S.E. Sem. III [INST]

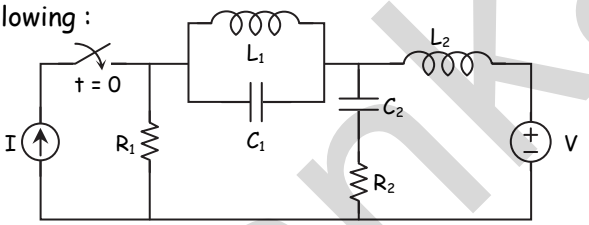
Electrical Network Analysis and Synthesis

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

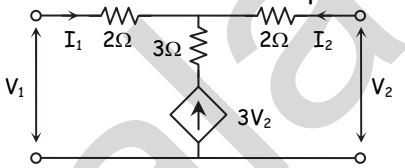
N.B.: (1) Question No. 1 is compulsory.
(2) Solve any three questions out of remaining.
(3) Assume suitable data if required.
(4) All questions carry equal marks.

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

(b) Draw dual of the following : **[5]**

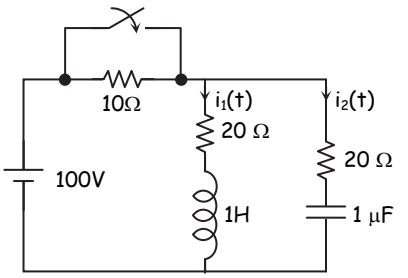


(c) Determine the short circuit admittance parameters of the network shown : **[5]**

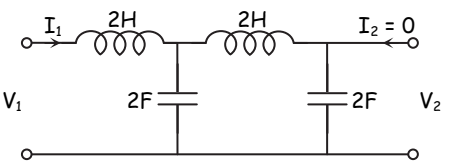


(d) State and prove final value theorem of Laplace transform. **[5]**

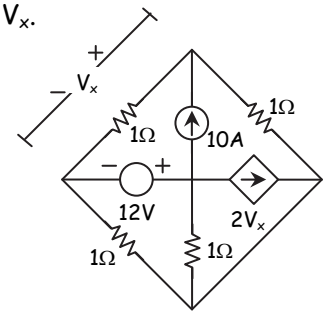
2. (a) The network shown in figure, a steady state is reached with the switch open. At t = 0, the switch is closed. Determine $V_c(0^-)$, $i_1(0^+)$, $i_2(0^+)$, $\frac{di_1}{dt}(0^+)$ and $\frac{di_2}{dt}(0^+)$. **[10]**



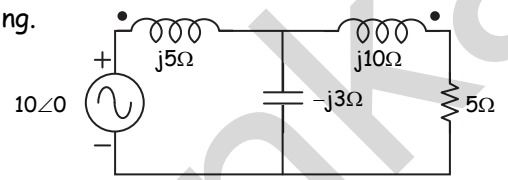
(b) Find the network functions $\frac{V_1}{I_1}, \frac{V_2}{I_1}, \frac{V_2}{V_1}$ for the network shown : **[5]**



(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]**

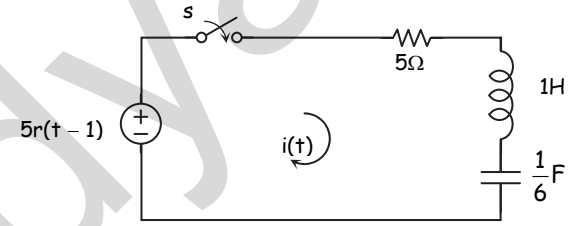


(b) Check the positive real function : **[8]**

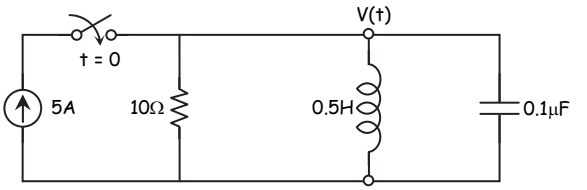
(i) $F(s) = \dfrac{s^2+6s+5}{s^2+9s+14}$ (ii) $F(s) = \dfrac{s^3+6s^2+7s+3}{s^2+2s+1}$

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

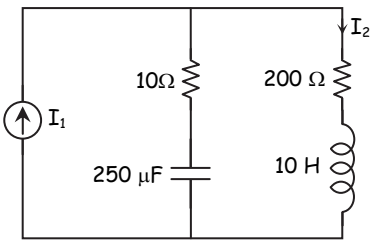
4. (a) For the network shown, determine the current i(t) when the switch is closed at t = 0 with zero initial conditions. **[8]**



(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]**



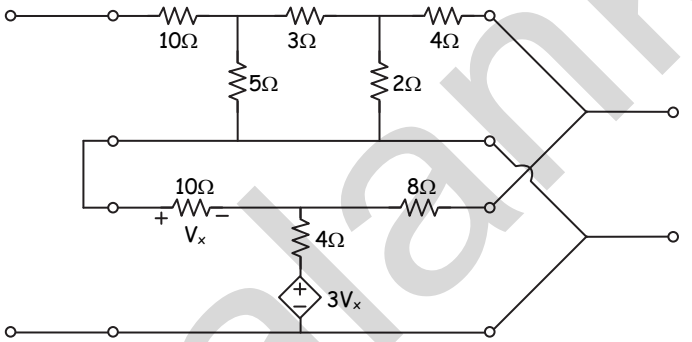
(c) Obtain pole-zero plot for $\frac{I_2}{I_1}$. **[4]**



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

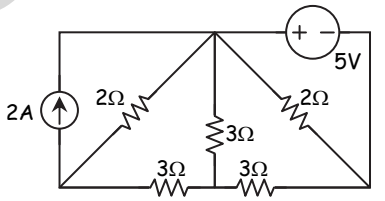
$$Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

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

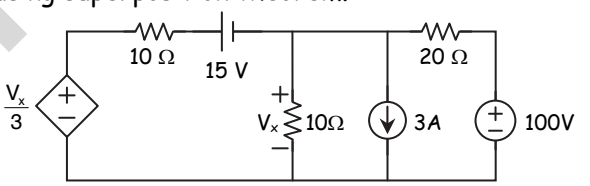


6. (a) For the network shown below, draw a graph of network. Select a tree and obtain : **[10]**

(i) Reduced incidence matrix
(ii) f-cut set matrix
(iii) f-tie set matrix



(b) Find V_x using superposition theorem. **[10]**



❑ ❑ ❑ ❑ ❑