



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

- State FOUR transformation processes of a transformer. (4 marks)
- State the difference between core type and shell type transformer. (4 marks)
- Using first principle, show that the transformation ratio K is given by:- (6 marks)
$$\frac{E_2}{E_1} = \frac{N_2}{N_1} = K$$
- A 30kVA 2400/120V, 50 Hz transformer has a h.v. winding 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

- State THREE reasons for conducting transformer test. (3 marks)
- Differentiate between no load test and impedance test of a transformer. (4 marks)
- Explain why transformers are rated in kVA. (3 marks)
- 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 $(2 + j1.5) \Omega$. Their impedances in secondary are $Z_A = (0.15 + j0.5)\Omega$ and $Z_B = (0.1 + j0.6)\Omega$. Their no-load terminal voltages are $E_A = 207 \angle 0^\circ$ and $E_B = 205 \angle 0^\circ$. 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 an 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 $0.25\Omega/\text{phase}$. 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)