



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**THIRD YEAR SECOND SEMESTER EXAMINATION DIPLOMA IN ELECTRICAL
ENGINEERING**

EED311 MACHINES AND UTILIZATION

DATE: 15/12/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) State the four advantages of three phase induction motors. (4 marks)
- b) Highlight the major similarities and differences between an induction motor and a transformer. (6 marks)
- c) Draw an equivalent and phasor diagram of a three phase induction motor. (6 marks)
- d) State the two properties of a good refrigerant. (2 marks)
- e) State any four advantages of a stepper motor. (4 marks)
- f)
 - i) Explain the two types of traction systems (4 marks)
 - ii) Highlight any Two advantages and disadvantages of traction systems in f (i) above (4 marks)

QUESTION TWO (20 MARKS)

- a) State the four methods of starting a three phase induction motor. (4 marks)
- b) A 500v, 60Hz, 6 pole, 3 phase, star connected induction motor has a per phase stator impedance $Z_1 = (0.08 + j 0.2)\Omega$, and rotor impedance referred to stator $Z'_2 = (0.09 + j 0.4)\Omega$. The magnetizing reactance is 10Ω and resistance of core-loss is 50Ω . The slip is 5%. Using approximate equivalent circuit, calculate: (16 marks)
- i) Stator current and its power factor.
 - ii) Developed torque.
 - iii) Gross efficiency.

QUESTION THREE (20 MARKS)

- a) State Any Two reasons why reluctance motors have: (4 marks)
- i) Small frame size
 - ii) Low power factor
- b) With the aid of labeled diagram, explain the principle operation of the following motors: (16 marks)
- i) Reluctance
 - ii) Hysteresis

QUESTION FOUR (20 MARKS)

- a) List any FOUR requirements of a braking system. (4 marks)
- b) Explain any three ways of braking a traction system. (6 marks)
- c) A 220v, 20Hp, electric train motor running at its rated speed of 1000rpm. It is braked by plugging. The armature resistance is 0.1Ω at a rated frequency of 80%. Calculate:
- i) Resistance to be connected in series with armature to reduce initial braking current to twice rated current.
- d) Initial braking torque. (10 marks)

QUESTION FIVE (20 MARKS)

a) Define the following terms with reference to refrigeration:

i) Refrigerant

ii) Miscibility

(6 marks)

b) With the aid of a labeled diagram, explain the operation of the absorption type refrigerator.

(14 marks)