MACHAKOS UNIVERSITY COLLEGE

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER SUPPLEMENTARY EXAMINATIONS FOR DIPLOMA IN ELECTRICAL AND ELECTRONICE ENGINEERING

PAPER CODE EED 214 MACHINES II

TIME; 2 HOURS 29th/06/2016.

Attempt any THREE Questions

Q1 (a) With the aid of a diagram describe the construction of a squirrel cage rotor of a three-phase induction motor (7mks)

(b) State any three advantages of three phase induction motor. (3mks)

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

Q2 (a) Define the following terms with regard to synchronous motors

(i) Load angle

(ii) Pull-out torque (4mks)

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

(ii) With the aid of a diagram explain the lamps in sequence method of synchronizing a synchronous machine with a three-phase voltage supply (6mks)

c) A factory with three-phase load of 840 KVA at a power factor of 0.65 lagging, has an additional load of 380 hp that is met by installation of a synchronous motor operating at an efficiency of 87% and also used to improve the power factor of the factory to 0.90 lagging.

Calculate the leading power factor that the synchronous motor must be operated at (7mks)

Q3 (a) Define the following terms

(i) Synchronous speed

(ii) Slip (4mks)

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

c) A three phase-, 415V, 50Hz ,6-pole star-connected induction motor has a full load slip of 4%. The motor resistance and stand still reactance are 0.12Ω and 0.85Ω per phase. The ratio of stator to rotor turns is 1.8.

Calculate

i) The full load torque

ii) The maximum torque

iii) The speed at maximum torque (6mks)

Q4 (a) Explain the principle of operation of a three phase synchronous motor. (8mks)

b) Show with the aid of a power and control diagram the direct-on- line starter method for starting a three-phase induction motor. (5mks)

c) A three-phase 6.6KV synchronous motor works at a constant voltage and constant excitation. Its synchronous reactance is 20Ω per phase and armature resistance negligible when the input power in 1000KW with a power factor of 0.8 leading. When the input power in increased to 1500KW, calculate

(i) The load angle

(ii) The power factor (7mks)

Q5 (a) Describe with aid of diagram the operation of a three- phase induction motor (5mks)

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 (9mks)

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 developed

iii) The gross mechanical power developed

iv)The net torque. (6mks)