



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

**THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DIPLOMA IN
ELECTRICAL AND ELECTRONIC ENGINEERING**

SEE 1303 – MACHINE UTILIZATION I

DURATION: 2 HOURS

DATE: 20TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

- a) Derive the relationship between the starting and the full load torque of an induction motor at a given slip. (4 marks)
- b) A three-phase induction motor is wound for 4-poles and supplied from a 50Hz system when running at a slip of 4%. Calculate:
- The synchronous speed
 - The rotor speed
 - The rotor frequency when the motor runs at 900 rpm (6 marks)
- c) With the aid of a block diagram describe the flow of power in a synchronous motor.(6 marks)
- d) Explain the following terms with reference to the synchronous motor.
- Starting torque
 - Running torque
 - Pull-in-torque
 - Pull-out-torque (4 marks)
- e) Converters are to convert current from one type to another. Depending on the type of function the converters can be grouped into 5-types. Briefly describe these types. (10 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

- a) With the aid of phasors show how a rotating magnetic field is produced in the stator of a 3-phase induction motor: Hint take intervals of 60° . (8 marks)
- b) A three-phase, 50Hz, 6-pole induction motor has a rotor impedance of $(0.01 + j0.25)\Omega$ at standstill. Full load torque is obtained at 720 rpm. Calculate:
- The synchronous speed
 - Full load speed
 - Full load slip
 - The ratio of maximum to full load torque
 - The speed at maximum torque
 - The rotor resistance to be added to get maximum starting torque (12 marks)

QUESTION THREE

- a) State FOUR applications of electric drives (4 marks)
- b) Explain the THREE categories into which electric drives are grouped (6 marks)
- c) A three-phase, 6,600V, 50Hz, Y-connected synchronous motor takes a current of 50A. The resistance and synchronous reactance are 1Ω and 20Ω respectively. Find the power supplied to the motor and induced emf for a power factor of 0.8 lagging. (10 marks)

QUESTION FOUR

- a) A three phase 400V, induction motor had the following test readings:

No load test: 400V 1250W 9A

Short circuit test: 150V 4KW 38A

The normal rating of the motor is 15KW.

Draw the circle diagram and determine;

- i. Full load current and its power factor
- ii. Full load speed if the motor is wound for 4-poles
- iii. Full load torque
- iv. Maximum output power of the motor
- v. Maximum torque

(20 marks)