S.E. Sem. III [ETRX]

Circuits Theory

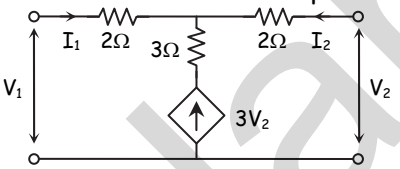
Time : 3 Hrs.] Prelim Question Paper **[Marks : 80**

N.B.: (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions out of remaining questions.
(3) Use Smith Chart wherever required.
(4) Assume suitable **data** if required.

1. (a) Test whether $P(s) = s^5 + 12s^4 + 45s^3 + 60s^2 + 44s + 48$ is Hurwitz polynomial. **[5]**

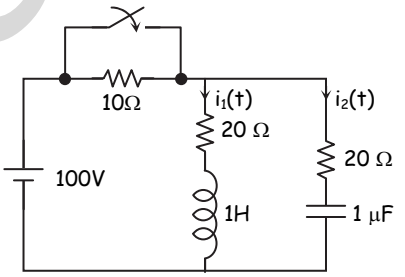
(b) The constants of a transmission line are R = 6 Ω/km, L = 2.2 mH/km, G = 0.25×10^{-6} Ʊ/km, C = 0.005×10^{-5} F/km. Determine the characteristic impedance, propagation constant and attenuation constant at 1 KHz. **[5]**

(c) Determine the short circuit admittance parameters of the network shown : **[5]**

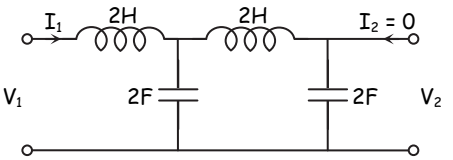


(d) State and prove final value theorem of Laplace transform. **[5]**

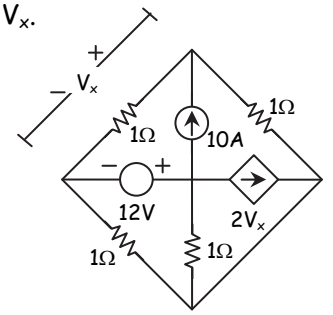
2. (a) The network shown in figure, a steady state is reached with the switch open. At t = 0, the switch is closed. Determine $V_c(0^-)$, $i_1(0^+)$, $i_2(0^+)$, $\frac{di_1}{dt}(0^+)$ and $\frac{di_2}{dt}(0^+)$. **[10]**



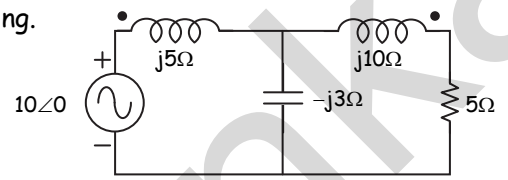
(b) Find the network functions $\frac{V_1}{I_1}, \frac{V_2}{I_1}, \frac{V_2}{V_1}$ for the network shown : **[5]**



(c) In the circuit shown in figure, find V_x. [5]



3. (a) Find the voltage across 5 Ω resistor in the network shown below. If K = 0.8 is coefficient of coupling. **[8]**

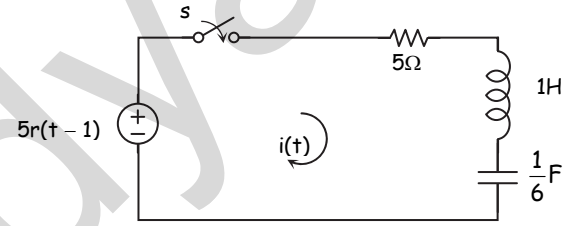


(b) Check the positive real function : **[8]**

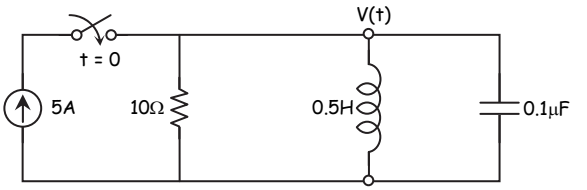
(i) $F(s) = \dfrac{s^2+6s+5}{s^2+9s+14}$ (ii) $F(s) = \dfrac{s^3+6s^2+7s+3}{s^2+2s+1}$

(c) List the types of damping in series R-L-C circuit and mention the condition for each damping. **[4]**

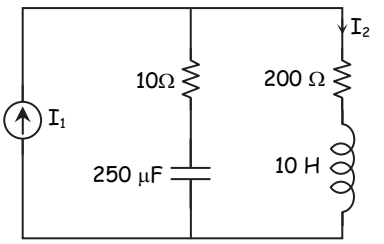
4. (a) For the network shown, determine the current i(t) when the switch is closed at t = 0 with zero initial conditions. **[8]**



(b) In the given network switch is closed at t = 0. Solve for V, $\dfrac{dV}{dt}$, $\dfrac{d^2V}{dt^2}$ at $t = 0^+$. **[8]**



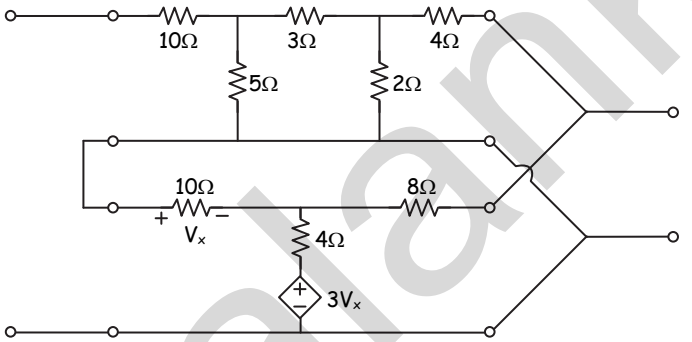
(c) Obtain pole-zero plot for $\frac{I_2}{I_1}$. **[4]**



5. (a) Synthesize the driving point function using Foster - I and Foster - II form : **[10]**

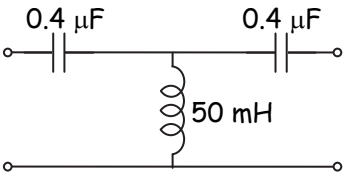
$$Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

(b) Obtain hybrid parameter of the inter-connected network. **[10]**



6. (a) The characteristic impedance of a high frequency line is 100 Ω. If its terminated by a load impedance of 100 + j100Ω. Using smith chart, find out : (i) VSWR, (ii) Reflection coefficient, (iii) Impedance at $(1/10)^{th}$ of wave length away from load, (iv) VSWR minimum and VSWR maximum away from the load. **[10]**

(b) Find the characteristic impedances, cut-off frequency and passband frequency for given network. **[5]**



(c) Explain various types of filters. **[5]**

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