TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS 2013/2014
FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

EE 2415: ELECTRICAL MACHINES V

Year IV Semester II SUPPLEMENTARY/SPECIAL EXAMINATIONS
SERIES: FEBRUARY 2013
TIME: 2 HOURS

INSTRUCTIONS:

- You should have the following for this examination:
  - Answer booklet
  - Scientific calculator
  - Drawing instrument
- This paper consists of **FIVE** questions
- Answer any T**HREE**
- All questions carry equal marks

This paper consists of Three printed pages.

QUESTION 1

a) i) Explain a position selsyn is and why is it known as synchros?
ii) Name the **FOUR** different types of synchros
iii) Describe the principle of operation of the transmitter receiver sylsyn. **(12 marks)**

b) i) Explain the direction of rotation of a universal motor can be reversed
ii) Explain single phase motors are usually set on rubber spring mounts.
iii) A universal motor when connected to a 250V, 50Hz supply and loaded to take 0.8A runs at 1700 rpm at a pt of 0.87 lagging. Determine what speed will it run when connected to a dc supply at the same voltage and taking the same current. The resistance of the motor is 300l. **(8 marks)**

QUESTION 2

a) Explain shunt motors caulf operate satisfactorily on ac supply? (4 marks)

b) Explain the principle of operation of a schrage motor. (8 marks)

c) i) Describe how the linear induction motor operates.

ii) An overhead crane in a factory is driven horizontally by means of 2 similar linear induction motors whose "rotor" are two I-beams on which the crane rolls. The 3-phase, 4-pole linear stators which are mounted on opposite sides of the crate have a pole pitch of 60mm and are energized by a variable-frequency electronic source when one of the motors was tested, it yielded the following results stator frequency = 25 Hz: Power to stator = 6kW;

d) Stator copper iron losses = 1.2kW ; crane speed = 2.4m/s. calculate:

i) Synchronous speed and slip
ii) Power input to the rotor
iii) Copper losses in the rotor
iv) Gross mechanical power developed
v) Thrust **(8 marks)**

QUESTION 3

a) Answer the following in brief:

i) How the sparks due to transformer emit in ac series motor is reduced
ii) How the direction of rotation of a repulsion-start induction motor is reversed
iii) Where repulsion-induction motors are used
iv) Why torque is not developed in a repulsion motor when brushes are placed directly in line with the stator pole centres
v) Why torque is not developed by a repulsion motor when brushes are placed in quadrature with the stator field axis.
vi) Why a centrifugal switch is provided in a repulsion-start induction motor. **(12 marks)**

b) Explain a single phase reluctance motor operates. **(8 marks)**

QUESTION 4

a) Explain a commuter frequency changer operate. **(6 marks)**

b) What will happen to a schrage motor it:

i) The brush pairs are together on the same commutator segment (i.e are electrically connected via the commutator).

ii) The brushes are parted in one direction

iii) Movement of brushes is reversed and they are parted in opposite directions. **(6 marks)**

c) i) Discuss the modifications necessary to operate a d.c series motor satisfactorily on a single phase a.c supply.

ii) Explain why the speed regulation of a series motor is greater when fed from ac mains rhan dc mains. **(8 marks)**

QUESTION 5

a) Explain what a rotary converter is. **(4 marks)**

b) A 3-phase, 250Kw rotary converter develops 250V on the commutator and is supplied from a 2200V, 3-phase system through 3 single-phase transformers, Δ-connected on the hv side and Y-connected on the lv side. The converter operates on full load at a pt of 0.9 lag and with 91% efficiency. Determine the voltage and current rating on both sides of the transformers, neglecting all losses. **(16 marks)**