MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION DIPLOMA IN ELECTRICAL ENGINEERING

EED 211: ELECTRICAL ENGINEERING PRINCIPLES IV

DATE: 19/12/2017 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

SECTION A: COMPULSORY QUESTION.

1. (a) Define the following terms with regard to a d.c series L – R circuit;
   (i) Rise time
   (ii) Settling time (4 marks)

   (b) With the aid of a plotted graph and using differential equations, derive the expression of the resultant current in a d.c series L – R circuit suddenly connected to a supply voltage V after being switched on. (7 marks)

   (c) The winding of an electromagnet, with an inductance value of 3 H and a resistance of 15 Ω, is connected to a 120 V d.c supply. Calculate the following values;
   (i) The induced emf after 0.1 sec
   (ii) The time for the current to rise to 85% of its final value
   (iii) The current after 0.3sec. (8 marks)

(d) Explain with the aid of circuit and phasor diagrams the operation of a single – phase practical transformer on no – load. (8 marks)

(e) State any three advantages of an Autotransformer. (3 marks)

SECTION B – ATTEMPT ANY TWO QUESTIONS

2. (a) Define the term " Time constant " with regard to a d.c series L – R circuit. (2 marks)

(b) Explain with regard to a.c series L –R –C circuits the following terms

(i) Overdamped

(ii) Critically damped. (4 marks)

(c) (i) Derive the emf equation of a single – phase ideal transformer. (5 marks)

(ii) Describe the Iron losses of a power transformer. (3 marks)

(d) A transformer has a primary winding of 800 turns and a secondary winding of 200 turns. When the load current on the secondary is 80 A at 0.8 power factor lagging, the primary current is 25 A at 0.707 power factor lagging. Determine with the aid of a phasor diagram;

(i) the no – load current and

(ii) the phase angle of the no – load current with respect to the voltage. (6 marks)

3. (a) Define the following terms with regard to unbalanced 3 – phase system of vectors;

(i) A positive – sequence component

(ii) A negative – sequence component

(iii) Zero – sequence component. (6 marks)

(b) Describe with the aid of a connection diagram a method of measuring zero – sequence component of voltage in an unbalanced 3 – phase, 3 – wire system. (5 marks)

(c) With the aid of sketch diagrams for the respective vectors, calculate the

(i) Positive – phase sequence

(ii) Negative – phase sequence and

(iii) Zero – phase sequence components of the following set of three unbalanced voltage vectors;

$V_A = 8.66+j5$; $V_B = 15 - j25.98$; $V_C = -12.29 + j8.60$. (9 marks)

4. (a) With regard to zero – sequence components of currents and voltage describe the following 3 – phase circuit connections;

(i) Four – wire Star connection.

(ii) Three – wire delta connection. (6 marks)

(b) A 50Hz sinusoidal voltage of maximum value of 400 V is applied to a series circuit of resistance 10 Ω and inductance 0.1 H. assuming that voltage is zero at the instant of application, determine;

(i) The expression for the value of the current at any instant after the voltage is applied ,

(ii) The value of the current 0.02 sec after switching on. (8 marks)

(c) In the no – load test of a single – phase transformer the following test data were obtained;

Primary voltage : 220 V ; Secondary voltage : 110 V

Primary current : 0.5 A ; Power input : 30 W

Resistance of Primary winding : 0.6 Ω .

Calculate the following ;

(i) The turns ratio

(ii) The magnetizing component of the no – load current

(iii) The working component of the no – load current

(iv) The Iron loss (6 marks)

5. (a) (i) State four conditions for satisfactory parallel operation of two single – phase transformers. (4 marks)

(ii) Explain with a diagram the principle of a current transformer. (5 marks)

(b) Derive the expression for the capacitor discharging current in a d.c series C – R circuit. (5 marks)

(c) A 40 V d.c supply is connected across a coil of inductance 25 mH and resistance 5Ω. Calculate the following ;

(i) the value of current after 10 mSec

(ii) The p.d across the resistor after 5 mSec

(iii) The value of the voltage across the inductance after 2 mSec.

(iv) The time when the current reaches 3 A. (6 marks)