八十五學年度國立台灣工業技術學院研究所碩士班招生考試

所別：電機工程技術研究所　　組別：電力組　　科目：電路學

1. Consider the circuit of Fig. 1 with $R_1 = 5\Omega$, $R_2 = 50\Omega$, $L_1 = 5H$, $L_2 = 50H$, $M = 8H$, and $v_s(t) = 100\sin 10t$ V.
(a) Find the value of capacitance C so that the phase angle on the steady- state response of current $i_2(t)$ is in phase with input voltage $v_s(t)$. (10%)
(b) Find the steady- state response of current $i_1(t)$ for this value of capacitance C. (10%)

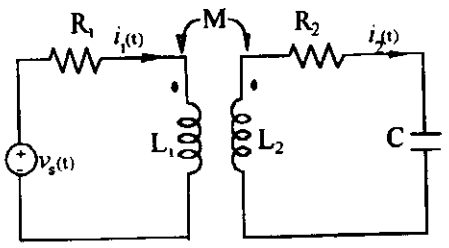

Fig. 1

2. For the ideal op-amp. circuit shown in Fig. 2, assume $R_1 = R_2 = 10K\Omega$, $C_1 = 0.1\mu F$, and $C_2 = 0.2\mu F$.
(a) Find the voltage transfer ratio $V_o(s)/V_i(s)$. Let $V_o(s)$ and $V_i(s)$ be Laplace transform of $v_o(t)$ and $v_i(t)$. (10%)
(b) If the input voltage $v_i(t) = 2\sin 100t + 2\sin 2000t$ V, find the steady-state response of $v_o(t)$. (10%)

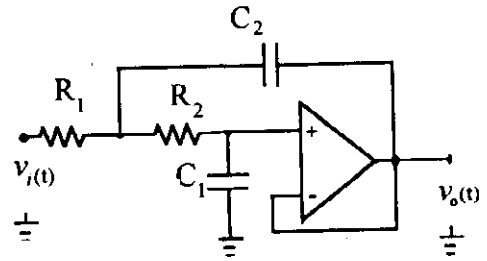

Fig. 2

3. The transmission matrix T is defined by

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ I_2 \end{bmatrix} = T \begin{bmatrix} V_2 \\ I_2 \end{bmatrix}$$

Find T for the two-port network shown in Fig. 3 with $R_1 = R_3 = 2\Omega$ and $R_2 = 4\Omega$. (20%)

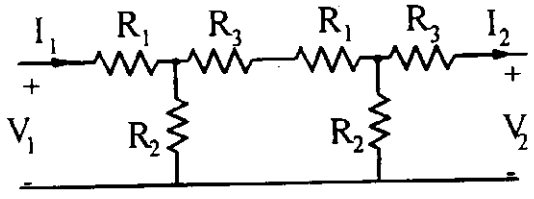

Fig. 3

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4. For the balanced 2400-V three-phase system shown in Fig. 4 , let V_{ab} be the reference, that is $V_{ab} = 2400\angle 0^{\circ}$(V). Assume a positive (abc) phase sequence.

(a)Determine the complex power absorbed by the combined load and the corresponding power factor.(10 %)

(b) Determine the minimum capacity(KVAR) of the capacitor bank which can be used to improve the total power factor to 0.95 leading.(10%)

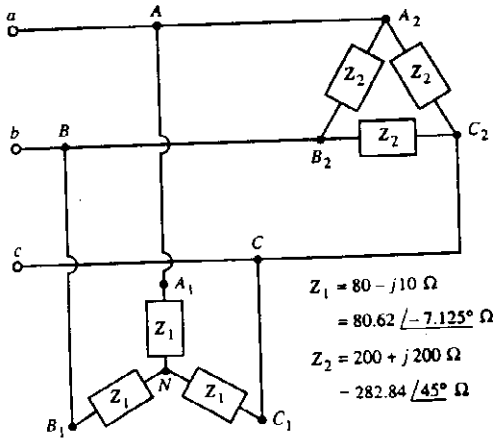

Fig. 4

5.(a) Set up the mesh-current equation in matrix form for the circuit shown in Fig. 5.(10%)

(b) Solve the mesh current solution of I_1 and I_2. (10%)

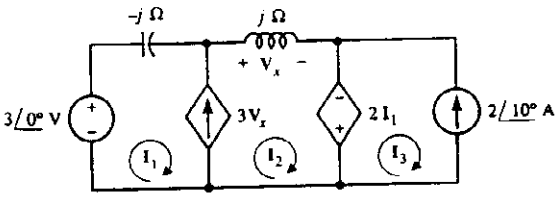

Fig. 5