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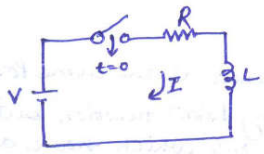
Department of Electronics and Communication Engg
First midterm question paper with answer
Session (2017-18)
Subject –circuit analysis and synthesis

Q.1 Derive the current relation in R-L series circuit when a dc, ac, step, ramp, impulse signal connect at time t=0, aasume intial condition are zero

Sol.1



Consider a series RL circuit shown in fig. Initial value of current is zero before switch closed. by applying KVL we get

$$L\frac{dI}{dt} + RI = V$$

$$\frac{dI}{dt} + \frac{R}{L}I = \frac{V}{L}$$

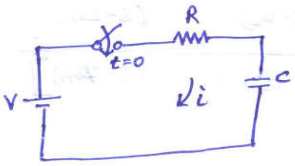
by the Analysis we get

$$i = \frac{V}{R}(1-e^{-(R/L)t})$$

by putting the i/p as Dc, ac, Ramp, impulse signal we get the expression. for example we get the eqn of current for Dc as above. by putting the step function we get the eqn $= i = \frac{1}{R}[1-e^{-(R/L)t}]$

Q.2 Derive the current relation in R-C series circuit when a dc, ac, step, ramp, impulse signal connect at time t=0, aasume intial condition are zero.

Sol 2.



Here we have a series RC circuit shown in fig. the Initial value of current is zero before switching. by applying the KVL we get

$$Ri + \frac{1}{C}\int i\,dt = V$$

$$R\frac{di}{dt} + \frac{i}{C} = 0$$

And by the analysis we get –

$$i(t) = -\frac{V}{R}e^{-t/RC}$$

for the Dc input at the ckt

similarly we can get the current Relation for the ac, Ramp and. impulse signal.

Q.3 What do you mean by pole and zero for a network function.

Sol2 A N/w function can be written as the ratio of two Polynomials.

$$H(s) = \frac{A(s)}{B(s)} = \frac{a_0 s^n + a_1 s^{n-1} + \cdots a_{n-1}s + a_n}{b_0 s^m + b_1 s^{m-1} + \cdots b_{m-1}s + b_m}$$

$$= \frac{a_0}{b_0}\frac{[(s-z_1)(s-z_2)\cdots(s-z_n)]}{[(s-p_1)(s-p_2)\cdots(s-p_m)]}$$

Then $z_1, z_2 \cdots z_n$ are the zero's.
and $p_1, p_2 \cdots p_m$ are the Poles.

Q.4 Write the interrelationship of parameters

Sol.4 Interrelation Ship bet^{n} Parameters

Parameter	Z		Y	
Z	Z_{11}	Z_{12}	$\frac{Y_{22}}{\Delta Y}$	$-\frac{Y_{12}}{\Delta Y}$
	Z_{21}	Z_{22}	$-\frac{Y_{21}}{\Delta Y}$	$\frac{Y_{11}}{\Delta Y}$
Y	$\frac{Z_{22}}{\Delta Z}$	$-\frac{Z_{12}}{\Delta Z}$	Y_{11}	Y_{22}
	$-\frac{Z_{21}}{\Delta Z}$	$-\frac{Z_{11}}{\Delta Z}$	Y_{21}	Y_{22}

Similarly we can find the other Relation.

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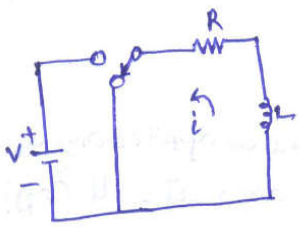
Q 1. Derive the current relation in R-L series circuit when a dc, ac, step, ramp, impulse signal disconnect at time t=0, aasume intial condition.

Sol 3



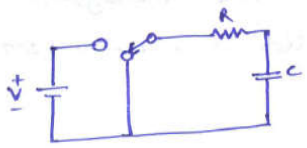
Now we circuit the i/p is disconected at time t=0, and we assume that initial condition is not zero then eqn for ckt will be $R\dot{i} + L\frac{di}{dt} = 0$ at t=0.

than by the analysis we get

$$\dot{i} = \frac{V}{R} e^{-1} = 0.368\, \dot{i}_0$$

Q.2 Derive the current relation in R-C series circuit when a dc, ac, step, ramp, impulse signal disconnect at time t=0, aasume intial condition

Sol 4



Here we have the ckt, the i/p is disconected at time t=0, and we assume that initial condition is not zero than the eqn

$$R\dot{i} + \frac{1}{C}\int i\,dt = 0$$

and by the analysis we can get

$$\dot{i}(t) = -\frac{V}{R} e^{-(t/RC)}$$

Similarly we can derive for the other given i/p's.

Q.3 Obtain the input output impedance of a two port network in Z, Y, h & T parameters.

Sol'1 input impedance of two Port N/w are.

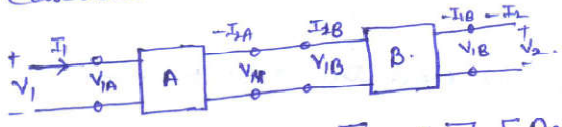
$$Z_{in} = \frac{Z_{11}Z_{22} - Z_{12}Z_{21} + Z_{11}Z_R}{Z_{22}Z_R}$$ Z Parameter

$$Z_{in} = \frac{AZ_L + B}{CZ_L + D}$$ ABCD or T Parameter

$$Z_{in} = h_{11} - \frac{h_{12}h_{21}Z_R}{1 + h_{22}Z_R}$$ h- Parameter

Q.4 Explain the cascade connection of two two-port network

Sol:2 Cascade Connection for Two Port N/W



$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} A_A & B_A \\ C_A & D_A \end{bmatrix} \begin{bmatrix} A_B & B_B \\ C_B & D_B \end{bmatrix}.$$

$$[T] = [T_A][T_B]$$