



# TECHNICAL UNIVERSITY OF MOMBASA

## FACULTY OF ENGINEERING AND TECHNOLOGY

### DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

#### UNIVERSITY EXAMINATION FOR:

DIPLOMA YEAR 3 SEMESTER 2

EPL 2306 : PLANT ELECTRICAL IV

END OF SEMESTER EXAMINATION

**SERIES:** APRIL 2016

**TIME:** 2 HOURS

**DATE:** Pick Date May 2016

#### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

**Do not write on the question paper.**

#### Question ONE

- Explain the working principle of a transformer. (4 marks)
- Briefly explain the advantage of shell type transformer over core type transformers. (4 marks)
- Using first principle, show that the emf equation of a transformer is given by:- (6 marks)

$$E_1 = 4.44fN_1\Phi_m$$

- A 50 KVA, 4400V/220V transformer has  $R_1 = 3.45\Omega$ ,  $R_2 = 0.09\Omega$ ,  $X_1 = 5.2\Omega$  and  $X_2 = 0.015\Omega$ . Calculate for the transformer, equivalent impedances as referred to both primary and secondary. (6 marks)

#### Question TWO

- State **THREE** reasons for conducting impedance test of a transformer. (3 marks)
- Explain why transformers are rated in kVA. (3 marks)
- Briefly explain how the core losses are separated from other transformer losses. (3 marks)
- A single phase, 10kVA, 500/250V, 50 Hz transformer has the following constants:-  
Reactance; Primary = 0.2, Secondary = 0.5  
Resistance; Primary = 0.4, Secondary = 0.1

No-load resistance =  $1500\Omega$  and no-load reactance =  $750\Omega$ .

Calculate the reading of the instruments when the transformer is connected for the open circuit and short circuit tests. (11 marks)

### Question THREE

- State FOUR conditions for parallel operation of single phase transformers. (4 marks)
- State TWO advantages of Y-Y connection. (2 marks)
- Two transformers A and B are connected to a load of  $(2 + j1.5)\Omega$ . Their impedances in secondary terms are  $Z_A = (0.15 + j0.5)\Omega$ ,  $Z_B = (0.1 + j0.6)\Omega$ . Their no-load voltages are  $E_A = 207 \angle 0^\circ V$  and  $E_B = 205 \angle 0^\circ$ . Calculate the power output and power factor of the transformer. (14 marks)

### Question FOUR

- Giving relevant examples, state TWO classifications of induction motors. (4 marks)
- State operating characteristics of a 3-phase squirrel cage induction motor when load is placed on it. (6 marks)
- State TWO differences between induction motor and a transformer. (2 marks)
- An 8-pole, 50Hz 3 phase induction motor is running at 4% slip when delivering full-load torque. It has standstill rotor resistance of  $0.1\Omega$  and reactance of  $0.6\Omega$  per phase. Calculate the speed of the motor if an additional resistance of  $0.5\Omega$  per phase is inserted. (8 marks)

### Question FIVE

- Explain how the following factors affect the choice of an electric motor. (6 marks)
  - Supply available
  - Enclosures
  - Ratings
- With reference to motor installation and operation, discuss the following requirements and methods:- (6 marks)
  - Location
  - Mounting
  - Alignment and Leveling
- Identify possible causes and corrective measures for each of the following abnormal conditions. (4 marks)
  - Excessive humming
  - Motor overheating
- A motor runs on a five minute duty cycle, having a 30 kW load for three minutes and no-load for two minutes. Calculate the theoretical continuous rating for a motor suitable for this duty. (4 marks)