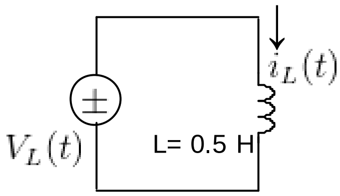
Institute of Engineering Studies (IES), Bangalore.

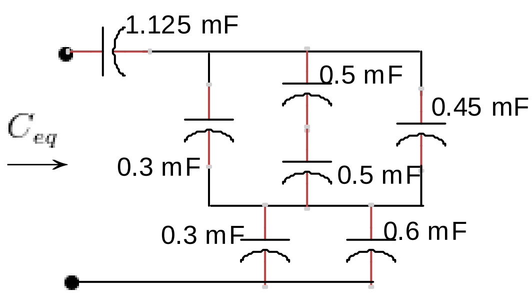
Practice paper on Network Analysis Transients.

1.For the circuit of figure , determine i_L (0) and i_L (t) for t ≥ 0 when V_L (t) = $e^{-|t|}$ V



Ans: , $i_L(0)$ = 2A, $i_L(t) = 4 – 2 e^{-t}$ A

2.For the circuit of figure , compute the equivalent capacitance C_{eq}

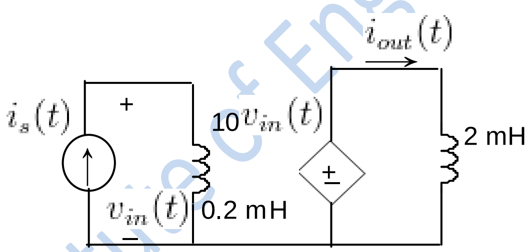


Ans : $C_{eq} = \frac{1}{3} mF$

3.(a) For $i_s(t)$ = sin (1000 t) mA in figure, calculate and sketch $i_{out}(t)$ for 0≤ t ≤ 15 ms, assuming both inductor currents are zero at t=0

(b)What is the instantaneous power delivered by the dependent source ?

(c) compute and sketch the energy stored in the 2 –mH inductor for 0 ≤ t ≤ 15 ms



Ans : (a) sin(1000 t) mA; $sin^2(1000t)$ nW

4.In the circuit of figure , suppose $i_s(t)$ = 4 sin (4t) A . Find i_C (t)

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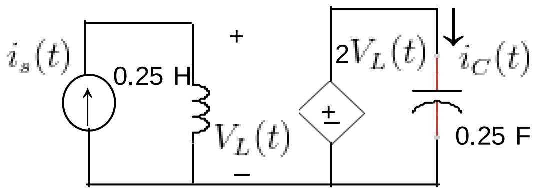
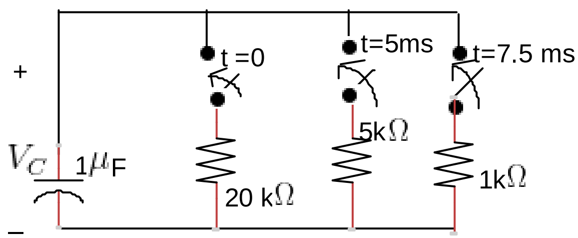
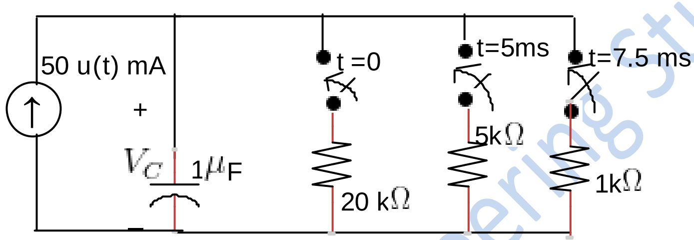


Ans : 8 sin (4t) A

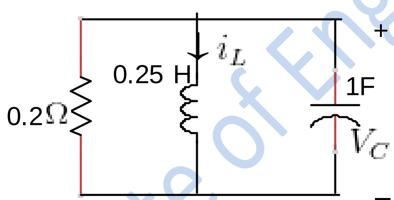
5.For the circuit of figure find an expression for $V_C(t)$ using step functions assuming $V_C(0) = 10$ V. plot this expression for $0 \le t \le 12$ ms



6.For the circuit of figure , find an expression for $V_C(t)$ using step functions assuming $V_C(0^-) = 0$. Plot this expression using for $0 \le t \le 12$ ms



7.Figure shows an over damped source-free circuit



(a) If $V_C(0) = -1$ V and $i_L(0) = 5$ A, find $V_C(t)$ for $t \ge 0$. Plot the $V_C(t)$ waveform and verify that there is no zero crossing

(b) If $V_C(0) = -1$ V and $i_L(0) = 5$ A, find $V_C(t)$ for $t \ge 0$. Plot the $V_C(t)$ waveform and verify that there is one zero crossing

8.In figure , the switch S has been at position A for a long time and is moved to position B at t =0

a. Find $V_C(t)$ for $t > 0$ b. Find $i_L(0^+)$, $i_L(\infty)$, and $i_L(t)$ for $t > 0$

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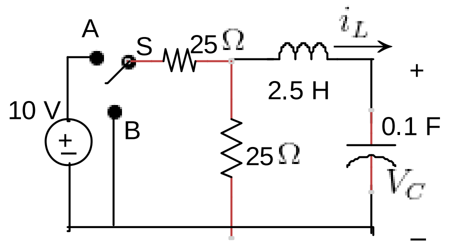
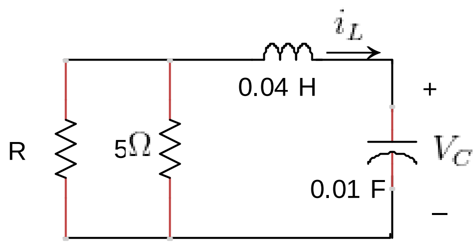
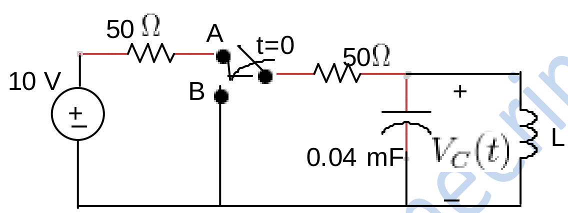


9.(a)Find the value of R (in ohms) that makes the circuit of figure critically damped

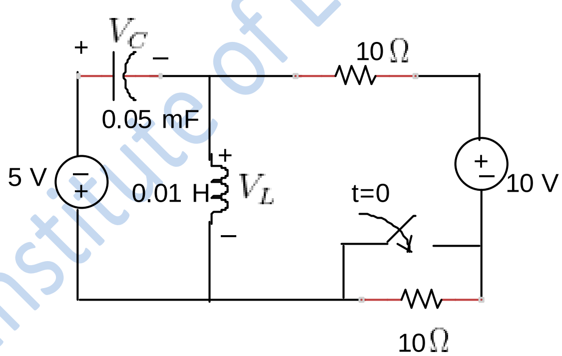
(b) Given this value of R, suppose $V_C(0) = 5$ V and $i_L(0) = -5$ A. Compute $V_C(t)$ and determine the first time at which the capacitor voltage is zero. Plot your result to verify your calculation



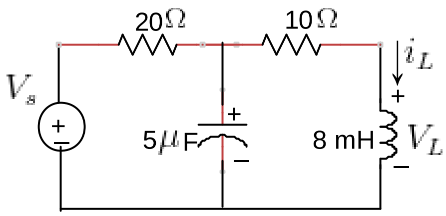
10.The switch in the circuit of figure is in position A for a long time and moves to position B at t =0. Find the voltage $V_C(t)$ for t >0 when L equals (a) 0.625 H, (b) 0.4 H, and (c) 0.2 H



11.The circuit of figure is in the steady state with the switch open . The switch closes at t =0 . Find $V_L(t)$ and $V_C(t)$ for t >0



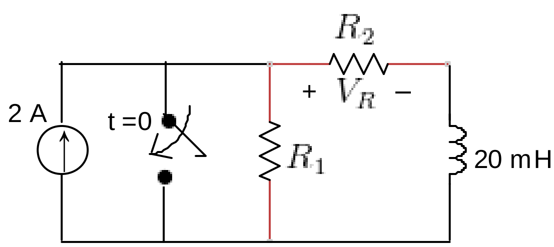
12. Draw the exact dual of the circuit shown in figure . Specify the dual variables and the dual initial conditions . (b) write nodal equations for the dual circuit. (c) Write mesh equations for the dual circuit



$V_C(0)$ = 12 V, $i_L(0)$= 2A

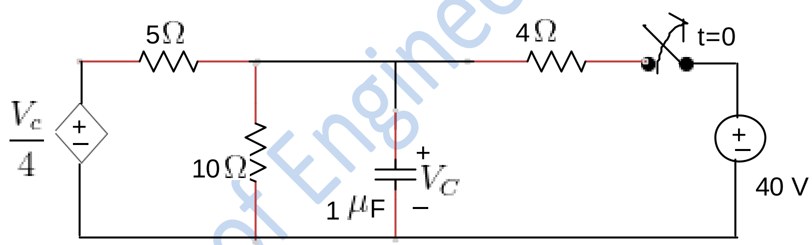
Ans : (a) V_{20}, i_L, i_C and V_C; $i_L(0)$ = 12 A and V_C (0) = 2 V

13.Select values for R_1 and R_2 in the circuit of figure so that $V_R(0^+)$ = 10 V and V_R (1 ms) = 5 V



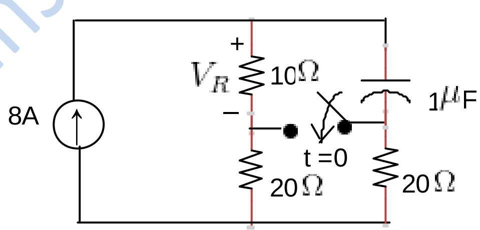
Ans: R_1 = 7.82 Ω, R_2 = 13. 86 Ω

14.Assume that the circuit shown in figure has been in the form shown for a very long time. Find $V_C(t)$ for all t after the switch opens



Ans: 20 $e^{-250,000\,t}$ V

15.In the circuit of figure , find $V_R(t)$ for (a) t < 0; (b) t> 0. Now assume that the switch has been closed for a very long time and opens at t =0. Find $V_R(t)$ for (c) t < 0; (d) t > 0



Ans : (a) 80 V; (b) $80 + 160\, e^{-100,000\, t}$ V;   (c) 80 V; (d) $80 - 32\, e^{-20,000\, t}$ V