S.E. Sem. III [EXTC]

Circuits and Transmission Lines

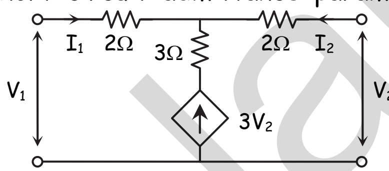
Time : 3 Hrs.] Prelim Question Paper **[Marks : 80**

N.B.:
(1) Attempt question 1 and any three from remaining questions. In all 4 questions are to be attempted.
(2) All sub-questions of the same question should be answered at one place only in their serial orders and not scattered.
(3) Assume suitable data with justification if missing.

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

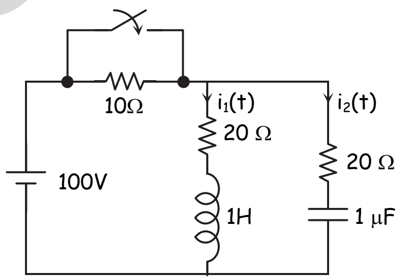
(b) The constants of a transmission line are $R = 6\ \Omega/km$, $L = 2.2\ mH/km$, $G = 0.25 \times 10^{-6}\ \mho/km$, $C = 0.005 \times 10^{-5}\ F/km$. Determine the characteristic impedance, propagation constant and attenuation constant at 1 KHz. **[5]**

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

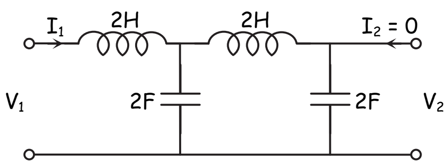


(d) State and prove final value theorem of Laplace transform. **[5]**

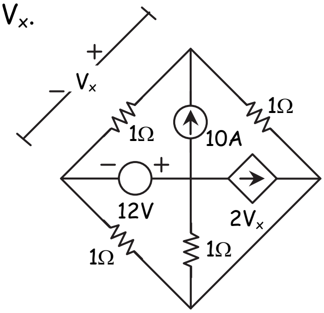
2. (a) The network shown in figure, a steady state is reached with the switch open. At t = 0, the switch is closed. Determine $V_c(0^-)$, $i_1(0^+)$, $i_2(0^+)$, $\frac{di_1}{dt}(0^+)$ and $\frac{di_2}{dt}(0^+)$. **[10]**



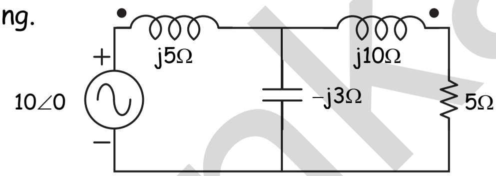
(b) Find the network functions $\frac{V_1}{I_1}, \frac{V_2}{I_1}, \frac{V_2}{V_1}$ for the network shown : **[5]**



(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]**

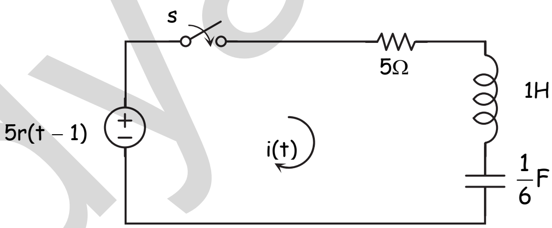


(b) Check the positive real function : **[8]**

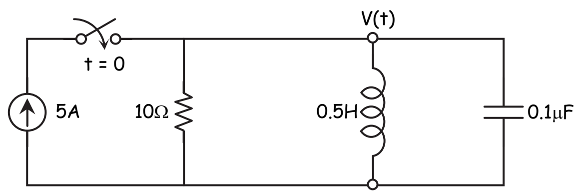
(i) $F(s) = \dfrac{s^2 + 6s + 5}{s^2 + 9s + 14}$ (ii) $F(s) = \dfrac{s^3 + 6s^2 + 7s + 3}{s^2 + 2s + 1}$

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

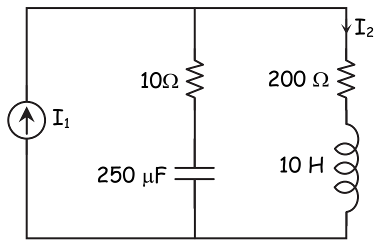
4. (a) For the network shown, determine the current i(t) when the switch is closed at t = 0 with zero initial conditions. **[8]**



(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]**



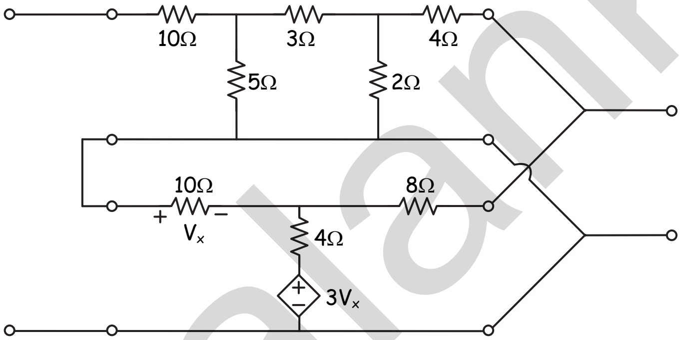
(c) Obtain pole-zero plot for $\frac{I_2}{I_1}$. **[4]**



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

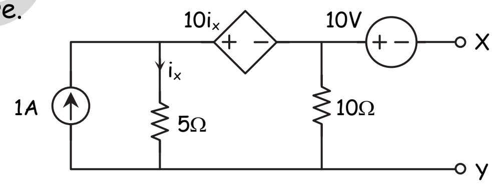
$$Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

(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 Thevenin's equivalent across the terminals XY for the circuit shown in figure. **[10]**



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