MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SEMESTER TWO EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING

EEE 204: CIRCUIT THEORY II

DATE:16/6/2017 **TIME: 8.30-10.30 AM**

INSTRUCTIONS.

This paper consists of **FIVE** questions. Answer Question **ON**E and any other **TWO** questions

QUESTION ONE (COMPULSORY-30 MARKS)

(a) (i) Define the following as applied to circuits
I. Quality factor
II. Power factor

(ii) State **any two** areas of application of resonant circuit. (4 marks)

(b) (i) Explain the **need for** unity power factor in industrial loads

(ii) State **two approaches** of improving power factor in the industrial loads (6 marks)

(c) (i) The general expression for power dissipated in a load is given the expression

$$p = VI\cos\theta - VI\cos\theta\cos 2\omega t + VI\sin\theta\sin 2\omega t$$

From this expression write down the expression for the following types of load is purely:

I. Resistive
II. Inductive
III. capacitive

(3 marks)

(ii) For the circuit in Figure 1, determine the

I. Real power
II. Reactive power
III. Apparent power

(6 marks)

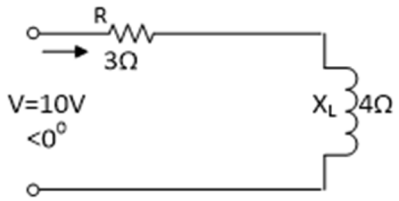

Figure 1

(c) Explain the **dot rule** in coupled circuit**.** (4 marks)

(d) Distinguish between the **transient** and **steady state** condition of a circuit. Explain why it's important to have knowledge of the two states for a given circuit.
(4 marks)

(e) State any **three** properties of a tree graph (3 marks)

QUESTION TWO (20 MARKS)

(a) For the schematic diagram of the system in Figure 2,

(i) Determine the

I. total number of watts
II. total number of volt-ampere reactive
III. total number of volt-amperes
IV. power factor, PF

(ii) Draw the power triangle

(iii) Find the current in phasor form (10 marks)

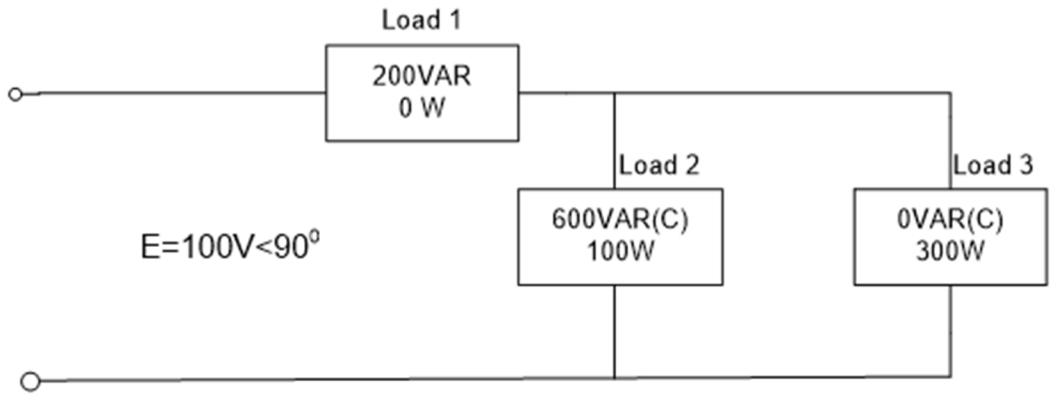

Figure 2

(b) Calculate the phasor currents and in the circuit of Figure 1 (10 marks)

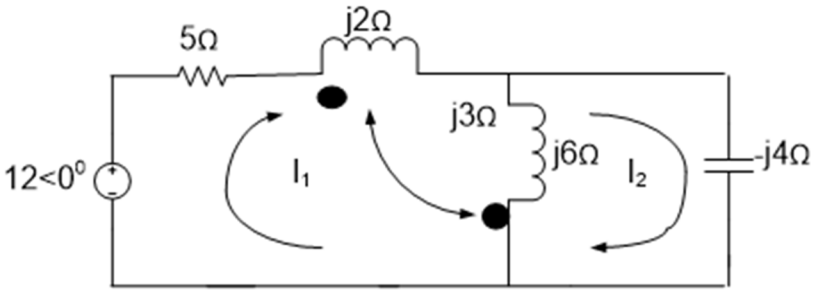

Figure 3

QUESTION THREE (20 MARKS)

(a) For the network shown in figure 4,

i. Draw the graph

ii. Write down the fundamental loop matrix (5 marks)

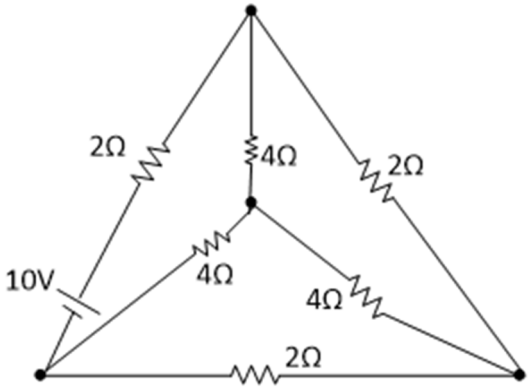

Figure 4

(b) The reduced incidence matrix of a graph is as under

$$\begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & -1 & 1 & -1 & 0 & 0 \\ -1 & 0 & -1 & 0 & -1 & 0 \end{bmatrix}$$

Determine the number of possible trees. (5 marks)

(c) For the network in Figure 5

i. Draw a graph
ii. Write a tie set schedule
iii. Using the tie set schedule obtain the loop equations
iv. Find current in all branches

(10 marks)

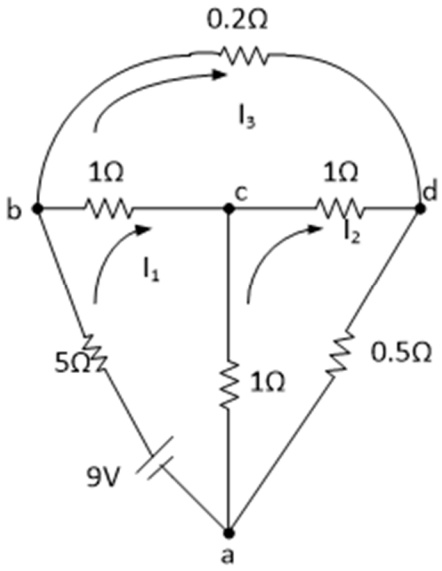

Figure 5

QUESTION FOUR (20 MARKS)

(a) The switch in the circuit in **figure 6** is moved from 1 to 2 at t=0. Find and for t>0.

(10 marks)

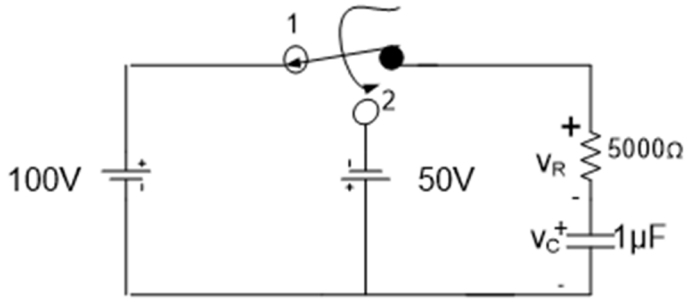

Figure 6

(b) Find the resonance frequency of the circuit in Figure **7** (10 marks)

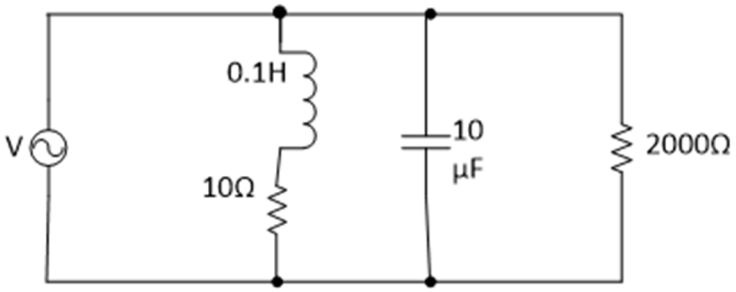

Figure 7

QUESTION FIVE (20 MARKS)

a) A series resonant circuit has the parameters, and source voltage . At resonance, determine the :

i. Circuit current voltage across the resistor, inductor and capacitance, and respectively;
ii. Quality factor at resonance, ;
iii. Bandwidth if the resonance frequency is 5000Hz;
iv. Power dissipated in the circuit at half power frequencies.

(10 marks)

b) (i) State **three** reasons why three phase systems are preferred over single phase systems for transmission of power

(ii) Explain the following as applied to three phase systems

I. Balanced load

II. Phase sequence

(iii) A Y-connected balanced three-phase generator with an impedance of (0.4+j0.3) Ω per phase is connected to a Y- connected balanced load with an impedance of (24+j19) Ω per phase. The line joining the generator and the load has an impedance of (0.6+j0.7) Ω per phase. Assuming a positive sequence of the source voltages and that $V_{an} = 120 < 0^0 \ \ V$ find:

I. The line voltages

II. Line currents

(10 marks)