calculator**
- 2. This paper consists of FIVE Questions**
- 3. Answer ANY THREE Questions**
- 4. All questions carry equal marks.**
- 5. This paper consists of THREE printed pages.**

Question ONE

a) State:

- i. Ohm's law for magnetic circuit.
- ii. What is meant by electromagnetic torque in motors?

(6 marks)

b) Describe the voltage equation of a motor

(6 marks)

c) A 4 pole wave wound motor is connected to a 250V d.c supply. The armature has 700 conductors and a resistance of 0.5Ω . and the flux per pole value of 0.03wb. Determine:

- i. The armature current if motor speed is 320 r.p.m
- ii. Torque developed at the above stated speed

(8 marks)

Question TWO

(a) Explain how torque is produced in an induction motor

(5 marks)

(b)

- i. Explain why an induction motor takes in a high starting current.
- ii. Explain why a synchronous motor cannot run at synchronous speed. **(5 marks)**

(c)

- i. Define synchronous speed
- ii. Describe the working principle of an Induction motor
- iii. State why Three Phase Induction motors are self-starting and why Single Phase induction motors are not self-starting

(10 marks)

Question Three

(a) State:

- i. Lenz law
- ii. Back EMF

(4 marks)

(b) Describe the three principal losses in DC machines

(8 marks)

(c) An 8 pole d.c generator has 800 conductors and a flux per pole of 0.04wb. Determine the EMF generated if it runs at 300 rev/min and is:

- i. Wave wound
- ii. The speed it must run to produce the same e.m.f when lap wound

(8 marks)

Question FOUR

(a) State the EMF equation of a generator clearly differentiating between the wave wound and the lap wound generators

(6 marks)

(b) Explain how speed control is achieved in DC machines

(4 marks)

(c)

- i. With the aid of 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 this field.

(10 marks)

Question FIVE

(a) Define slip in Induction machines

(2 marks)

(b) Draw the equivalent circuit diagram of a single phase induction motor at stand still

(4 marks)

(c)

- i. A three phase 4 pole induction motor has a synchronous speed of 30 rev/s.
Determine the frequency of the supply to the stator winding.
- ii. An 8 pole three phase 415 volts, 50Hz induction motor has a full load slip of 3.5%. Determine:
 - I. The synchronous speed
 - II. Rotor speed
 - III. Frequency of rotor currents at slip 0.04
 - IV. Rotor frequency when rotor runs at 520r.p.m
 - V. Rotor current frequency at standstill

(14 marks)