## NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY
DEPARTMENT OF ELECTONIC ENGINEERING
BAGHELOR OF ENGINEERUNG (HONST DEGREE
Final Examination January 2011
TEE 1103
ELECTRICAL ENGINEERING CIRCUIT ANALYSIS
Duration of Examination - 3 Hours

## INSTRUCTIONS TO CANDIDATES

1. Answer any FIVE questions only.
2. Each question carries 20 marks.
3. Show your steps clearly in any calculen.
4. Start the answers for each question on a fresh page.

## Question 1

For the network shown in figure 1 ,
a) Calculate the current through the $2 \mathrm{k} \Omega$ resistor.
b) What is the voltage across, and the power dissipated in, the $2 \mathrm{k} \Omega$ resistor.


Figure 1.(All resistances are in Ohms and $k$ denotes kilo)

## Question 2

For the network in figure 2 :
a) Using the format approach, write the nodal equations.
(tand betetemine the voltage acress $R_{5}$
c) Is the bridge balanced? Give reasons


Figure 2. (All resistances are in Ohms)

## Question 3

For the circuit in Figure 3
a) The capacitor is initially uncharged. Find mathematical expressions for the voltage across the capacitor, $C_{1}$, resistor $R_{1}$ and the current through the capacitor after the switch is thrown into position 1 .
b) After 6 time constants, the switch is thrown into position 2. Find mathematical expressions for the voltage across the capacitor, $\mathrm{C}_{1}$, resistor $\mathrm{R}_{2}$ and the current through the capacitor after the switch is thrown into position 2.
c) Plot the waveforms for voltages and currents obtained in parts (a) and (b) on the same axis.
[8 marks]


Figure 3. (All resistances are in Ohms and $k$ denotes kilo)

## Question 4

For Figure 4,
a) Find the Thevenin's equivalent circuit for the network external to the $6 \Omega$ capacitive impedance.


Figure 4(All impedances are in Ohms)

## Question 5

The network in figure 5 shows reactive and real power consumed by each block in an ac circuit.
$\begin{array}{ll}\text { a) Find the total real, reactive and apparent power. } & \text { [6 marks] } \\ \text { b) Find the power factor. } & {[2 \text { marks }]} \\ \text { c) Find the current } \mathrm{I}_{\mathrm{T}} . & {[3 \text { marks] }} \\ \text { d) Draw the power triangle. } & \text { [6 marks] } \\ \text { e) State the type of elements in each electrical box. } & \text { [3 marks] }\end{array}$


Figure 5

## Question 6

For the circuit shown in figure 6 , the frequency is 60 Hz .
a) Find the inductance of the $3 \Omega$ impedance.
b). Using Superposition Theorem, find the current through the $3 \Omega$ impedance, $[14$ marks]
c) What is the voltage across the $3 \Omega$ impedance? $\quad$ [3 marks]


Figure 6. (All impedances are in Ohms)

