Linear Systems – FE Electrical Live Training
Week # 9 – Saturday Session

STUDY FOR FE

Focus of this homework assignment will be on the following topics of 'Linear Systems'.

- ❑ Frequency/Transient Response
- ❑ Resonance
- ❑ Laplace Transform
- ❑ Transfer Functions

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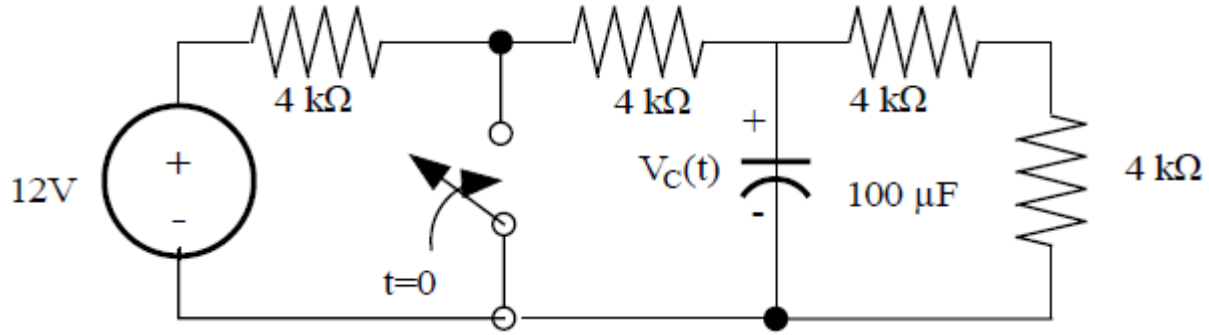
HW Problem # 1 – Determine the value of $V_c(t)$ for $t > 0$ if the switch has been in open position for a long time before closing at $t = 0$.



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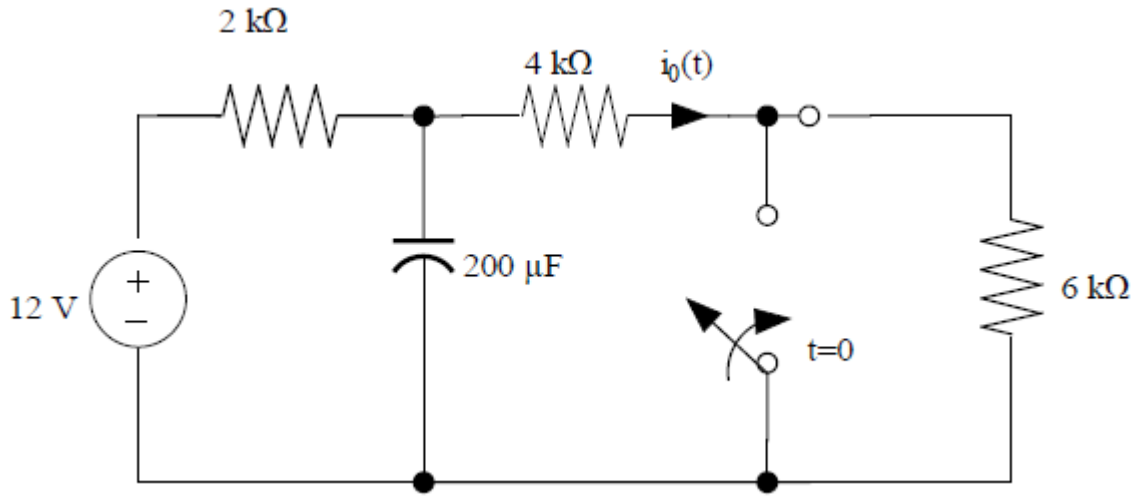
HW Problem # 2 – Determine the value of $i_o(t)$ for $t > 0$ if the switch has been in open position for a long time before closing at $t = 0$.



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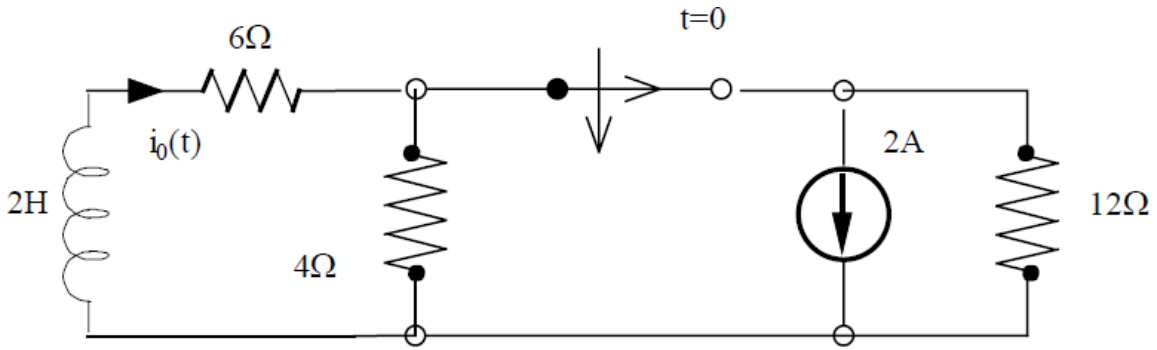
HW Problem # 3 – Determine the value of $i_o(t)$ for $t > 0$ if the switch has been in closed position for a long time before opening at $t = 0$.



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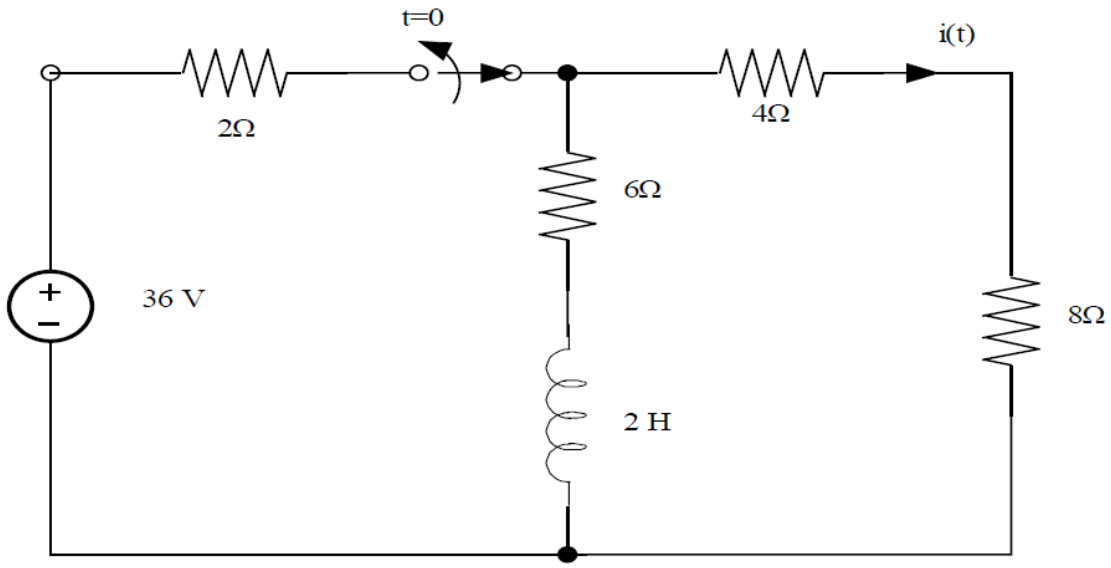
HW Problem # 4 – Determine the value of $i_o(t)$ for $t > 0$ if the switch has been in closed position for a long time before opening at $t = 0$.



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HW Problem # 5 – Determine the Laplace Transform of following function.

$$f(t) = \sin^2(2t)$$

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HW Problem # 6 – Determine the Laplace Transform of following function.

$$f(t) = \cos(\omega t + \theta)$$

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HW Problem # 7 – Determine the limit of $f(t)$ as $t \to \infty$ if $F(s)$ is given below.

$$F(s) = \frac{4}{(s)(s+1)}$$

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HW Problem # 8 – Determine the limit of $f(t)$ as $t \to 0$ if $F(s)$ is given below.

$$F(s) = \frac{4(s+1)}{s^2 + 4s + 7}$$

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HW Problem # 9 – Determine the Laplace Transform of following function.

$$f(t) = te^{-a(t-1)}\delta(t-1)$$

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HW Problem # 10 – Determine the Inverse Laplace Transform of following function.

$$F(s) = \frac{s+10}{(s+4)(s+6)}$$

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HW Problem # 11 – Determine the Inverse Laplace Transform of following function.

$$F(s) = \frac{24}{(s+2)(s+8)}$$

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HW Problem # 12 – Determine the Inverse Laplace Transform of following function.

$$F(s) = \frac{1}{s^2(s+1)}$$

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HW Problem # 13 – Determine the Inverse Laplace Transform of following function.

$$F(s) = \frac{s^2 + 7s + 12}{(s+2)(s+4)(s+6)}$$

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HW Problem # 14 – Determine the Inverse Laplace Transform of following function.

$$F(s) = \frac{10(s+2)}{(s^2+4s+5)}$$

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Consider the following transfer function for the next 3 problems.

$$H(s) = \frac{640(s+1)(0.01s+1)}{s^2(s+10)}$$

HW Problem # 15 – Express the transfer function $H(s)$ in standard form.

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$$H(s) = \frac{640(s+1)(0.01s+1)}{s^2(s+10)}$$

HW Problem # 16 – Determine the poles and zeros of given transfer function $H(s)$.

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$$H(s) = \frac{640(s+1)(0.01s+1)}{s^2(s+10)}$$

HW Problem # 17 – Express the gain of given transfer function $H(s)$ in dB.

FE Electrical Live Training
Linear Systems – Answer Key

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1) $6e^{\left(-\frac{15t}{4}\right)}V$

2) $2 + 0.5e^{(-3.75t)}mA$

3) $\frac{2}{3}e^{(-5t)}A$

4) $-4e^{(-9t)}A$

5) $\frac{1}{2s} - \frac{1}{2}\left(\frac{s}{s^2+16}\right)$

6) $\cos\theta\left[\frac{s}{[s^2+(\omega t)^2]}\right] - \sin\theta\left[\frac{\omega t}{[s^2+(\omega t)^2]}\right]$

7) 4

8) 4

9) e^{-s}

10) $3e^{-4t} - 2e^{-6t}$

11) $6e^{-2t} - 4e^{-8t}$

12) $-1 + t + e^{-t}$

13) $\frac{1}{4}e^{-2t} + \frac{3}{4}e^{-6t}$

14) $10e^{-2t}\cos(t)$

15) $\frac{64(s+1)(0.01s+1)}{s^2(\frac{s}{10}+1)}$

16) Poles: 2nd order @ DC 0Hz, and 1st order pole at s = -10 rad/s

Zeroes: 1st order zeroes at s = -1 rad/s and -100 rad/s

17) $36.1dB$