L -9- Find : $\mathcal{L}^{-1}\{ (s-1)^{-3}+(s^2+2s-8)^{-1}\}$ p(13)

a. $0.5e^{t}t^2+(2/3)e^{t}.Cosh(3t)$
b. $0.5e^{t}t^2+(1/3)e^{-t}.Sinh(3t)$
c. $0.5e^{t}t^2+(1/3)e^{t}.Cosh(3t)$
d. $0.5e^{t}t^2+(2/3)e^{-t}.Cosh(3t)$
e. None of the above

L -1- The Laplace transform of $f(t)=\frac{\text{Sin } 5t}{t}$ is (p12)

a. $(\pi/2)-\tan^{-1}(s/2)$ b. $(\pi/2)-\tan^{-1}(s)$ c. $(\pi/5)-\tan^{-1}(s/5)$
d. $(\pi/2)-\tan^{-1}(s/5)$ e. None of the above

L -2- The inverse Laplace transform of $F(s)=\frac{s+3}{s^2-s-2}$, is (p12)

a. $(2/3)e^{2t}+(5/3)e^{-t}$ b. $(2/3)e^{2t}-(2/3)e^{-t}$
c. $(5/3)e^{2t}+(2/3)e^{-t}$ d. $(2/3)e^{2t}-(5/3)e^{-t}$ e. None of the above

-5- Find the Laplace transform of $f(t)= \begin{cases} t, & 0\le t\le 2 \\ 2, & t>2 \end{cases}$ (p 12)

a. $(1-e^{-2s})/s^2$ b. $(1-s-e^{-2s})/s^2$ c. $(1-2s-e^{-2s})/s^2$
d. $(1-se^{-2s})/s^2$ e. None of the above

L **21.** Find I(t) for t>0. (p34)

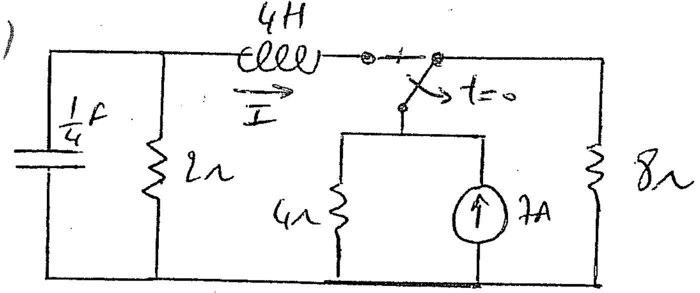
a) $e^{-2t}(4Cost+2Sint)$

b) $e^{-2t}(-4Cost+2Sint)$

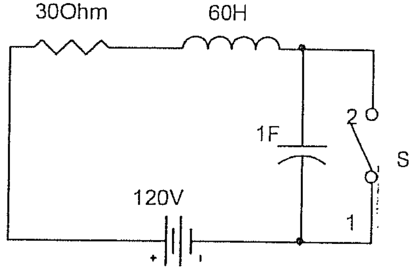
c) $e^{-2t}(4Cost-2Sint)$

d) $-e^{-2t}(4Cost+2Sint)$

e) None of the above



L -2- In the following circuit, the switch is opened at t=0. Find I(s). (p14)



a. $\dfrac{240s+120}{60s^2+30s+1}$

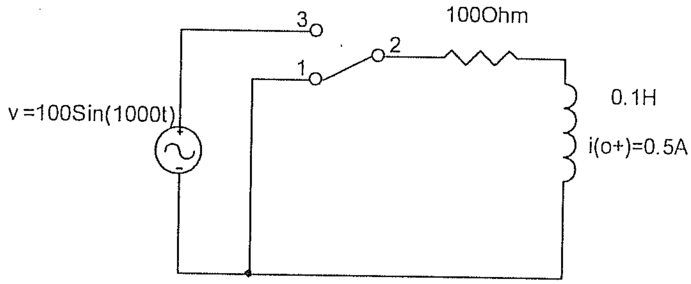
b. $\dfrac{120}{s+0.46}$.

c. $\dfrac{40s+2}{(s+46)(s+0.36)}$

d. $\dfrac{4s}{(s+0.46)(s+0.0036)}$.

e. None of the above

L **-3-** In the circuit shown, the switch has been for a long time at position 1. At t=0, it is moved to position 3. Find I(s). (p15)

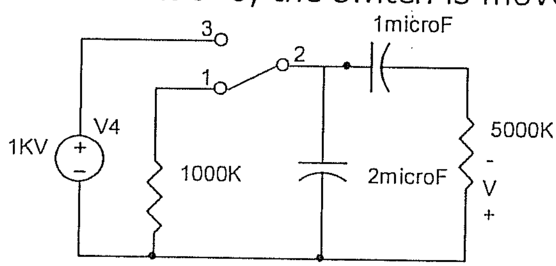


a. $(0.5s^2+1.5\times10^6)/(s^2+10^6)(s+1000)$
b. $(10^6s^2)/(s+10^6)(s-1000)$
c. $(s^2+1.5\times10^6)/(s+10^6)(s+1000)$
d. $(1.5\times10^6)/(s^2+10^6)(s+1000)$
e. None of the above

L **-4-** Calculate I(t) for problem 3, for t>0. (p15)

a. $[\sin(1000t+45°)+e^{-1000t}].u(t)$
b. $[(1/\sqrt{2})\sin(1000t+45°)+e^{-1000t}].u(t)$
c. $[(1/\sqrt{2})\sin(1000t-45°)+e^{-1000t}].u(t)$
d. $[\sqrt{2}.\sin(1000t-45°)-e^{-1000t}].u(t)$
e. None of the above

L **-5-** In the circuit shown, the switch has been for a long time at position 3. At t=0, the switch is moved to position 1. Find V(s) p(15)



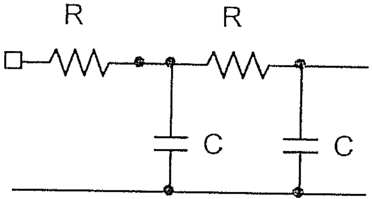
a. $500/(s+0.1)$ b. $1020/(s^2+0.8s+0.1)$
c. $-1020/(s+0.155)$ d. $500/(s^2+0.8s+0.1)$
e. None of the above

L **-6-** Find v(t) for t>0 for problem 5. (p15)

a. $500(e^{-0.1t}).U(t)$ b. $1020(e^{-0.645t}-e^{-0.155t}).U(t)$
c. $-1020(e^{-0.155t}).U(t)$ d. $500(e^{-0.645t}-e^{-0.155t}).U(t)$
e. None of the above

-10-Consider the cascaded connection of 2-RC low-pass filters and determine the impulse response at the output. Let RC=1. (p16)

a. $t.e^{-2t}U(t)$
b. $e^{-t}U(t)$
c. $t^2.e^{-2t}U(t)$
✓d. $t.e^{-t}U(t)$
e. None of the above



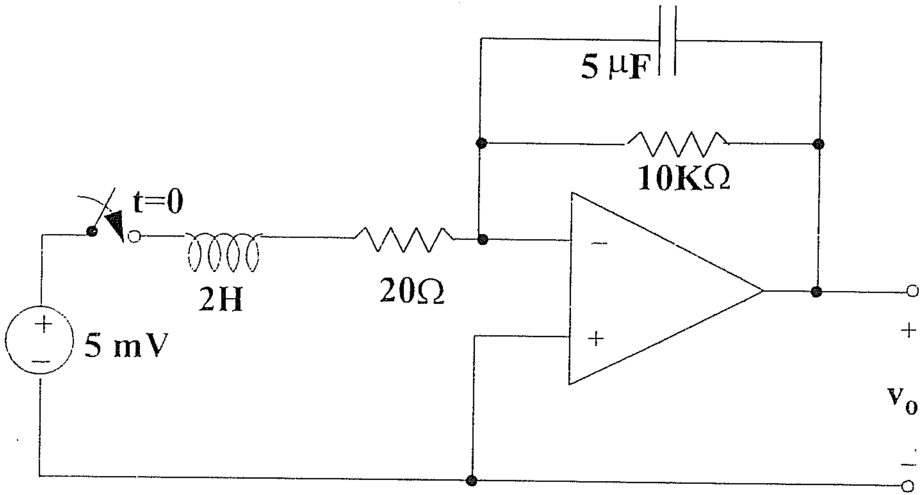


Figure 22

L 23. The inductor and capacitor in figure 22 have no inital stored energy and the op amp is ideal. The switch is closed at t = 0. Determine v_o for $t > 0$. (p57)

a) $5e^{-10t} - 2.5e^{-20t} - 2.5$ V
b) $10e^{-10t} - 5e^{-20t} - 5$ V
c) $8e^{-10t} - 4e^{-20t} - 4$ V
d) $6e^{-10t} - 3e^{-20t} - 3$ V
e) None of the above

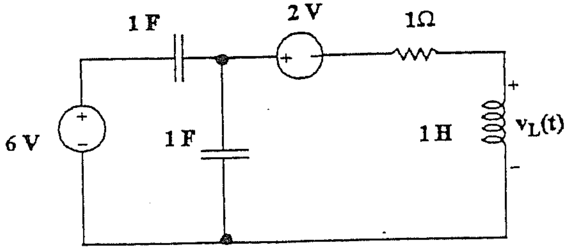


Figure 1.

L 1. Derive $V_L(s)$ in Fig. 1, assuming zero initial conditions. (p65)

A. $(s + 2) / (s^2 + s + 1)$
B. $2s^2 / (s^2 + 3s + 1)$
C. $(s + 1) / (3s^2 + 2s + 1)$
D. $2s / (2s^2 + 2s + 1)$
E. None of the above

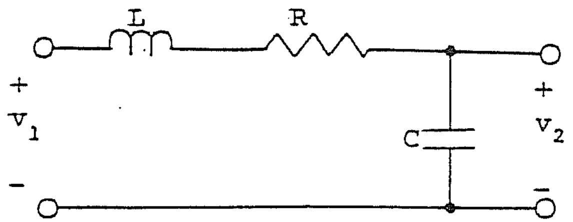


Figure 3.

L **4.** The voltage ratio $V_2(s) / V_1(s)$ in Fig. 3 has a pole at $-100 + j700$ rad/s. If R = 500 ohms, find L and C. (p66)

A. L = 1.5 H, C = 1.388 µF
B. L = 1.0 H, C = 2.083 µF
C. L = 2.5 H, C = 0.800 µF
D. L = 2.0 H, C = 1.040 µF
E. None of the above

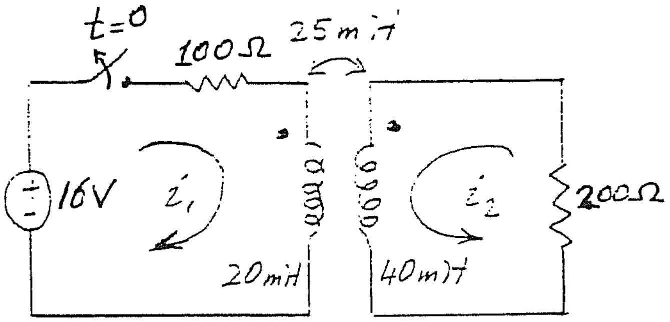


Figure 9.

L **11.** In the circuit of Fig. 9. steady current i_1 is flowing, with $i_2 = 0$, for $t < 0$. At $t = 0$, the switch is opened. Determine i_2 as a function of time in ms. (p69)

A. $0.15e^{-4t}$ A
B. $0.1e^{-5t}$ A
C. $0.2e^{-2t}$ A
D. $0.4e^{-3t}$ A
E. None of the above

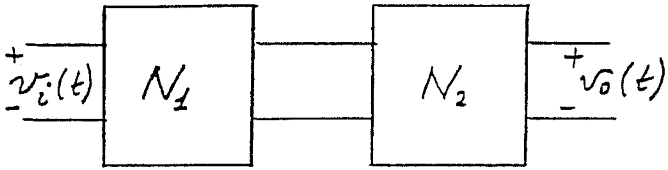


Figure 6.

L 7. Two networks N_1 and N_2 are cascaded as shown in Fig. 6. The impulse response of N_1 is $2\delta'(t)$, where $\delta'(t)$ is the first time derivative of the unit impulse. The impulse response of N_2 is $e^{-t}\sin 2t$. Determine the impulse response of N_1 cascaded with N_2. (p67)

A. $2e^{-2t}(\cos t - 2\sin t)$
B. $2e^{-t}(2\cos 2t - \sin 2t)$
C. $\delta(t) - e^{-t}\cos 2t - 2e^{-t}\sin 2t$
D. $\delta(t) - 2e^{-2t}\cos t - 2e^{-2t}\sin t$
E. None of the above

L 8. A function x(t) when convolved with the function $(1 - e^{-2t})$ gives the function $1 - e^{-2t} - 2te^{-t}$, $t \geq 0$. Determine x(t). p(67)

A. te^{-t}
B. te^{-2t}
C. $te^{-t}\sin t$
D. $te^{-2t}\cos t$
E. None of the above

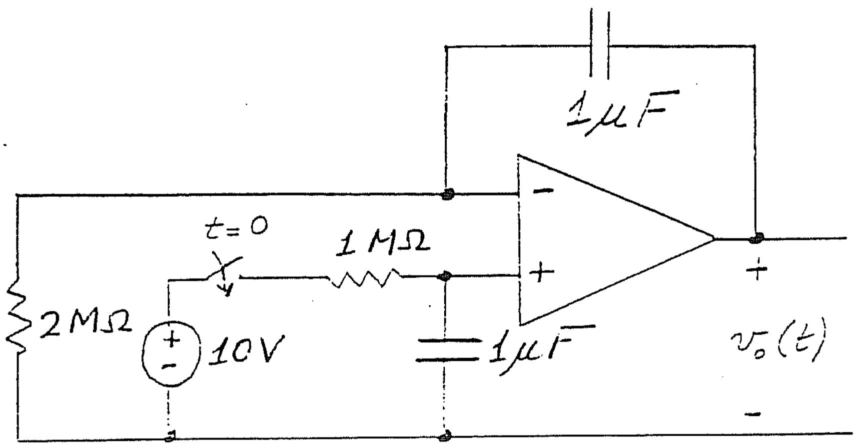


Figure 7.

L 9. In the circuit of Fig. 7, the capacitors have zero initial energy storage. The switch is closed at t = 0. Determine $v_o(t)$ (p68)

A. $6(t - 1 + e^{-2t})$ V
B. $6(t + 1 - e^{-t})$ V
C. $5(t + 1 - e^{-t})$ V
D. $5(t - 1 + e^{-t})$ V
E. None of the above

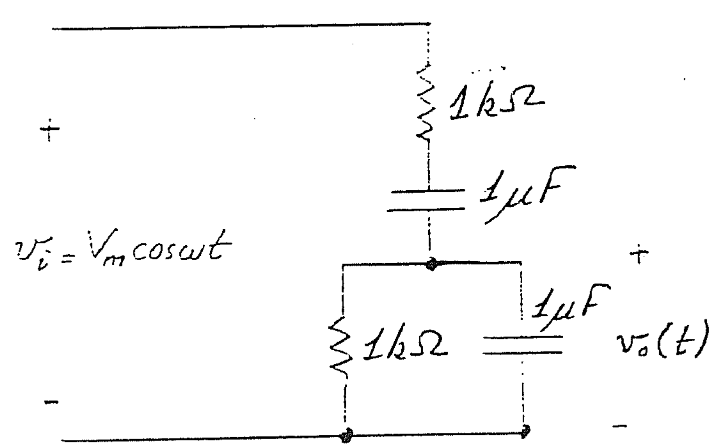


Figure 8.

10. Given the circuit of Fig. 8. Determine: (a) whether the response is bandpass or bandstop, (b) the frequency of maximum, or minimum, response, and (c) the half-power bandwidth.

A. Bandstop; 3000 rad/s; 1000 rad/s
B. Bandpass; 3000 rad/s; 1000 rad/s
C. Bandstop; 1000 rad/s; 3000 rad/s
D. Bandpass; 1000 rad/s; 3000 rad/s
E. None of the above

L 5. Find the Laplace transform of the non-periodic staircase function shown in Fig. 4. p(71)

A. $V(s) = 15(e^{-2s} + e^{-4s} + e^{-6s} + 3e^{-8s}) / s$

B. $V(s) = 5(e^{-2s} + e^{-4s} + e^{-6s} - 3e^{-8s}) / s$

C. $V(s) = 10(e^{-2s} + e^{-4s} + e^{-6s} - 3e^{-8s}) / s$

D. $V(s) = 5(e^{-2s} - e^{-4s} - e^{-6s} + 3e^{-8s}) / s$

E. None of the above

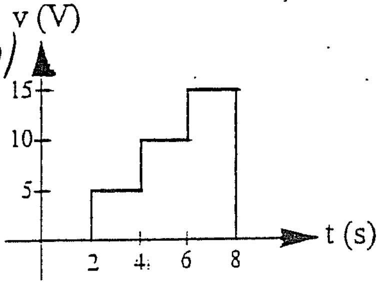


Figure 4.

L 24. Determine the zeros and poles of the transfer (p76)

function $\frac{V_o}{V_i}(s)$ in the circuit of Fig. 21

assuming R = 1 Ω, L = 1 H, and C = 1 F.

A. zeros: s = 0, -2; poles: $-0.5 \pm 0.5j$, ∞
B. zeros: s = 0, -1; poles: $-0.5 \pm 0.5j$, ∞
C. zeros: s = 0, -1; poles: $-0.5 \pm 0.5j$
D. zeros: s = 0, -2; poles: $-1 \pm j$
E. None of the above

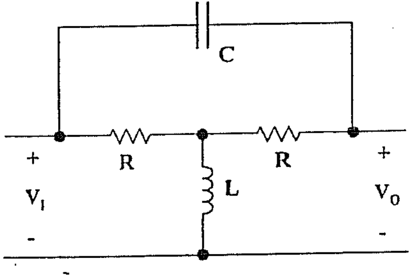


Figure 21

L

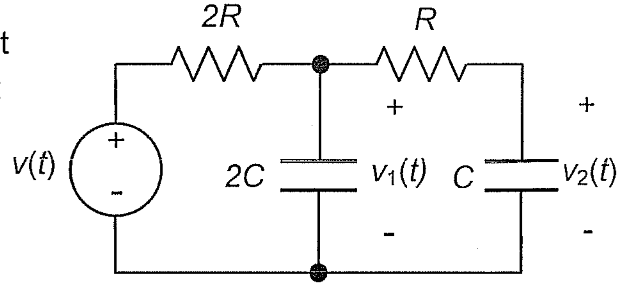
5. The current through a 0.1 H inductor is given by (p 100)

$$I_L(s) = \left(\frac{-s+100}{s(s+100)} \right)$$

If $I_L(0^+)$=-1A, find $v_L(t)$.

— a) $20e^{-100t}$, V
b) $-0.2e^{-100t}$, V
c) $-20e^{-100t}$, V
d) $0.2e^{-100t}$, V
e) None of the above

L 8. An unknown voltage $v(t)$ is applied to the circuit shown. If $v_1(t) = e^{-t}$, determine $v_2(t)$, given that $R = 1\ \Omega$ and $C = 1$ F. (p101)



A. $2te^{-t}$ V

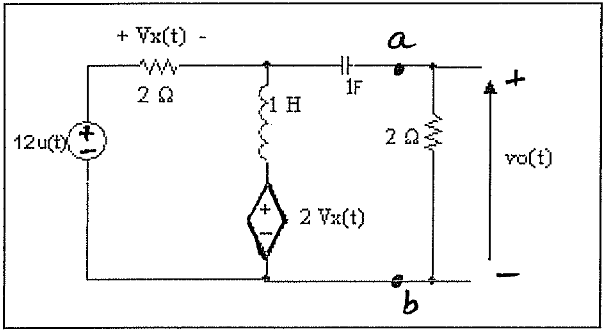
B. te^{-t} V

C. $2\left(e^{-t} - e^{-2t}\right)$ V

D. $1.5\left(e^{-t} - e^{-3t}\right)$ V

E. None of the above

L 11. Determine the Thevenin equivalent voltage seen from terminals ab in the circuit shown below. (p102)



a) $V_{th} = \dfrac{12}{s(s+6)}$

b) $V_{th} = \dfrac{(s+4)}{s(s+6)}$

c) $V_{th} = \dfrac{12\,(s+4)}{s(s+6)}$

d) $V_{th} = \dfrac{12\,(s+4)}{(s+6)}$

e) None of the above

L 12. The transfer function is given as: $H(s) = V_o/V_i = (10/s)/(4 + 0.4s + (10/s))$ and the input voltage is given as $v_i = 10\,[u(t) - u(t-0.1)]$ V. Use the convolution integral to find v_o for $t \geq 0.1$. (p103)

a) $10 - 10e^{-5t}(5t + 1)$
b) $10e^{-5t}(5t + 1)$
c) $10e^{-5(t-0.1)}(5t + 0.5) - 10e^{-5t}(5t + 1)$
d) $10e^{-5(t-0.1)}(5t + 0.5)$
e) None of the above

L 6. Solve for i(t) in the circuit shown. (p105)

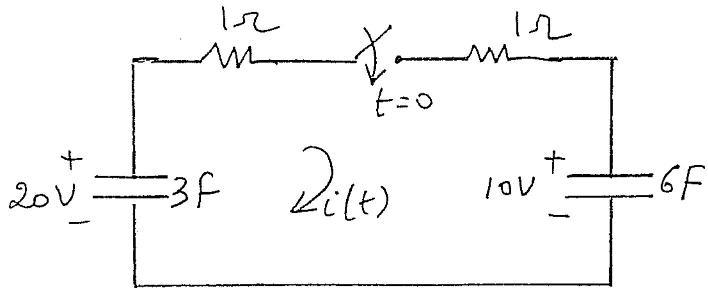
a. $I(s)=\dfrac{10}{4s+1}$

b. $I(s)=\dfrac{40}{4s+1}$

c. $I(s)=\dfrac{20}{4s+1}$ ✓

d. $I(s)=\dfrac{60}{4s+1}$

e. None of the above



L 7. In problem 6, determine the voltage on the 3F capacitor.. (p105)

a. $V(s)=\dfrac{24s+40}{3(4s+1)}$

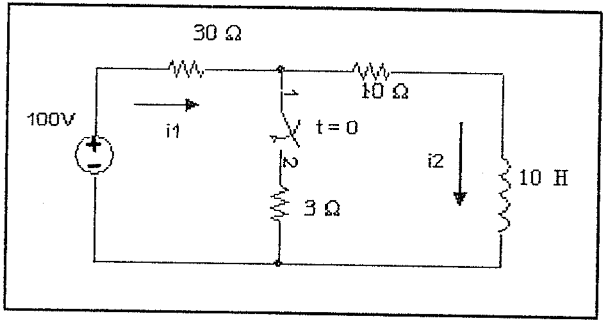
b. $V(s)=\dfrac{240s+40}{4s(s+1/3)}$

c. $V(s)=\dfrac{240s+40}{3s(4s+1)}$ ✓

d. $V(s)=\dfrac{240s+40}{12s^2+1}$

e. None of the above

L 7. Determine the current $I_1(s)$ for the circuit shown below. (p123)



a) $\dfrac{20+55s}{s(28+22s)}$

b) $\dfrac{2860}{s(28+22s)}$

c) $\dfrac{86.67+71.67s}{s(28+22s)}$

d) $\dfrac{2860+2365s}{s(28+22s)}$

e) None of the above

L 6. Given $F(s)=\dfrac{1+e^{-s}}{(s+1)^2}$. Determine $f(t)$ at $t = 2$ s. (p132)

A. -0.64
B. 0.64
C. 1.28
D. -1.28
E. None of the above

L 7. The current in a circuit is given by (p140)

$$\frac{d^2i}{dt^2}+2\frac{di}{dt}+i=0$$

If the initial conditions are $I(0^+)=1$ and $(di/dt)=0$ at $(t=0^+)$. Find $I(t)$

A. $e^{-t}(1+2t)$, A
B. $e^{-2t}(1+t)$, A
C. $e^{-t}(1+t^2)$, A
D. $e^{-t}(1+t)$, A
E. None of the above

L 12. Find f(t) if $F(s) = [40 + 2(s^2+4s+5)^2] / (s^2 + 4s + 5)^2$. (p141)

a. $f(t) = 2\, t\, \delta(t) + 20\, e^{-2t} \sin t\, u(t) - 20\, e^{-2t} \cos t\, u(t)$
b. $f(t) = 2\, d(\delta(t))/dt + 20\, t\, e^{-2t} \sin t\, u(t) - 20\, e^{-2t} \cos t\, u(t)$
c. $f(t) = -10\, t\, e^{-2t} \cos t\, u(t) + \delta(t) + 20\, e^{-2t} \sin t\, u(t)$
d. $f(t) = -20\, t\, e^{-2t} \cos t\, u(t) + 2\delta(t) + 20\, e^{-2t} \sin t\, u(t)$
e. None of the above

L 17. source of unknown voltage is applied to the circuit shown. Given that $i_C(t) = (1 + t)u(t)$ A, determine $i(t)$. (p143)

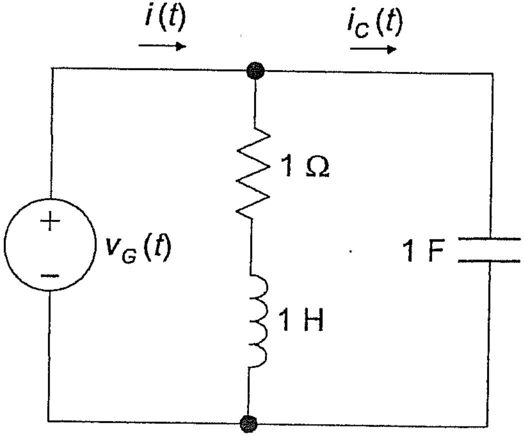
A. $(e^{-t} + t + t^2/2)u(t)$ A

B. $(e^{-t} + t - t^2/2)u(t)$

C. $(1 + t + t^2/2)u(t)$ A

D. $(1 - t + t^2/2)u(t)$ A

E. None of the above



L 19. The response of a given circuit to a unit voltage impulse is $(e^{t} - e^{-t})$ Vs, with no initial energy stored in the circuit. Determine the response to a sawtooth waveform defined by $f(t) = t$ V for $0 \le t < 1$ s, and $f(t) = 0$ for $t < 0$ and $t > 1$ s. (p.144)

A. $[e^{t} + e^{-t} - 2t]u(t) + [e^{t} + e^{-t} - 2t]u(t-1)$ V

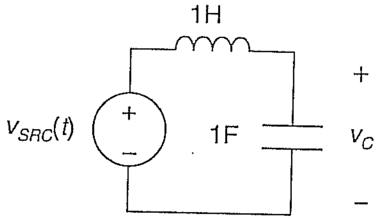
B. $[e^{t} + e^{-t} - 2t]u(t) + [e^{t-1} + e^{-t+1} - 2t + 2]u(t)$ V

C. $[e^{t} - e^{-t} - 2t]u(t) - [e^{t-1} - e^{-t+1} - 2t + 2]u(t-1)$ V

D. $[e^{t} + e^{-t} - 2t]u(t) + [e^{t-1} + e^{-t+1} - 2t + 2]u(t-1)$ V

E. None of the above

L 8. Determine $v_C(t)$ given zero initial conditions and $v_{SRC}(t) = \delta^{(1)}(t)$, the derivative of the unit impulse at the origin. (p.158)



A. $\sin t$

B. $\cos t$

C. $\sin 2t$

D. $2\cos 2t$

E. None of the above

L **16. What is the transfer function H(s) that relates Vo and Vi as H(s)=Vi/Vo** (p.161)

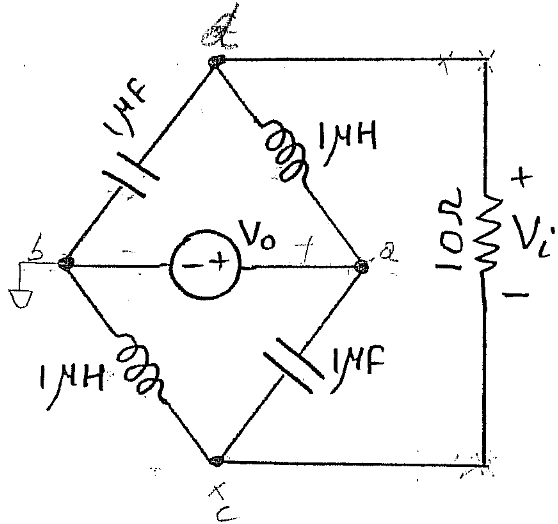
a. $\dfrac{(500x10^{-3})(10^{12}-s^2)}{s^2+200x10^3\,x\,s+10^{12}}$

b. $\dfrac{2x(10^{12}-s^2)}{s^2+200x10^3\,x\,s+10^{12}}$

— c. $\dfrac{10^{12}-s^2}{s^2+200x10^3\,x\,s+10^{12}}$

d. $\dfrac{10^{12}+s^2}{s^2+200x10^3\,x\,s+10^{12}}$

e. None of the above



17. The time domain representation of a certain periodic signal is:
$f(t) = 2\delta(t+3T/8) - 2\,\delta(t+T/8) + 2\,\delta(t-T/8) - 2\,\delta(t-3T/8)$

The correct truncated Fourier series for T=1 is

a. $8\sqrt{2}\cos(2\pi t) - 8\sqrt{2}\cos(6\pi t) - 8\sqrt{2}\cos(10\pi t) + 8\sqrt{2}\cos(14\pi t)$

b. $-8\sqrt{2}\sin(2\pi t) - 8\sqrt{2}\sin(6\pi t) + 8\sqrt{2}\sin(10\pi t) + 8\sqrt{2}\sin(14\pi t)$

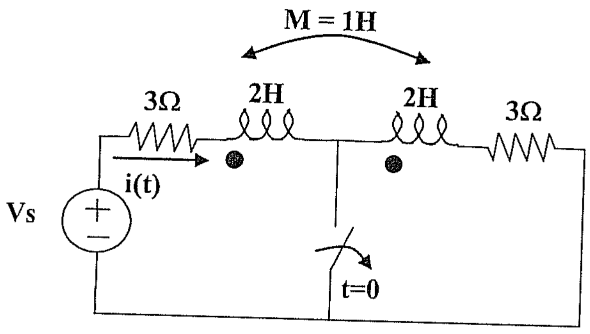
— c. $16\sin(4\pi t) - 16\sin(12\pi t)$

d. $-16\cos(8\pi t) + 16\cos(16\pi t) + 8$

e. None of the above

5. In the circuit shown Vs = 12V, find the expression of the current i(t) for t>0 flowing through the source when the switch opens at t=0 after being closed for a long time. (p.175)

Remarks: u(t) is the unit step function, its Laplace transform is 1/s; δ(t) is the impulse function, its Laplace transform is 1.



A. $i(t) = u(t)$ A
B. $i(t) = 2u(t)$ A
C. $i(t) = \delta(t)$ A
D. $i(t) = 2\delta(t)$ A
E. None of the above