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）

1. **The network N in Fig. 1(a) contains only R's, L's, and C's and has the following z-parameters.**

$$Z_{11} = \frac{4s+15}{2s+3} \qquad Z_{12} = \frac{9}{2s+3}$$

Prior to t=0, N is in the zero-energy state. It is excited as shown in Fig. 1(b) with the terminal C, D open-circuited.

(a) Determine the transfer function A(s) where $v_2 = A(s)v_3$. (10%)

(b) Find $v_2(t)$ for t>0, if $v_2(0+) = 0$. (10%)

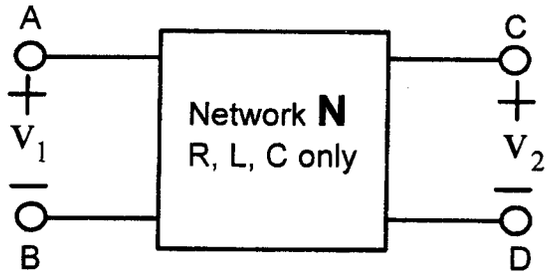

Fig. 1(a)

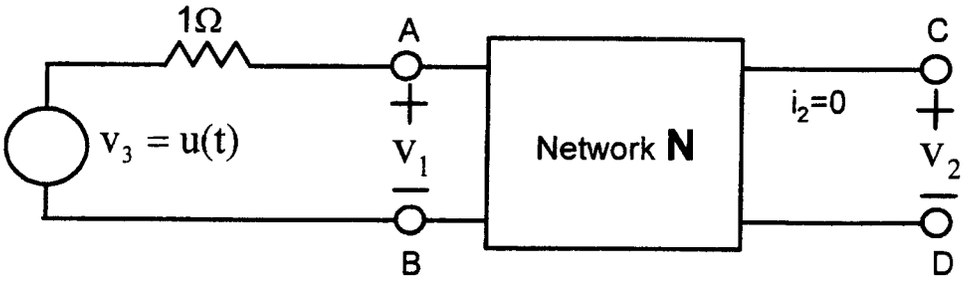

Fig. 1(b)

2. **Determine the input admittance Y(s) for the circuit in Fig. 2. (10%)**

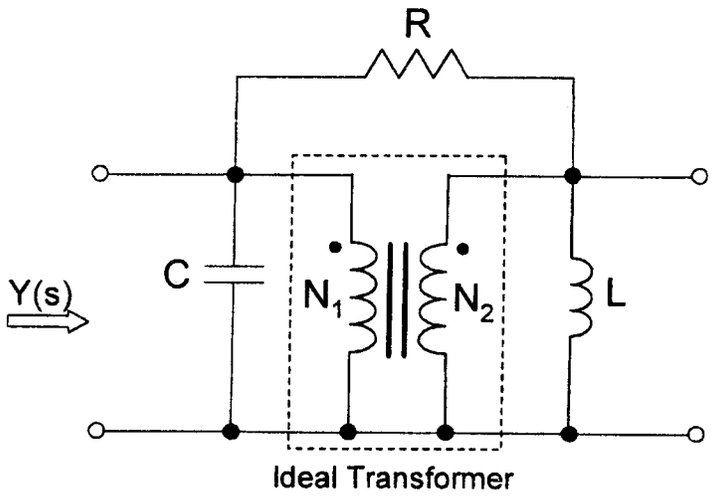

Fig. 2

(背面仍有題目,請繼續作答)

3. **Derive the following transfer functions for the circuit shown in Fig. 3.**
   - **(a) V_S/I_S (10%)**
   - **(b) V_{OUT}/I_O (10%)**

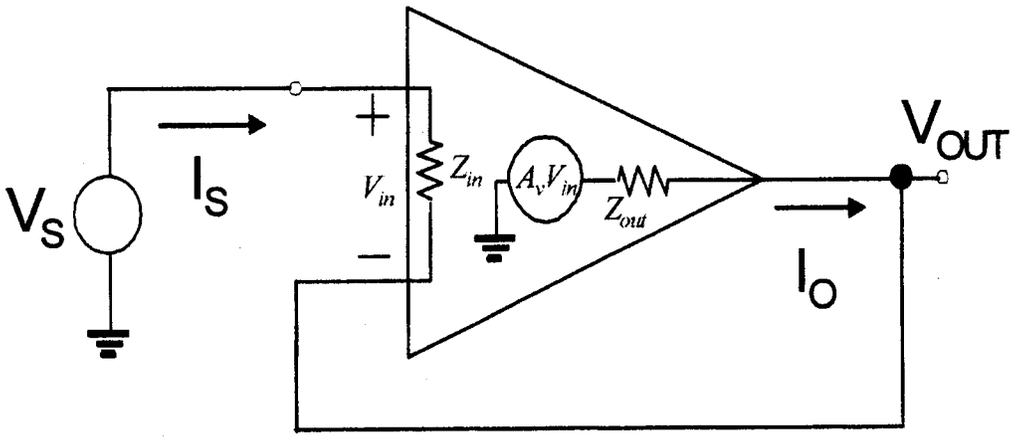

Fig. 3

4. **Use mesh analysis to decide i_1, i_2, and i_3 in Fig. 4, where $V_1 = 3V$; $A_1 = 4A$; $R_1 = 2\Omega$; $R_2 = 1\Omega$; $R_3 = 4\Omega$; $R_4 = 1\Omega$; $R_5 = 1\Omega$; (a) Formulate mesh analysis in matrix form, i.e., $M \times \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$, where y_1,y_2, y_3 and all entries of matrix M must be scalar. (b) Solve the equations and obtain i_1, i_2, and i_3. (20%)**

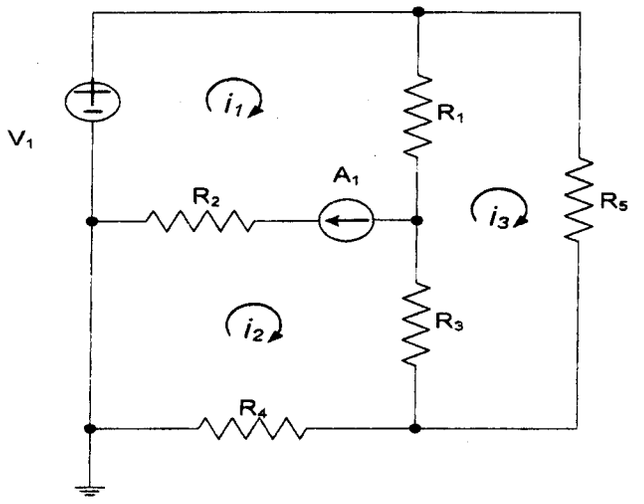

Fig. 4

5. Given the circuit as shown in Fig. 5 whose $R_1 = 10k\Omega$; $R_2 = 40k\Omega$; $R_3 = 20k\Omega$; $R_4 = 10k\Omega$; $R_5 = 10k\Omega$. Determine (a) the closed-loop gain v_{out}/v_S; (b) find i_{out} when $v_S = 0.5V$. Assuming the operational amplifier is ideal. (15%)

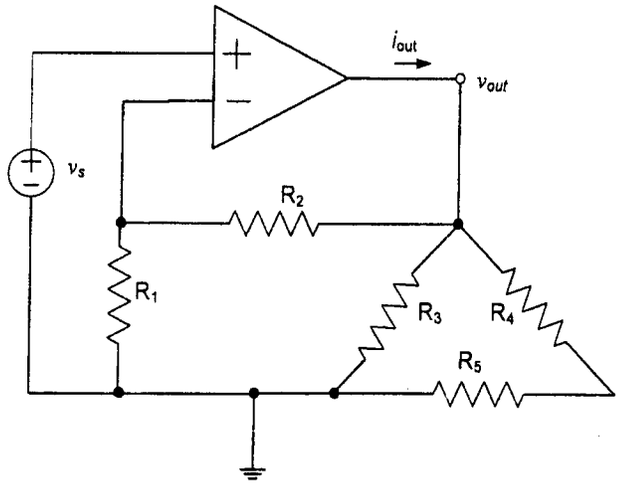

Fig. 5

6. **Given the input voltage as shown in Fig. 6-1, derive the output voltage (v_{out}) in term of v_{in}, R_1 and C_1. Then sketch v_{out} of the circuit in Fig. 6-2 when C_1= 0.1 μF and R_1= 10kΩ. (15%)**

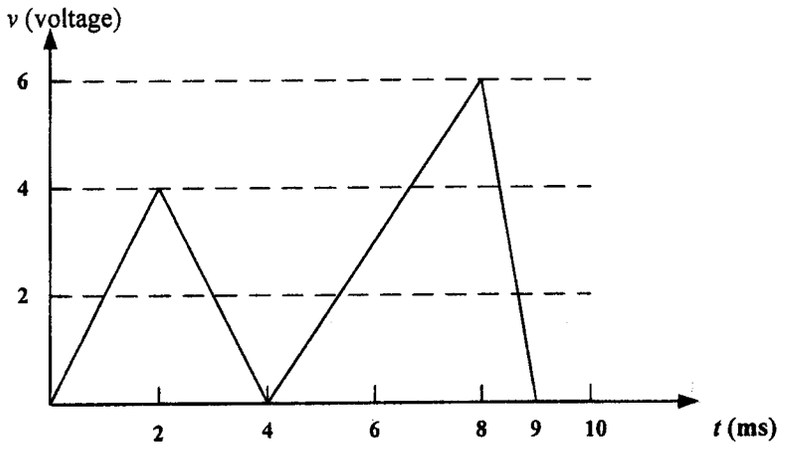

Fig. 6-1

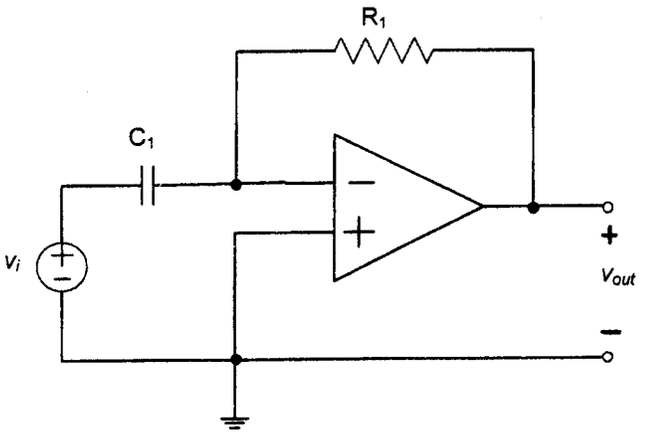

Fig. 6-2