



MURANG'A UNIVERSITY COLLEGE

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

DEPARTMENT: ELECTRICAL ENGINEERING

LEVEL: DIPLOMA
CLASS: EE/P/14DM
UNIT: ELECTRICAL CIRCUIT ANALYSIS
TERM/SEMESTER: I YEAR 2
ACADEMIC YEAR: 2014/2015
UNIT CODE: SEE 1206
DATE: 23RD APRIL 2015 **TIME:** 2 HOURS

Instructions to candidates

This paper contains FOUR questions

Attempt question 1 and any other two questions

You should have the following for this examination;

- Drawing instruments
- Scientific calculator

Mobile phones are not allowed in examination room.

QUESTION 1

- a) With reference to alternating current, define the following terms:
- Period
 - Frequency
 - Amplitude (6 marks)
- b) A star- connected load consists of three identical coils, each of inductance 159.2 mH and resistance 50Ω. If the supply frequency is 50 Hz and the line current is 3A .Determine
- Phase voltage
 - Line voltage (4 marks)
- c) With the help of a labelled diagram describe the construction of a d.c machine. (6 marks)
- d) With the aid of a diagram, explain the principle of operation of a single phase transformer (5 marks)

- e) A $30\mu\text{F}$ capacitor is connected in parallel with an $80\ \Omega$ resistor across a $240\ \text{V}$, $50\ \text{Hz}$ supply. Calculate
- The current in each branch
 - The supply current
 - The circuit impedance
 - The power dissipated
- (9 marks)

SECTION B

QUESTION 2

- a) A $60\ \text{kVA}$, $1600\text{V}/100\text{V}$, 50Hz , single phase transformer has 50 secondary windings. Determine the:
- The primary and secondary current
 - Number of primary turns
 - Maximum value of the flux
- (7 marks)

- b) An alternating current varies with time over half a cycle as follows:

Current(A)	0	0.7	2.0	4.2	8.4	8.2	2.5	1.0	0.4	0.2	0
Time(ms)	0	1	2	3	4	5	6	7	8	9	10

The negative half cycle is similar. Plot the curve and determine:

- The frequency
 - The instantaneous values at 3.4ms and 5.8ms
 - The average value
 - The r.m.s value
- (13 marks)

QUESTION 3

- a) The following three impedances are connected in series across a $40\ \text{V}$, $20\ \text{kHz}$ supply: a resistance of $8\ \Omega$, a coil of inductance $130\mu\text{H}$ and $5\ \Omega$ resistance and a $10\ \Omega$ resistor in series with a $0.25\mu\text{F}$ capacitor. Determine;
- The circuit impedance
 - The circuit current
 - The circuit phase angle
 - Voltage drop across each impedance
- (10 marks)
- b) A six-pole lap wound motor is connected to a 250V d.c supply. The armature has 500 conductors and a resistance of $1\ \Omega$. The flux per pole is 20mWb and armature resistance is 40A . Determine
- The speed
 - The torque developed
- (6 marks)
- c) Derive from first principles an expression for efficiency of a d.c motor. (4 marks)

QUESTION 4

- a) Sketch the terminal voltage/load current characteristics of the following generators
- Series
 - Shunt
 - Separately excited
 - Compound wound
- (8 marks)

- b) A compound wound d.c generator is to supply a load of 25kW at 220V. The armature circuit, series field and shunt field resistances are 0.06Ω , 0.04Ω and 50Ω respectively. If the voltage drop per brush is 2V, determine the generated e.m.f when the machine is connected in:
- i. Long shunt
 - ii. Short shunt (8 marks)
- c) A 200kVA rated transformer has a full-load copper loss of 1.5kW and an iron loss of 1kW. Determine the transformer efficiency at full load and 0.85 power factor