الرقم الجامعي:- الاسم:-

King Saud University
College of Engineering
Dept. of Electrical Engineering

EE-212: Electric Circuits
Midterm Exam (*2*) 03.02.1434
(*16.12.2012*) Time Allowed: *1.75 Hours*

<u>Question # 1</u> *(15 points)*

In the circuit shown in Fig. 1, both switches have been open for a long time. They are both closed at the same time $t = 0$.

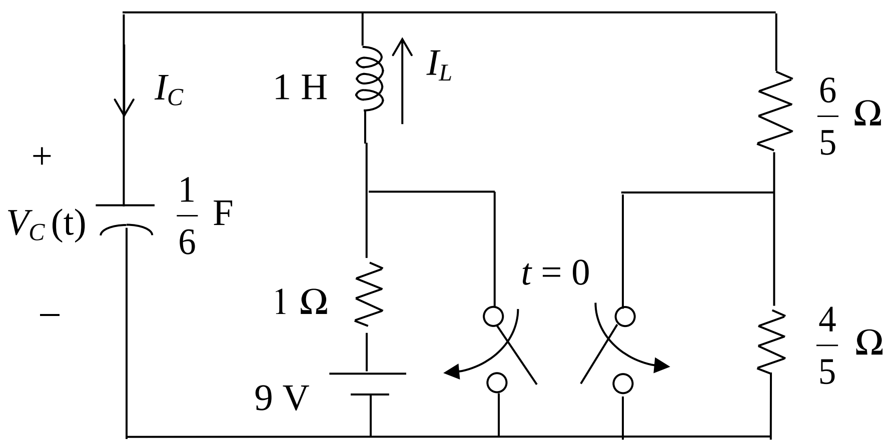

Fig. 1

a) Determine current in the inductor L, immediately before closing the switch (I_L (0-)) and immediately after closing the switch (I_L (0+)).

b) Determine voltage across the capacitor C, immediately before closing the switch (V_C (0-)) and immediately after closing the switch (V_C (0+)).

c) Determine current in the capacitor C, immediately before closing the switch (I_C (0-)) and immediately after closing the switch (I_C (0+)).

d) Determine expression of voltage across the capacitor C, after closing the switch (V_C (t)).

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Question # 2 ***(10 points)***

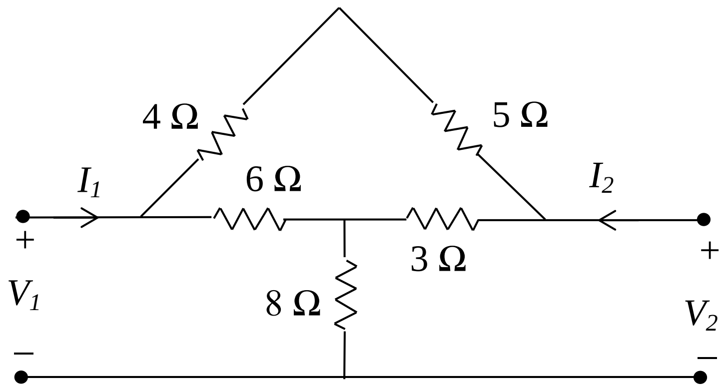

Fig. 2

a) For the circuit shown in Fig. 2 determine the Z-parameters, where

$V_1 = Z_{11}I_1 + Z_{12}I_2$ and $V_2 = Z_{21}I_1 + Z_{22}I_2$

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b) For the circuit shown in Fig. 3, determine the T-Parameters, where

$V_1 = AV_2 - BI_2$ and $I_1 = CV_2 - DI_2$

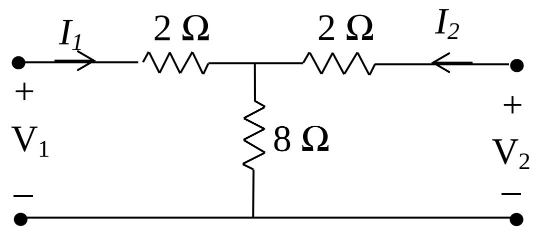

Fig. 3

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Question # 3 ***(10 points)***

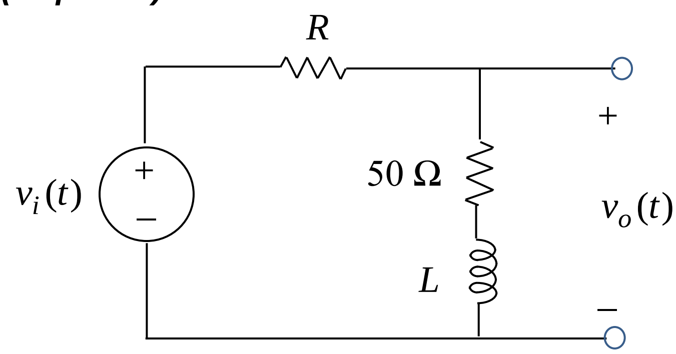

Fig. 4

The input to the circuit shown in Fig. 4 is the voltage of the voltage source $v_i(t)$. The output is the voltage $v_o(t)$ across the series connection of the inductor L and the 50 Ω resistor.

a) Find the transfer function as a function of s, $H(s)$, and as a function of $j\omega$, $H(j\omega)$.

b) The transfer function in (a) is written as $H(j\omega) = (0.6)\dfrac{\left(1+\dfrac{j\omega}{12}\right)}{\left(1+\dfrac{j\omega}{20}\right)}$.

Determine the values of the inductance, L, and of the resistance, R.

c) Derive expression of the magnitude of the transfer function $|H(j\omega)|$

d) Prove that, at $\omega = 0$, $|H(j0)| = 0.6$ and that, at $\omega = \infty$, $|H(j\infty)| = 1.0$

e) Sketch the magnitude of the transfer function $|H(j\omega)|$ for $0 \le \omega \le \infty$

f) What is the value of $|H(j\omega_c)|$, where ω_c is the cutoff frequency.

g) What type of filter does this circuit represent?.

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Question # 4 ***(10 points)***

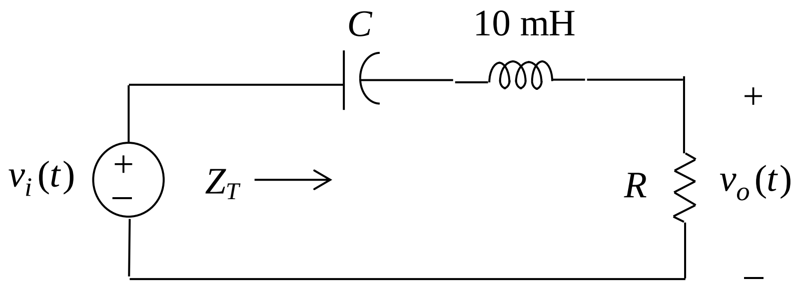

Fig. 5

For the circuit shown in Fig. 5,

a) What type of filter does this circuit represent?

b) If the angular frequency, ω of the input source $v_i(t)$ is increased until it is equal to 1000 rad/s, such that the total impedance at this frequency is $Z_T = (2 - j5)\ \Omega$, determine the values of resistance, *R* and capacitor, *C*.

c) Determine the resonance angular frequency ω_0.

d) Determine the lower and upper cutoff angular frequencies ω_{c1} and ω_{c2}

e) Determine the bandwidth of this circuit.

f) Determine the quality factor of this circuit.

g) If the output $v_o(t)$ is taken across L and C in series, what will be the filter type?