MACHAKOS UNIVERSIT

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND EXAMINATION FOR DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

SUPPLEMENTARY EXAMINATION

EED 214: MACHINES II

DATE: 1/9/2017 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

Attempt the compulsory Question in section A and any Two Questions in section B.

SECTION A.

1. (a) With the aid of a diagram describe the construction of a squirrel cage rotor of a three-phase induction motor. (7 marks)

(b) Explain the following terms with regard to squirrel cage induction motors

(i) Crawling

(ii) Cogging (6 marks)

(c) A three- phase slip-ring Induction motor with star-connected rotor has an induced emf of 180V between slip-rings at standstill with normal voltage applied to the stator. The rotor windings has a resistance per phase of 0.5Ω and standstill leakage reactance per phase of 2.0 Ω .

Calculate (i) Rotor current per phase when running short - circuited with 4% slip.

(ii) The slip and

(iii) Rotor current per phase when the rotor is developing maximum torque.

(7 marks)

d) Explain with the aid of a diagram the method of self synchronizing a synchronous motor coupled to an induction pony motor. (10 marks)

SECTION B: ANSWER ANY OTHER TWO QUESTIONS

2. (a) State any three advantages of a three phase induction motor. (3 marks)

b) i) State three conditions to be met before a machine can be synchronized with an incoming three phase power supply. (3 marks)

ii) With the aid of a diagram explain the lamps in sequence method of synchronizing a synchronous machine with a three-phase voltage supply

(6 marks)

c) A three-phase Induction motor having a 6-pole star - connected stator winding runs on 415V ,50Hz supply. The rotor resistance and standstill reactance are 0.15Ω and 0.95Ω per phase.The ratio of stator to rotor turns is 1.8. The full load slip is 4%.

Calculate (i) The developed torque at full load.

(ii) Maximum torque

(iii) Speed at maximum torque. (8 marks)

3. (a) Define the following terms

(i) Synchronous speed

ii) Slip (4 marks)

(b) With the aid of wave form and phasor diagrams explain the production of a rotating magnetic field in a three-phase induction motor. (10 marks)

c) Show with aid of power and control circuit diagrams the star-delta method of starting a three -phase Induction motor. (6 marks)

4. a) Explain the principle of operation of a three phase synchronous motor

(9 marks)

b) Define the following terms with regard to synchronous motors

(i) Load angle
(ii) Pull-out torque (4 marks)

c) A three-phase, 2300V ,star-connected synchronous motor has a resistance of 0.2Ω per phase and a synchronous reactance of 2.2Ω per phase. The motor is operating at 0.5 power factor leading with a line current of 200A. Determine the value of the generated emf per phase. (7 marks)

5. (a) Describe the production of torque on the rotor conductors of a three- phase induction motor (5 marks)

(b) Explain with the aid of a torque-speed characteristics and circuit diagram the rotor resistance starter method for starting a three-phase would- rotor induction motor. (9 marks)

(c) A three –phase 50 Hz, 8-pole induction motor runs at a speed of 710rpm with an input power of 35 KW. The stator losses are 1200 W while the rotational losses are 600W. Calculate the

i) Rotor copper loss

ii) The gross torque deve

iii) The net torque. (6 marks)