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

a. Explain the working principle of a transformer.   (4 marks)
b. Briefly explain the advantage of shell type transformer over core type transformers.   (4 marks)
c. Using first principle, show that the emf equation of a transformer is given by:-   (6 marks)
$$E_1 = 4.44 f N_1 \emptyset_m$$
d. 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

a. State THREE reasons for conducting impedance test of a transformer.   (3 marks)
b. Explain why transformers are rated in kVA.   (3 marks)
c. Briefly explain how the core losses are separated from other transformer losses.   (3 marks)
d. 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 = 1500Ω and no-load reactance = 750Ω.

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

Question THREE

a. State FOUR conditions for parallel operation of single phase transformers. (4 marks)
b. State TWO advantages of Y-Y connection. (2 marks)
c. 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 $E_A = 207 < 0^o V$ and $E_B = 205 < 0^o$. Calculate the power output and power factor of the transformer. (14 marks)

Question FOUR

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

Question FIVE

a. Explain how the following factors affect the choice of an electric motor. (6 marks)
   i. Supply available
   ii. Enclosures
   iii. Ratings
b. With reference to motor installation and operation, discuss the following requirements and methods:-

   i. Location
   ii. Mounting
   iii. Alignment and Leveling (6 marks)

c. Identify possible causes and corrective measures for each of the following abnormal conditions.
   i. Excessive humming
   ii. Motor overheating (4 marks)
d. 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)