

King Saud University
College of Engineering
Electrical Engineering Department

EE 212: Electric Circuits
Final Exam

2nd Semester 1436 H
Time: 3 hours

الرقم الجامعي:

الاسم:

Mobile phones and programmable calculators are not allowed
Answer all questions

Question #1A [10 Marks]

In the circuit shown in **Fig. 1A**,
find I_1 and node voltage V_a

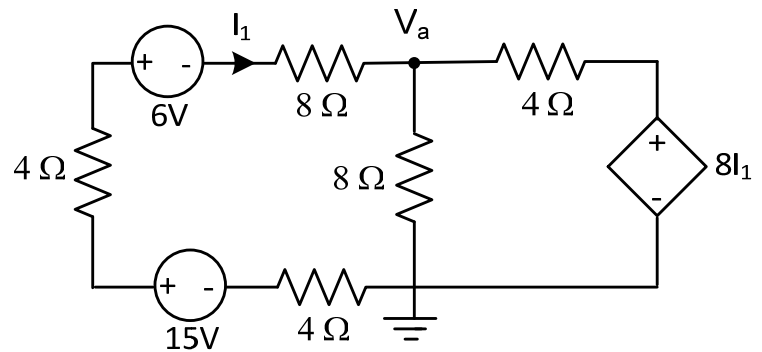


Fig. 1A

Question #1B [10 Marks]

In the circuit shown in **Fig. 1B**, find V_0 and I_0 .

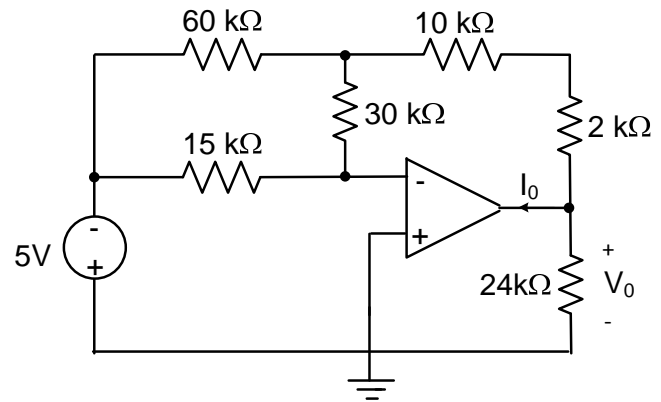


Fig. 1B

Question #2A [10 Marks]

In the circuit shown in **Fig. 2A**, find I_1 and V_0 .

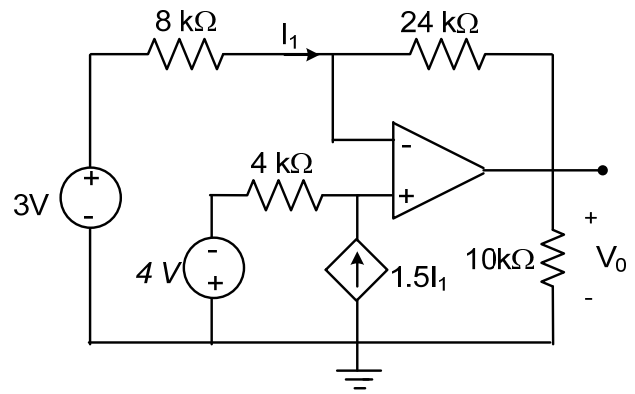


Fig. 2A

Question #2B [10 Marks]

In the circuit shown in **Fig. 2B** the switch has been closed for a long time.

- (i) If the switch is opened at $t=0$, find $I_L(t)$ for $t > 0$.
- (ii) Determine the value of $I_L(t)$ at $t=1.5$ s.
- (iii) If the switch is closed again at $t=1.5$ s, find $I_L(t)$ for $t > 1.5$ s.
- (iv) Sketch $I_L(t)$ versus t .

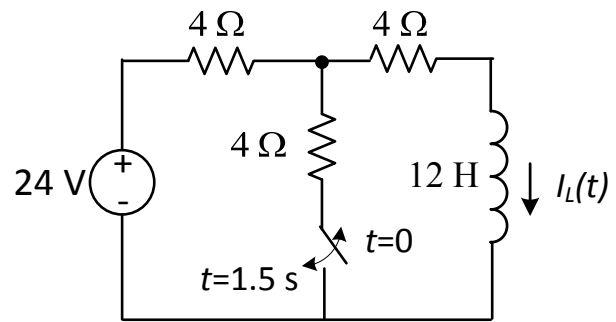


Fig. 2B

Question #3A [10 Marks]

In the circuit shown in **Fig. 3A** the switch has been closed for a long time. It is opened at $t = 0$. Find

- (i) The inductance L such that $I_L(t)$ is critically damped for $t > 0$.
- (ii) $I_L(t)$ for $t \geq 0$

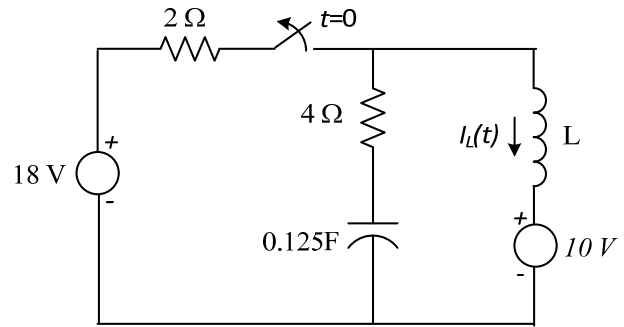


Fig. 3A

Question #3B [10 Marks]

In the circuit shown in **Fig. 3B**, determine:

- (i) The currents I_1 and I_2 .
- (ii) The voltages V_1 and V_2 .

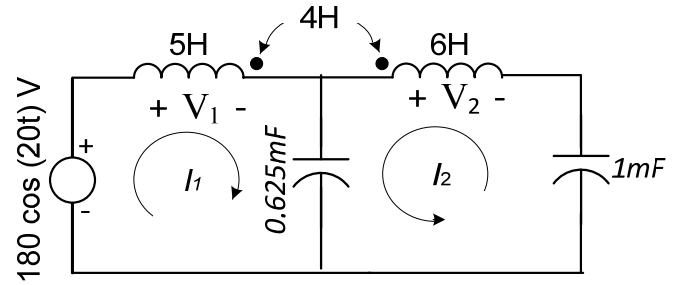


Fig. 3B

Question #4A [10 Marks]

In the circuit shown in **Fig. 4A**,
determine:

- (i) The transfer function $H(s) = \frac{V_o}{V_i}$.
- (ii) The poles and zeros of $H(s)$.
- (iii) Find the values of a , b and K ,
if $H(\omega)$ is expressed as

$$H(\omega) = \frac{K}{(1+j\frac{\omega}{a})(1+j\frac{\omega}{b})}$$

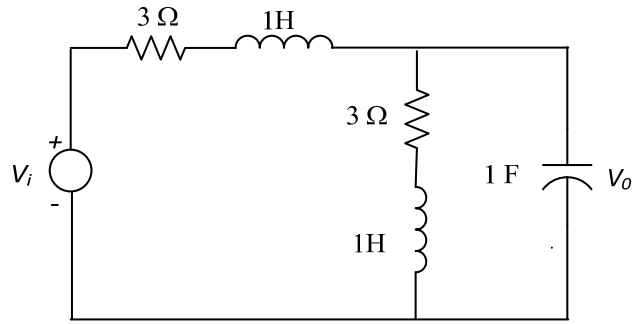


Fig. 4A

Question #4B [10 Marks]

For the circuit shown in **Fig. 4B**, find:

- (i) Resonant frequency ω_0 ,
- (ii) Lower cut-off frequency ω_1 ,
- (iii) Upper cut-off frequency ω_2 ,
- (iv) Bandwidth β
- (v) Quality factor Q .
- (vi) What type of filter does this circuit represent?

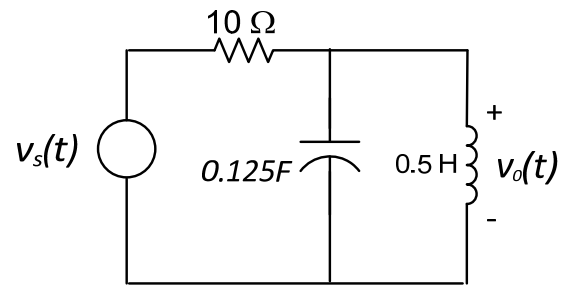


Fig. 4B

Question #5A [10 Marks]

For the 2-port network shown in **Fig. 5A**.

$$V_1 = Z_{11}I_1 + Z_{12}I_2$$

$$V_2 = Z_{21}I_1 + Z_{22}I_2$$

Assume the following measurements were made on the circuit,

Port-1 Open:

$V_1 = 10$ V, $V_2 = 15$ V, and $I_2 = 30$ A

Port-1 Short Circuited:

$V_2 = 10$ V, $I_2 = 30$ A, and $I_1 = -15$ A

- i) Find the **Z**-parameters for this network.
- ii) Determine the equivalent T-circuit inside the box which will have the above Z-parameters.

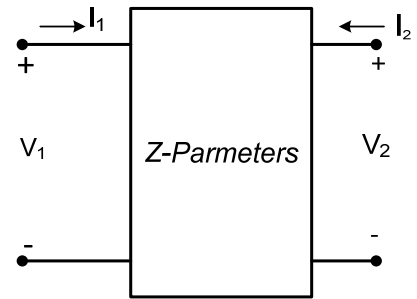


Fig. 5A

Question #5B [10 Marks]

For the 2-port circuit shown in **Fig. 5B**, the h -parameters, are given in the figure, where

$$V_1 = h_{11}I_1 + h_{12}V_2$$

$$I_2 = h_{21}I_1 + h_{22}V_2$$

Find

- (i) The rms value of voltage V_2
- (ii) The output power delivered to load R_L .

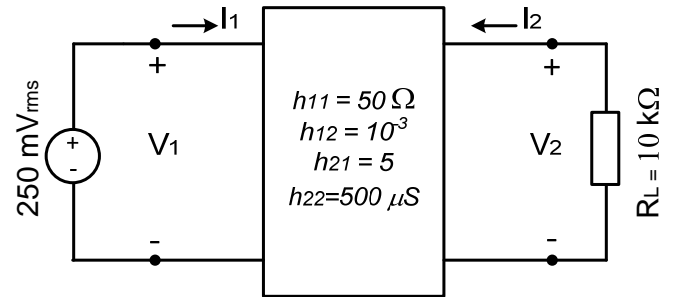


Fig. 5B