ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SEMESTER I EXAMINATION, 2016/2017 ACADEMIC SESSION

COURSE TITLE: ELECTRIC CIRCUIT THEORY

COURSE CODE: EEE 317

EXAMINATION DATE: 4TH APRIL, 2017

COURSE LECTURER: DR R. O. Alli-Oke

HOD's SIGNATURE

TIME ALLOWED: 2½ HRS

INSTRUCTIONS:

1. ANSWER **QUESTION 1** AND ANY OTHER TWO QUESTIONS (TOTAL OF 3 QUESTIONS)
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW CALCULATORS AND ANY OTHER WRITING MATERIALS DURING THE EXAMINATION.

1)

a)

i) Differentiate between networks and circuits? (3 marks) Explain briefly what you understand by passive sign convention for circuit elements. (3 marks)

ii) Determine the absorbed power by each of the circuit elements shown in the figure 1 below. (4 marks)

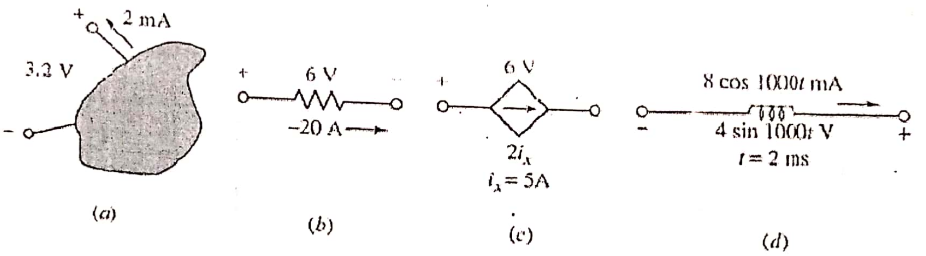


Figure 1: Circuit Elements

b) Find the relation between V_1 and V_2 that must hold so that $I = 1$A. (3 marks)

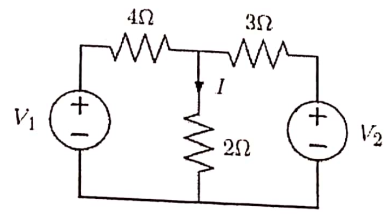


Figure 2: A 2-Loop Circuit

c) The Parseval's theorem states that $\int_{-\infty}^{\infty}|x(t)|^2 dt = \frac{1}{2\pi}\int_{-\infty}^{\infty}|X(\omega)|$ where $X(\omega) = F_{\omega}\{x(t)\} = \int_{-\infty}^{\infty} x(t)\ e^{-j\omega t}\ dt$ is the Fourier transform of the signal $x(t)$. Find the energy in the signal $x(t) = e^{-at}u(t)$ and find the bandwidth W such that 95% of the energy is contained in frequencies below W.

(5 marks)

d) Determine the steady-state current $i(t)$ shown in this circuit. *Hint: use phasor-domain analysis* (5 marks)

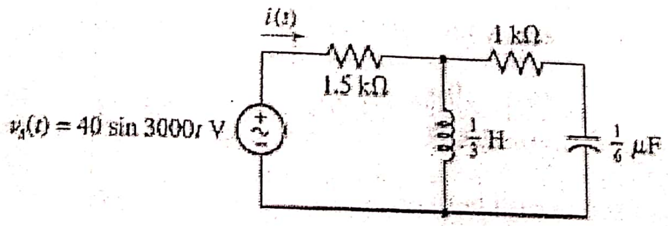


Figure 3: A Sinusoidal-Excited Circuit

e) Design an analog passive band-pass filter that has a Q-factor of 0.8 and a bandwidth of 20 kHz. Use only resistors-capacitors combination for your design and assume that the center frequency is the midpoint of the bandwidth.

(6 marks)

c) A 5 μF capacitor with an initial voltage of 4V is connected to a parallel combination of a 3 kΩ and a 6 kΩ resistor. Find the current i in the 6 kΩ resistor. (5 marks).

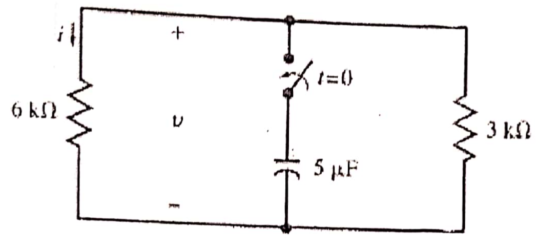


Figure 7: Source-Free RC Circuit

4)

a) Differentiate between Laplace-Domain circuits and Phasor-Domain circuits (2 marks).

b) Use phasor-domain analysis on the circuit shown in the figure (b) to determine the sinusoidal steady-state currents I_1, and I_2. (5 marks)

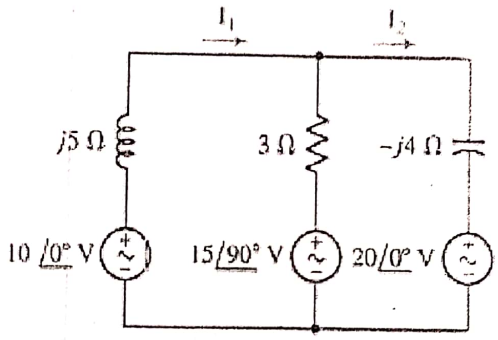


Figure 8: Phasor-Domain Analysis

c) Consider the following circuit in figure 7. Assume the input is $V_i(t) = V_p \cos \omega t$.

i) Use phasor-approach to determine $V_o(t)$ (3 marks)

ii) Let V_i and V_o represents phasors corresponding to input and output voltages respectively. Determine the frequency transfer function $H(j\omega) = \frac{V_o}{V_i}$ (3 marks)

iii) Classify the kind of filter is the R-C network is? Use at least 3 categories of classification. (3 marks)

iv) Determine 3dB cut-off frequency analytically or otherwise (2 marks)

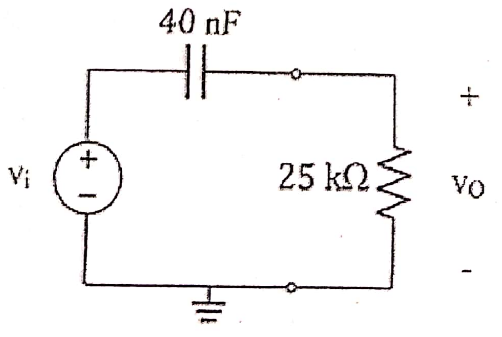


Figure 9: Filters - Phasor-Domain Analysis

2)

a) State 3 electric circuit analysis techniques you know. (3 marks)

b) Consider the following resistive circuit shown in figure 2.

i) Determine the current through the 10Ω resistor (6 marks).

ii) Compute the power absorbed by the 10Ω resistor (4 marks)

Hint: $\begin{bmatrix}-0.8 & 0.1\\ 0.1 & -0.85\end{bmatrix}^{-1} = \begin{bmatrix}-1.2687 & -0.1493\\ -0.1493 & -1.1940\end{bmatrix}$

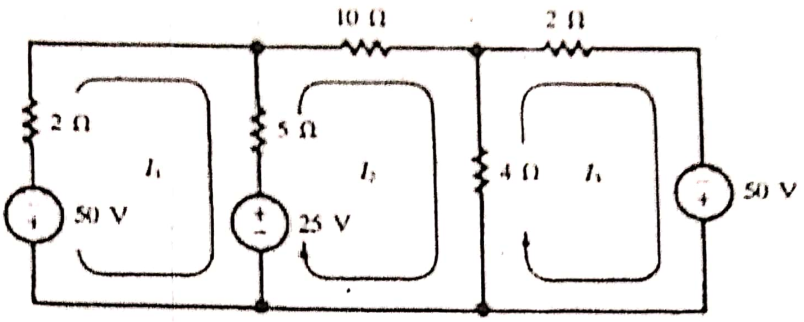
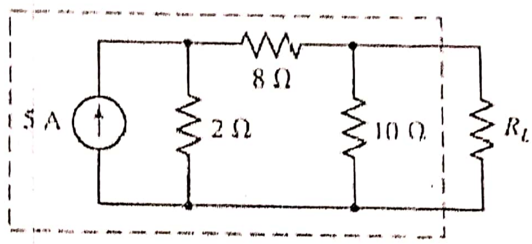


Figure 4: Resistive Circuit with DC sources.

c) Using repeated source transformation, determine the Norton equivalent of network A. (5 marks)



Network A

Figure 5: Source Transformation

3)

a) Differentiate between Thevenin's theorem and Norton's theorem. (3 marks)

b) Find the Thevenin's equivalent of the network shown in figure 6 as viewed from the following ports:

i) port $x - x'$ (5 marks)

ii) port $y - y'$ (5 marks)

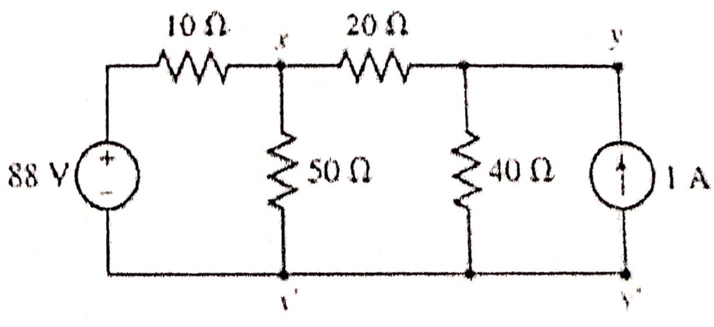


Figure 6: Multiple-Loop Circuit