TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING (Y2 S2)

EEP 2251: ELECTRICAL MACHINES & UTILIZATION II

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions. Answer question **ONE (compulsory)** and any other **TWO** questions

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Define "synchronous motor" **(1 mark)**

b) State any TWO applications of synchronous motor. **(2 marks)**

c) Describe how the synchronous motor is started. **(4 marks)**

d) A 3-phase synchronous motor has 12 poles and operates from 440V, 50Hz supply:
- **(i)** Calculate its speed
- **(ii)** If it takes a line current of 100A at 0.8 p.f leading, determine the torque the motor will be developing. **(9 marks)**

e) Compare the 3-phase synchronous motor and 3-phase induction motor on criteria of:
- **(i)** Speed
- **(ii)** Power-factor
- **(iii)** Excitation
- **(iv)** Economy
- **(v)** Self-starting
- **(vi)** Construction **(14 marks)**

Question Two

a) State another name for "synchronous generator" **(1 mark)**

b) A 1500KVA, 6.6KV, 3-phase, star connected synchronous generator has a resistance of 0.5 Ω per phase and a synchronous reactance of 5 Ω per phase. Calculate the voltage regulation for:
- **(i)** Unit p.f
- **(ii)** 0.8 p.f lagging **(9 marks)**

c) Describe the following types of 3-phase synchronous generators:
- **(i)** Salient pole type
- **(ii)** Non-salient pole type

Illustrate your answer with the aid of labeled diagrams. **(10 marks)**

Question Three

a) Define "slip" **(1 mark)**

b) The torque developed by an induction motor is 45Nm at a rotor speed of 1440 r.p.m Calculate the power developed at this speed. **(3 marks)**

c) Explain the principle of operation of 3-pase induction motor **(7 marks)**

d) A 3-phase induction motor is wound for 4 poles and is supplied from a 50Hz system. Calculate:
   (i) The synchronous speed
   (ii) The speed of the rotor when the slip is 4%
   (iii) The rotor frequency when the speed of the rotor is 600 r.p.m **(9 marks)**

Question Four

a) Define "maintenance" **(1 mark)**

b) Describe:
   (i) Breakdown maintenance
   (ii) Planned preventive maintenance **(3 marks)**

c) State ONE symptom and corrective remedy for each of the following causes of electrical system failures:
   (i) Power-failure
   (ii) Over-voltage
   (iii) Under-voltage
   (iv) Poor-quality power supplies
   (v) Short-circuits
   (vi) Loose connections
   (vii) Wrong operations procedure
   (viii) Unfavourable working environment **(16 marks)**

Question Five

a) Define "electric shock" **(1 mark)**

b) State any SIX contents of a First-Aid Box **(6 marks)**

c) Describe the following types of motor drives:
   (i) Group drives
   (ii) Individual drives **(6 marks)**

d) Explain why:
   (i) Water-type fire-extinguisher is not suitable for dealing with electrical fires
   (ii) Electricity is usually transmitted at high voltages **(7 marks)**