本試題是否可以使用計算機：☑可使用　，□不可使用　（請命題老師勾選）

***A total of 7 problems are given in the following.***

1. (16%) As the circuit shown in Fig. 1, for $v_{in} = 50$ Vdc, $R_1 = R_2 = 500\Omega$, and $C_1 = C_2 = 2\mu F$, find the total solution for $v_{out}(t)$.

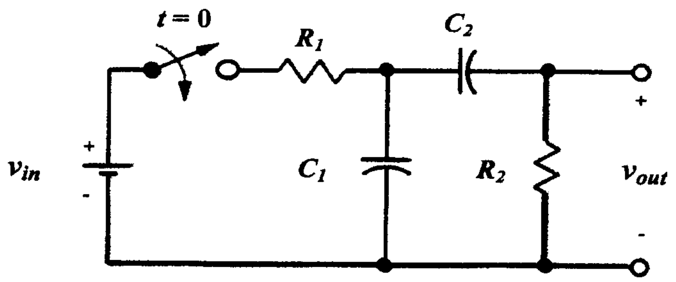


**Fig. 1**

2. (16%) A circuit system has a transfer function $T(s) = \dfrac{K}{(s-s_1)(s-s_2)}$. The input voltage is zero for negative time and +15V for positive time. With this input, the output voltage is $v_{out}(t) = 10 + 15e^{-2t} - 10e^{-3t}$.

(a) Determine $K$, $s_1$ and $s_2$ for the transfer function. (6%)

(b) If the input voltage is changed to $5e^{-t/3}\ V$ for $t > 0$, find $v_{out}(t)$ for $t > 0$, assuming that the initial conditions remain unchanged. (10%)

3. (16%) For the filter shown in Fig. 3, sketch the asymptotic Bode plots for (a) the magnitude and (b) the phase angle of the filter, with as much information as possible shown on the diagrams.

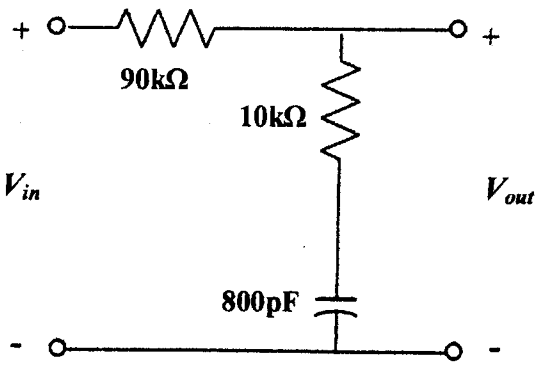


**Fig. 3**

4. (10%) For a circuit shown in Fig. 4, find the following:

(a) At what frequency would the magnitude of the input impedance be 100 Ω? (3%)

(b) What value of a capacitor $C$ should be added in parallel to make the circuit appear purely resistive at this frequency? What is this resultant resistance? (7%)

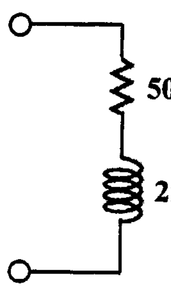


**Fig. 4**

5. (10%) Please translate the following paragraph into Chinese.
Considerable effort has been expended over the years to express the power relations as simple as possible. Power engineers have coined the term ***complex power***, which they use to find the total effect of parallel loads. Complex power is important in power analysis because it contains all the information pertaining to the power absorbed by a given load.

6. (16%) The circuit shown in Fig. 6 has a main amplifier and a feedback network. The main amplifier has a gain of 500, infinite input impedance, zero output impedance and a -3dB point at 5kHz (note that the main amplifier has one pole only). For the circuit shown in Fig. 6, determine $C$ such that the poles are real and negative, and they differ from each other by a factor of 2.

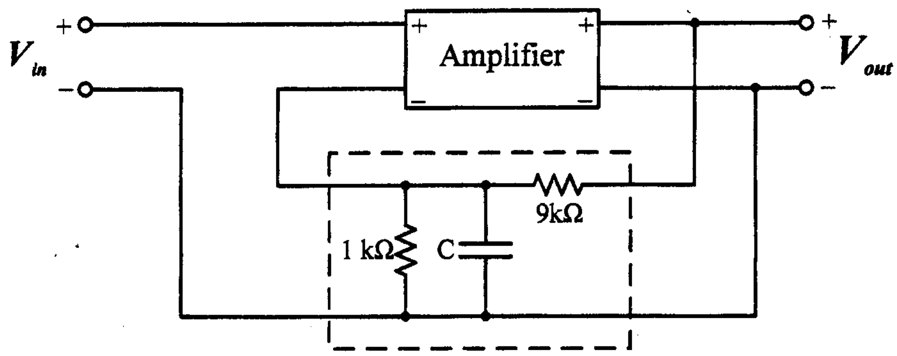


**Fig. 6**

7. (16%) As shown in Fig. 7, the dc voltage and current sources are applied simultaneously to the circuit. No energy is stored in the circuit at the instant of switch actions. Find $v_2(t)$.

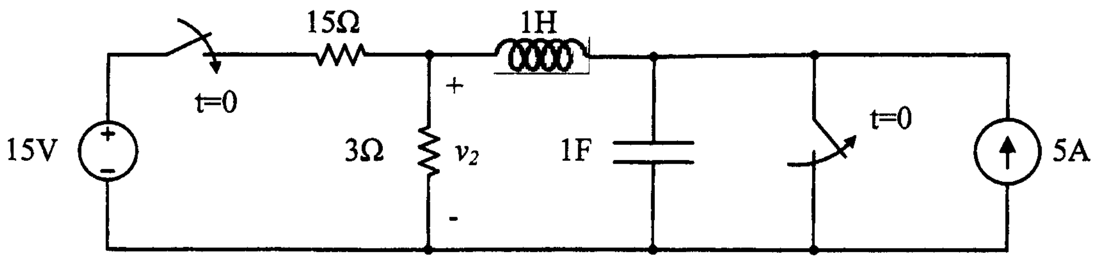


**Fig. 7**