



MACHAKOS UNIVERSITY

University Examinations for 2016/2017
SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL
AND ELECTRONICS ENGINEERING

EED 214: ELECTRICAL MACHINES II

DATE: 30/5/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

This paper consists of FIVE Questions. Answer Question ONE and ANY OTHER TWO questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) State **FOUR** Comparison between Synchronous and Induction Motor. (4 marks)
- (b) Define slip for an induction motor. (2 marks)
- (c) State **FOUR** types of single phase induction motors. (4 marks)
- (d) State and explain **TWO** starting methods of a synchronous motor. (6 marks)
- (e) State **FIVE** applications of synchronous motor. (5 marks)
- (f) 3-phase, 6 pole, Y-connected, 50Hz, 240V connected induction motor delivers 15 kW at a slip of 5%.

Calculate the following:

- i. Synchronous speed.
- ii. Rotor speed.
- iii. Frequency of Rotor current. (9 marks)

QUESTION TWO (20 MARKS)

- a) Derive the frequency of rotor currents and voltages for an induction Motor. (6 marks)
- b) The frequency of the supply to the stator of an 8-pole induction motor is 50 Hz and the rotor frequency is 3 Hz. Determine the slip and the rotor speed. (6 marks)
- c) With a neat equivalent circuit diagram, explain the component for an induction motor. (8 marks)

QUESTION THREE (20 MARKS)

- a) State three applications of Capacitor-Start Motor. (3 marks)
- b) Describe the working principle of a stepper motor (5 marks)
- c) Explain the working principle of Capacitor-Start Capacitor-Run Motor. (12 marks)

QUESTION FOUR (20 MARKS)

A 460 V, 25 hp, 60 Hz, four pole, Y-connected induction motor has the following impedances:

$$R_1 = 0.641 \, \Omega$$

$$R_2 = 0.332 \, \Omega$$

$$X_1 = 1.106 \, \Omega$$

$$X_2 = 0.464 \, \Omega$$

$$X_m = 26.3 \, \Omega$$

The total rotational losses (including core losses) are 1100 W for a slip = 2.2%, find:

- i) The speed.
- ii) The converted and output power
- iii) The stator current.
- iv) The induced and load torque
- v) Power factor
- vi) Efficiency (20 marks)

QUESTION FIVE (20 MARKS)

- a) Explain with the aid of explain the working principle of Capacitor-Start Motor: (10 marks)
- b) State and explain types of losses in an induction motor. (10 marks)