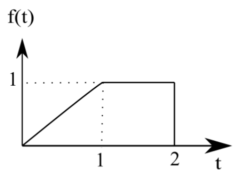
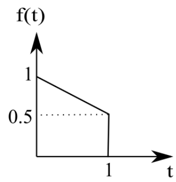
# AVP 213 Drill Problems - Set 1

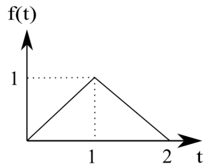
Q. Find Laplace Transform of the following:




(1)




(2)




(3)

Q. Solve for *y(t)* using Laplace Transform for the following:

(4) $y'' + 0.04y = 0.02t^2$ ; $y(0) = -25$ ; $y'(0) = 0$

(5) $y'' + 3y' + 2.25y = 9t^3 + 64$ ; $y(0) = 1$ ; $y'(0) = 31.5$

(6) $y'' + 2y' + 5y = 50t - 100$ ; $y(2) = -4$ ; $y'(2) = 14$

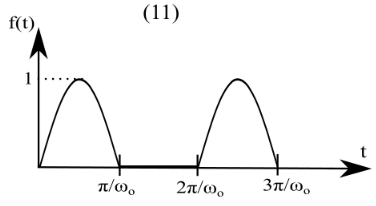
(7) $$\begin{aligned} y'' + 3y' + 2y &= 4t \quad if \quad 0 \le t < 1 \quad , \; y(0) = 0 \\ &= 8 \quad if \quad t \ge 1 \qquad , \; y'(0) = 0 \end{aligned}$$

(8) $$\begin{aligned} y'' + 2y' + 5y &= 10sint \quad if \quad 0 \le t < 2\pi \quad , \; y(\pi) = 1 \\ &= 0 \qquad if \quad t \ge 2\pi \qquad , \; y'(\pi) = 2e^{-\pi} - 2 \end{aligned}$$

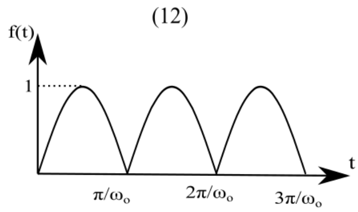
(9) $y'' + 4y = \delta(t - \pi)$ ; $y(0) = 8$ ; $y'(0) = 0$

(10) $y'' + 3y' + 2y = 10[sint + \delta(t - 1)]$ ; $y(0) = 1$ ; $y'(0) = -1$

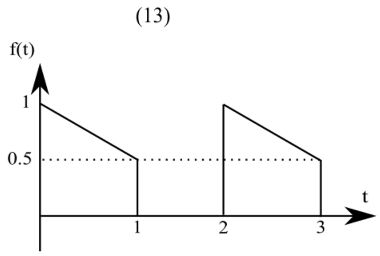
Q. Find F(s) for the periodic waveforms f(t) in the problems (11) to (14)

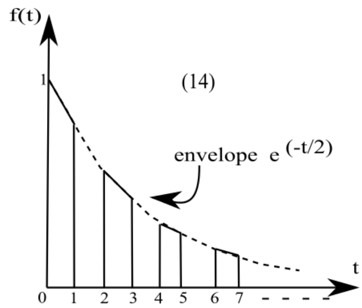



Half Wave Rectified sinusoids



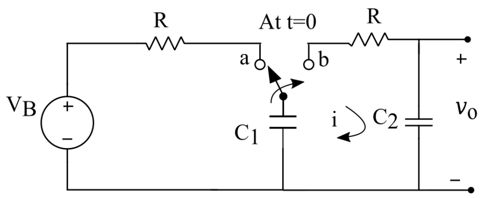

Full Wave Rectified sinusoids



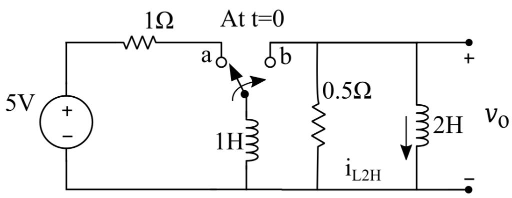




Q. Analyse and solve for problems (15) to (29) by methods applicable in time domain.

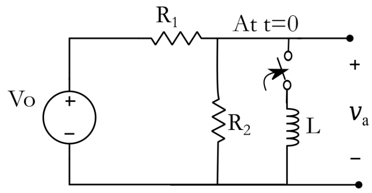
(15) Switch moves from ‘a’ to ‘b’ at $t = 0$. Steady state was initially reached at position ‘a’. Given $v_0(0^{-})$=0. Find $i(t)$ and $v_0(t)$ for t>0.



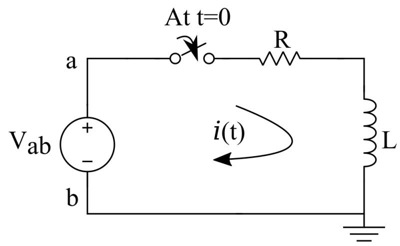

(16) Solve for $v_0(t)$, given $i_{L2H}(0^{-}) = 0$. Steady state was initially reached at position ‘a’.



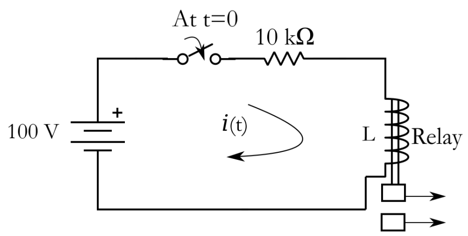
(17) $V_0 = 3V, R_1 = 10\Omega, R_2 = 5\Omega, L = 0.5H$ at $t = 0$, switch is closed. Find $v_a(t)$ for $t > 0$



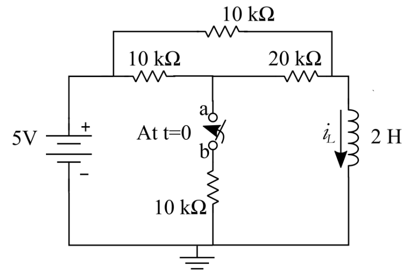

(18) $v_{ab} = V_m sin\omega_0 t$, solve for $i(t)$



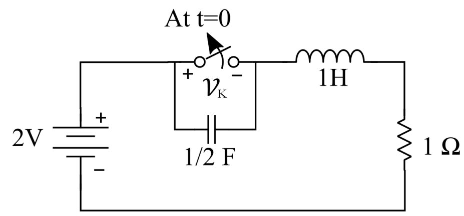

(19) Relay is an electromagnetic switch which constitute of a coil inductance 'L' is having movable parts. The relay is designed and constructed in such a manner that it is activated when current through the coil is 0.008A. After the switch is closed at $t = 0$, it is observed that the relay gets activated when $t = 0.1sec$. Find the inductance (L) of the coil.



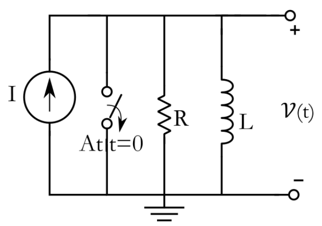
(20) Initially the switch was open with the network reaching steady state. At $t = 0$, the switch is closed. Find and plot $i_L(t)$ for $t > 0$.



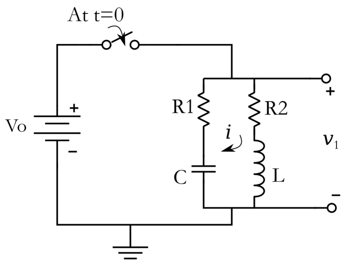

(21) Network was at steady state with switch Sw closed. At $t = 0$, Sw is opened. Determine $v_k$ and $\dfrac{dv_k}{dt}$ at $t = 0^+$



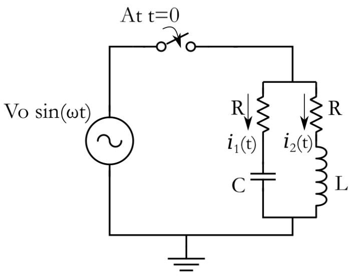

(22) If $I = 1A, R = 100\Omega, L = 1H$, solve for $v, \dfrac{dv}{dt}, \dfrac{d^2v}{dt^2}$ at $t = 0^+$



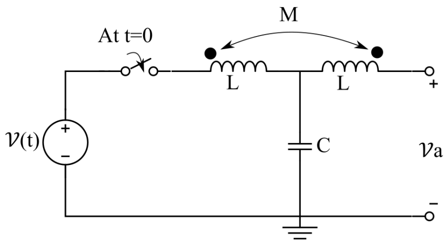
(23) Network unenergized before $t = 0$, Determine $v_1, \frac{dv_1}{dt}, \frac{d^2v_1}{dt^2}$ at $t = 0+$




(24) Find $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at $t = 0^+$




(25) Network initially relaxed $v(t) = V_m sin(\frac{t}{\sqrt{MC}})$.

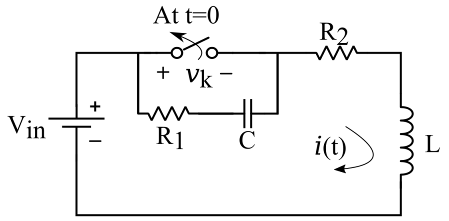



Show that,

(a) $v_a(0^+) = 0$,

(b) $\frac{dv_a}{dt}(0^+) = \frac{V\sqrt{M}}{L\sqrt{C}}$

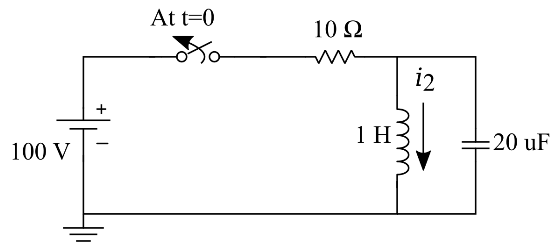
(26) Network initially reached steady state with switch closed.At $t = 0$, it is opened.



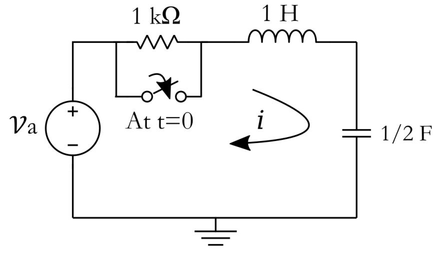

(a) Find an expression for the voltage across the switch $v_k$ at $t = 0^+$

(b) If the parameters are adjusted such that $i(0+) = 1$ and $\frac{di}{dt}(0^+) = -1$,what is the value of $\frac{dv_k}{dt}$ t=0+?

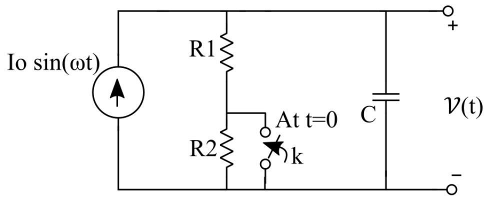
(27) Initially switch was closed and steady state was reached in the network. At $t = 0$, the switch is opened. Find expression for $i_2(t)$.



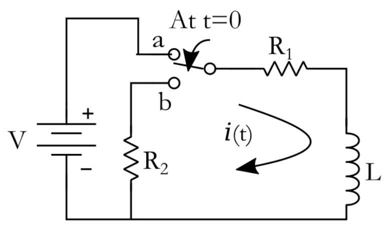

(28) Steady state was reached with switch open. $v_a = 100sin377t$. At $t = 0$, switch is closed. Determine $i(t)$ for $t \geq 0$



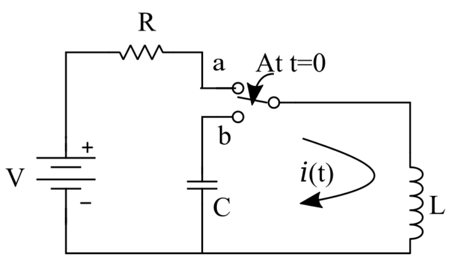
(29) Network initially was operating in steady state with 'k' opened. At $t = 0$, 'k' is closed. Find expression for $v(t)$ for $t \geq 0$.



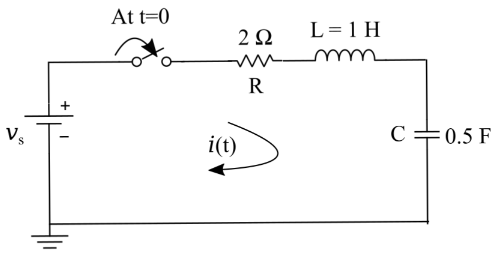

(30) Steady state was initially reached with switch at position 'a'. Solve for $i(t)$ using Laplace transform method.



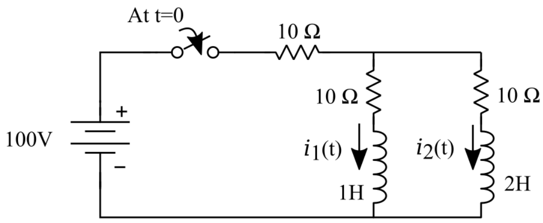

(31) Steady state was initially reached at position 'a'. Solve for $i(t)$ using Laplace transform method.



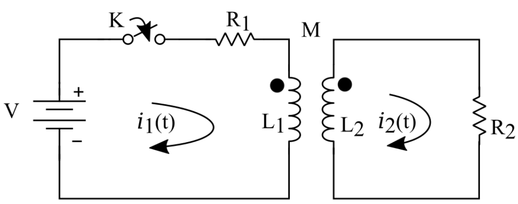
(32) $v_s = sint$, Initially relaxed network. Find $i(t)$ for $t > 0$.



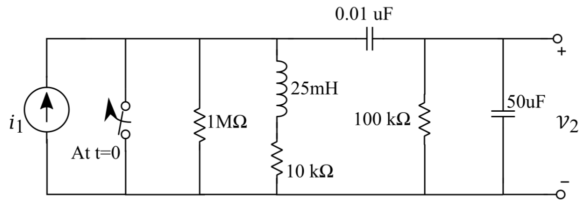

(33) Initially unenergized network. Find $i_1(t)$, $i_2(t)$for $t > 0$



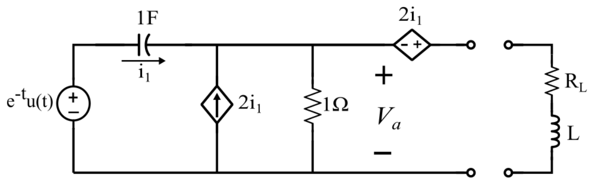

(34) Initially unenergized network. $L_1 = 1H, L_2 = 4H, M = 2H, R_1 = R_2 = 1\Omega, V = 1V$. Find $i_1(t)$, $i_2(t)$



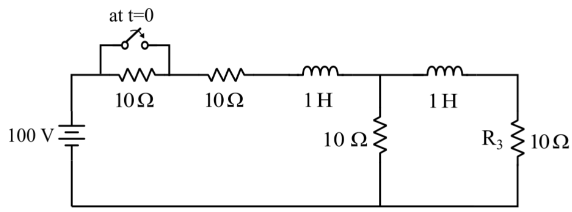
(35) Initially unenergized network. Switch opened at $t = 0$ If $i_1(t) = 10^{-3}e^{-t}u(t)A$, find and plot $v_2(t)$ for $t \geq 0$



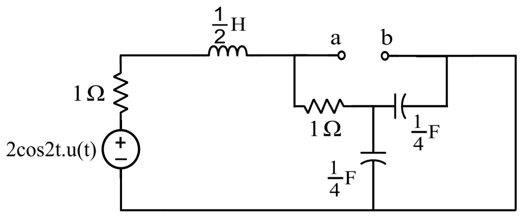

(36) With respect to the load consisting of $R_L$ and L determine the Thevenin equivalent network.



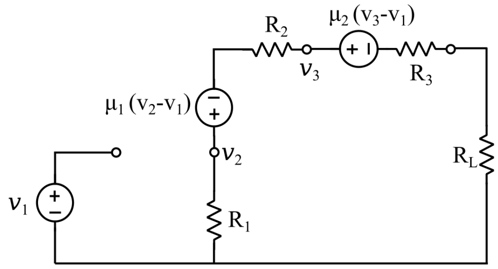

(37) Find the current in $R_3$ using (a) Thevenin's theorem (b) Norton's theorem




(38) Find both Thevenin's and Norton's equivalent network for the terminals a-b in the figure for zero initial conditions.



(39) $R_L$ is the load. Determine the equivalent Thevenin Network to find the current in load $R_L$.




(40) $v_s = \sqrt{2}V_1.sin2\pi ft,\ \ where\ \ V_1 = 230\ V\ \ and\ \ f = 50\ Hz.$

(a) Design an appropriate filter which passes the DC component in $v_o$(t) and attenuates (reduces/seals down) all AC components having frequency 50Hz or more by atleast 100 times.
Note : Remember for this problem as well as subsequent problems, the best designed filter is the one which is simplest yet meets all it's specifications.

(b) Design an appropriate filter which attenuates the DC component in $v_o$(t) by atleast $100^2$ times and passes all the AC components having frequency 50 Hz or more with phase error (if any) less than 2°.

(c) Repeat problem (a) and (b) by re-designing the filters with op-amps.