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. State FOUR transformation processes of a transformer. (4 marks)

b. State the difference between core type and shell type transformer. (4 marks)

c. Using first principle, show that the transformation ratio K is given by:- (6 marks)

$$\frac{E_2}{E_1} = \frac{N_2}{N_1} = K$$

d. A 30kVA 2400/120V, 50 Hz transformer has a h.v. windmg resistance of 0.1Ω and leakage reactance of 0.22Ω. The l.v. resistance is 0.35Ω and reactance is 0.012Ω. Calculate the equivalent impedance. (6 marks)

Question TWO

a. State THREE reasons for conducting transformer test. (3 marks)

b. Differentiate between no load test and impedance test of a transformer. (4 marks)

c. Explain why transformers are rated in kVA. (3 marks)

d. Obtain the equivalent circuit of a 200/400V, 50Hz single phase transformer from the following test data.

O.C. test : 200V, 0.7A, 70W on l.v. side

S.C. test: 15V, 10A, 85W on h.v. side

Calculate the secondary voltage when delivering 5kW, 0.8 power factor lagging, the primary voltage being 200V. (10 marks)

Question THREE

a. State FOUR conditions for parallel operation of 3-phase transformer which does not apply to running of 1-phase transformer. (4 marks)
b. State THREE advantages of Delta-Delta transformer configuration. (3 marks)
c. Two transformers A and B are connected in parallel to a load of (2 + j1.5) Ω. Their impedances in secondary are $Z_A = (0.15 + j0.5)\Omega$ and Z_B= (0.1 + j0.6)Ω. Their no-load terminal voltages are $E_A = 207 < 0^o$ and $E_B = 205 < 0^o$. Calculate the power output and power factor of each transformer. (13 marks)

Question FOUR

a. State TWO main parts of an induction motor. (2 marks)
b. Give and explanation for each of the following statements:-
   i. Rotor slots are skewed
   ii. The brushes of a phase wound rotor are externally connected to a 3-phase star connected rheostat. (6 marks)
c. State THREE differences between squirrel cage induction motors and phase wound induction motors. (3 marks)
d. A 4-pole, 50Hz, 3-phase induction motor develops a maximum torque of 110Nm at 1360rpm. The resistance of a star connected rotor is 0.25Ω/phase. Calculate the value of resistance that must be inserted in series with each rotor phase to produce a starting torque equal to half-maximum torque. (9 marks)

Question FIVE

a. State THREE factors considered when choosing an electric motor. (3 marks)
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 situations:-
   i. Motor starts bumping
   ii. Over-heating during operation
   iii. Brush sparking when speed increases excessively (6 marks)
d. Calculate the theoretical continuous rating of a motor which has a duty cycle of 20 kW for 2 mins, 5 kW for 2 mins, 10 kW for 3 mins and stopped for three minutes. (5 marks)