國立雲林科技大學 112 學年度 碩士班招生考試試題

系所：電機系

科目：電路學

1. The bottom node G in the circuit of **Fig. 1** refers to the reference node of zero potential. Find the voltages V_b and V_c. (10%)

2. Find the currents I_a and I_b in the circuit shown in **Fig. 2**. (20%)

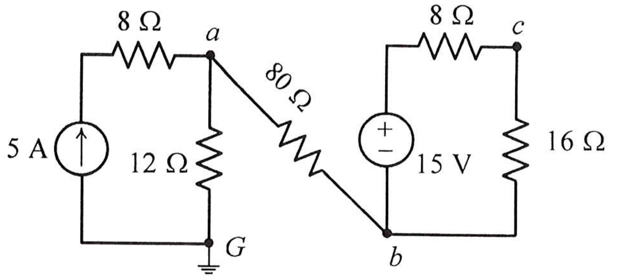

Fig. 1

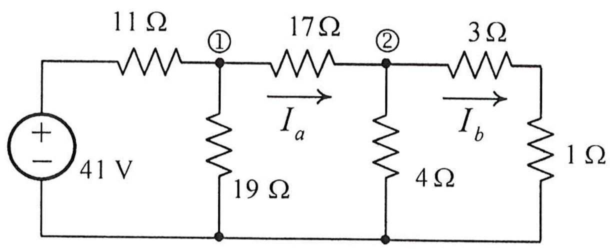

Fig. 2

3. The switch in the circuit of **Fig. 3** has been closed for a long time before opening at t=0. Find the current $i(t)$ for t>0. (20%)

4. Determine v_o in the circuit in **Fig. 4**. (15%)

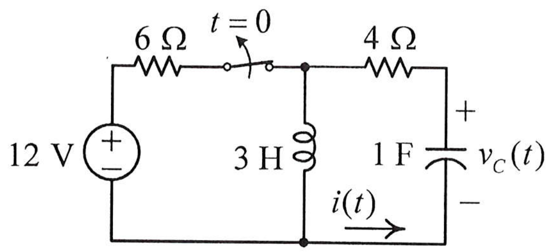

Fig. 3

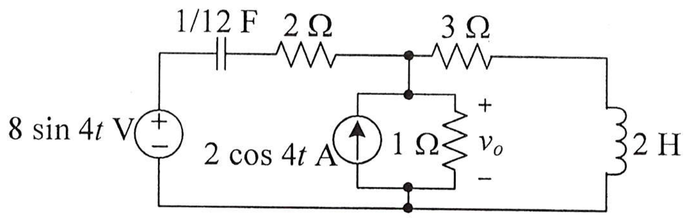

Fig. 4

5. A balanced three-phase source serves three loads, as follows:

   Load 1: 24 kW at 0.6 lagging power factor

   Load 2: 10 kW at unity power factor

   Load 3: 12 kVA at 0.8 leading power factor

   If the line voltage at the loads is 208 V rms at 60 Hz, we wish to determine the line current and the combined power factor of the loads. (15%)

6. The transfer function for a network is

$$\mathbf{H}(s) = \frac{s+10}{s^2+4s+8}$$

   Determine the pole-zero plot of **H**(s), the type of damping exhibited by the network, and the unit step response of the network. (20%)

國立雲林科技大學 112 學年度
碩士班招生考試試題

系所：電機系
科目：工程數學(1)

1. (15%) Solve the general solution of the following differential equations:

(1) $y' = 5\sin 3x$ (5%)

(2) $y' + y = e^{5x}$ (5%)

(3) $\frac{dy}{dx} = (x + y + 3)^2$ (5%)

2. (15%) Use the Laplace transform or inverse transform to solve the given problems:

(1) $f(t) = te^{4t} + e^{2t}\sin t$; 求$F(s) = \mathcal{L}[f(t)]$ (5%)

(2) $F(s) = \frac{e^{-2s}}{s(s-1)}$; 求$f(t) = \mathcal{L}^{-1}[F(s)]$ (5%)

(3) $f(t) = \int_0^t \sin\tau \cos(t - \tau)d\tau$; 求$F(s) = \mathcal{L}[f(t)]$ (5%)

3. (10%) Use Laplace transform to solve the given initial-value problem:

$y'' - y' = e^t \cos t,\ y(0) = 0, y'(0) = 0$

4. (10%) Solve the given Cauchy-Euler differential equation:

$2x^2y'' + 5xy' + y = x^2 - x$

5. (15%) Show that (a) the set V of all symmetric 2×2 matrices is a vector space, and find the dimension of V. (b) Find a basis of V consisting of invertible matrices.

6. (15%) Compute the rank of matrix A=$\begin{bmatrix} 1 & 2 & 2 & -1 \\ 3 & 6 & 5 & 0 \\ 1 & 2 & 1 & 2 \end{bmatrix}$ and find the bases for the row space and column space of A.

7. (10%) Using Gram-Schmidt orthogonalization algorithm, find an orthogonal basis of the row space of A=$\begin{bmatrix} 1 & 1 & -1 & -1 \\ 3 & 2 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

8. (10%) Compute A^8 using block multiplication, where A=$\begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 0 \\ 1 & -1 & -2 \end{bmatrix}$.

Hint: A=$\begin{bmatrix} X & 0 \\ Y & Z \end{bmatrix}$, $X = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$, $Y = [1 \quad -1]$, $Z = [-2]$