國立臺灣科技大學
八十九學年度碩士班招生考試試題

系所組別： 電機工程系甲組
科　目： 電路學

1. The transmission matrix T is defined by $\begin{bmatrix}\bar{V}_1\\ \bar{I}_1\end{bmatrix}=\begin{bmatrix}A & B\\ C & D\end{bmatrix}\begin{bmatrix}\bar{V}_2\\ \bar{I}_2\end{bmatrix}=T\begin{bmatrix}\bar{V}_2\\ \bar{I}_2\end{bmatrix}$.

(a) Find T for the two-port network shown in Fig. 1 under sinusoidal steady-state conditions and the angular frequency $\omega=1000\,rad./s$. (15%)

(b) Find the open-circuit voltage transfer function $H\triangleq\left.\frac{\bar{V}_2}{\bar{V}_1}\right|_{\bar{I}_2=0}$. (5%)

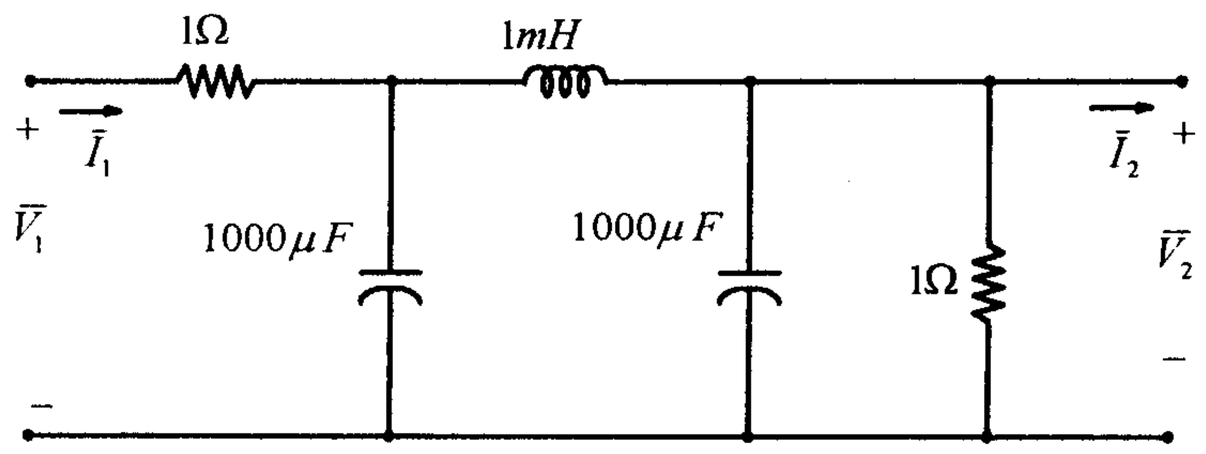

Fig.1

2. Consider the circuit shown in Fig. 2.

(a) Write the state equation in matrix form $\begin{bmatrix}\frac{di_L}{dt}\\ \frac{dv_c}{dt}\end{bmatrix}=A\begin{bmatrix}i_L\\ v_c\end{bmatrix}+B\,v_s$. (10%)

(b) Find the transfer function $\frac{V_c(s)}{V_s(s)}$. Let $V_c(s)$ and $V_s(s)$ be the Laplance transform of v_c and v_s, respectively. (10%)

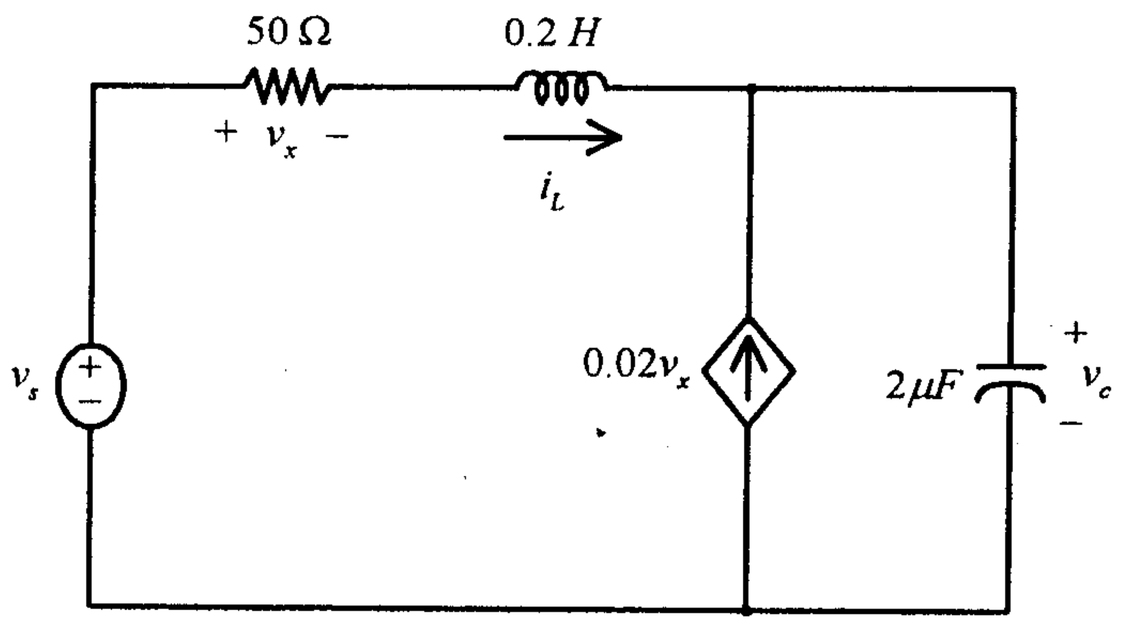

Fig.2

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3. For the ideal op-amp circuit shown in Fig. 3, the initial conditions are $v_a(0^+) = 0V$ and $v_b(0^+) = 5V$. Determine the output voltage $v_o(t)$ for $t > 0$ with $R = 100K\Omega$ and $C = 1\mu F$. (20%)

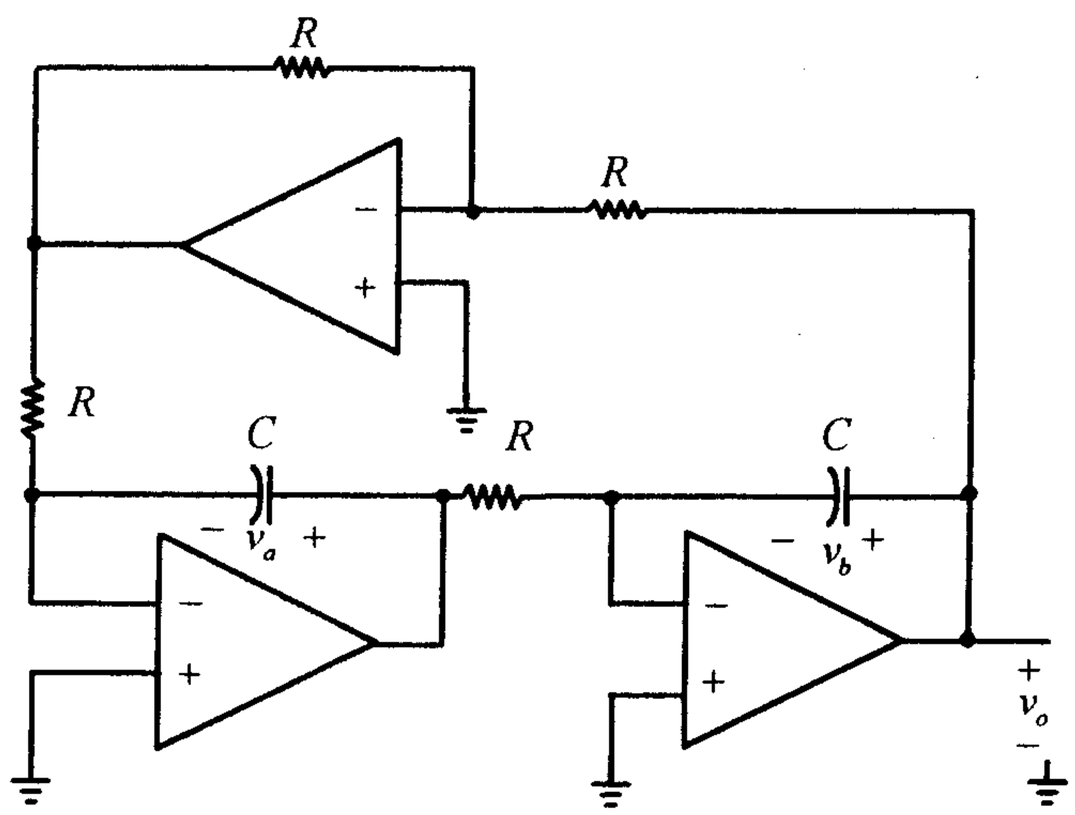

Fig. 3

4. In the circuit of Fig. 4, $R_1 = 2\Omega, R_2 = 0.12\Omega, j\omega L_1 = j8\Omega, \quad j\omega L_2 = j0.45\Omega, j\omega M = j1.7\Omega,$ $\bar{Z}_s = 1 + j1\Omega, \bar{Z}_L = 2 - j1\Omega$ and $|\bar{V}_s| = 400V$ (rms).

(a) Find the current $|\bar{I}_1|$ and $|\bar{I}_2|$. (12%)

(b) Calculate the average power delivered to the load $\bar{Z}_L$. (8%)

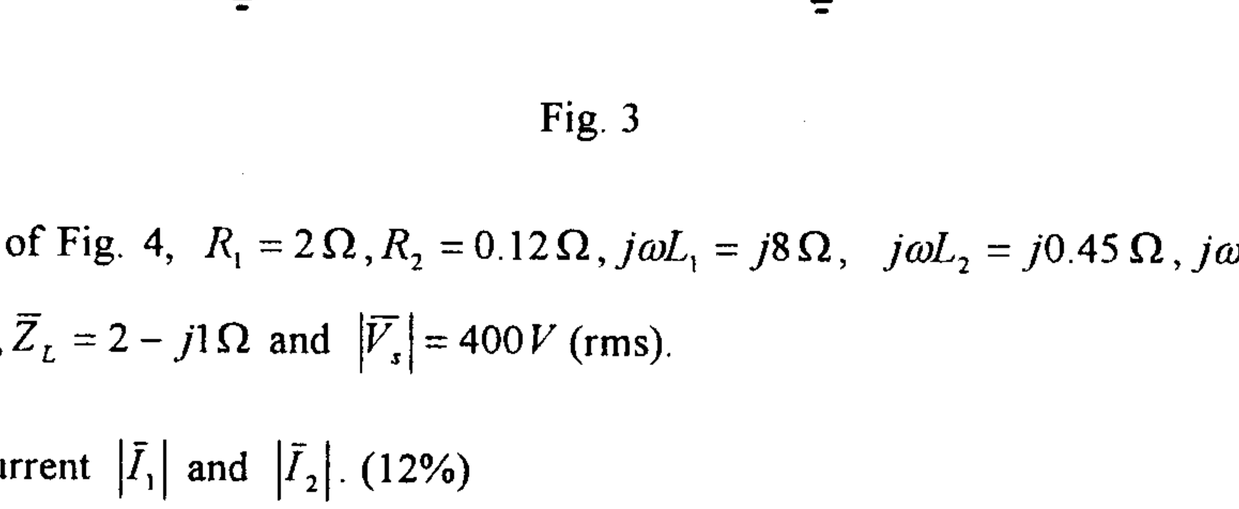

Fig.4

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5. Two wattmeters are connected to the balanced three-phase load as shown in Fig. 5. The line voltage in the balanced positive (abc)-sequence source is $\overline{V}_{ab} = 480\angle 0^0\ V$ (rms).

(a) Determine the two wattmeter readings (W_1, W_2).(10%)
(b) Calculate the real power absorbed by the total load.(5%)
(c) Calculate the power factor of the total load. (5%)

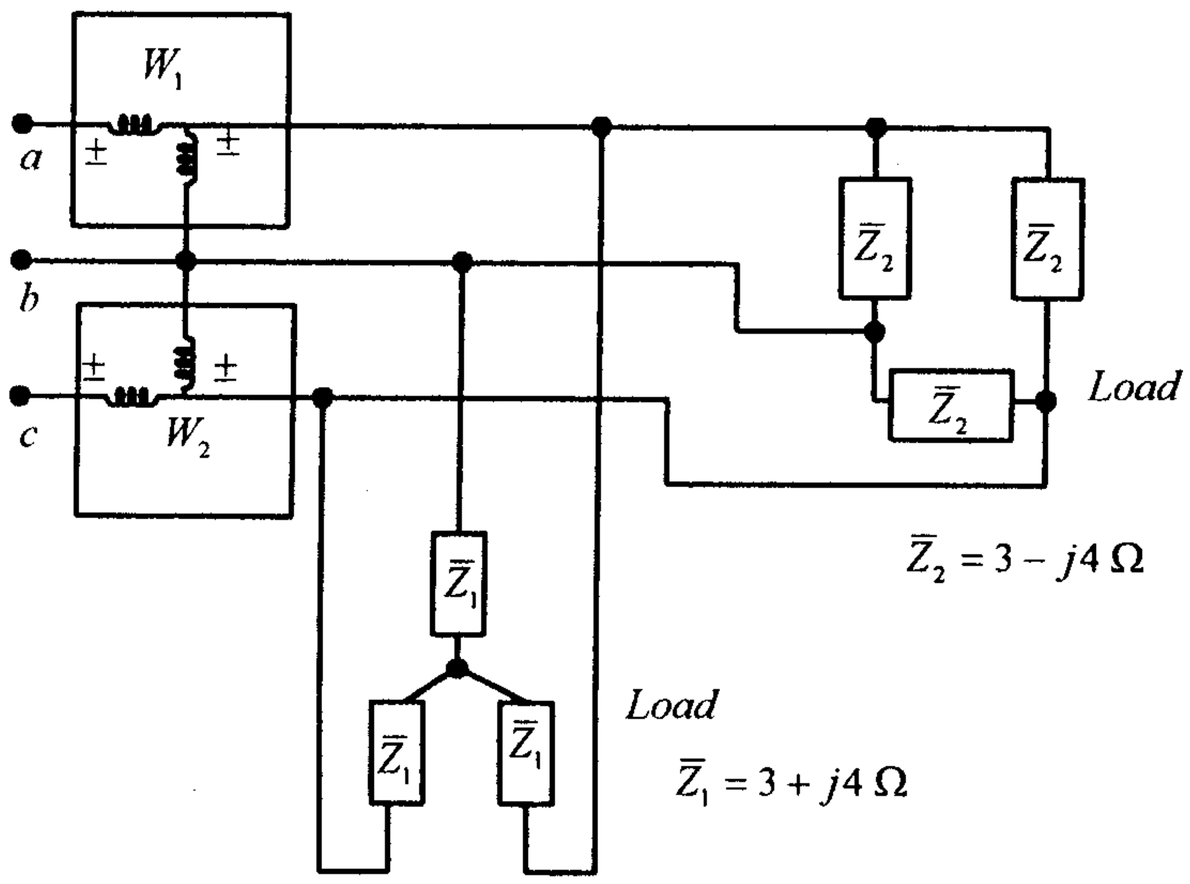

Fig.5