國立高雄大學九十六學年度轉學招生考試試題

科目：工程數學　　系所：電機工程學系　　是否使用計算機：是

考試時間：90 分鐘　　本科原始成績：100 分

1. (10%) Determine the equation is linear or nonlinear

(a) $(\frac{dy}{dx})^2+\sin x=0$

(b) $(\sin x)\frac{d^2y}{dx^2}+(\cos x)\frac{dy}{dx}=e^x$

(c) $\frac{d^3y}{dx^3}+\sin y=0$

(d) $(1-y)\frac{dy}{dx}+2x=0$

(e) $\frac{dy}{dx}=x^{1/2}y^{1/2}$

2. (10%) Solve $\frac{d^4y}{dx^4}+4\frac{d^2y}{dx^2}+4y=0$

3. (10%) Solve the differential equation $\begin{cases}\frac{dx}{dt}=3x-y\\ \frac{dy}{dt}=2x\end{cases}$, given $x(0)=3, y(0)=4$

4. (10%) Solve $f(t)=te^t+\int_0^t \tau f(t-\tau)d\tau$ for f(t)

5. (10%) Solve $y''+y=f(t)$, $y(0)=0$, $y'(0)=1$, where $f(t)=\begin{cases}0, & 0\le t\le 1\\ 1, & 1\le t\le 2\\ 0, & t\ge 2\end{cases}$

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6. (10%) Find the solution of the following system $\begin{cases} w+2x-y+z=2 \\ -2w-3x-2y+2z=3 \\ 2w+6x+y-z=6 \end{cases}$

7. (10%) λ_1, λ_2 and λ_3 are the eigenvalues of the matrix A

$$A=\begin{pmatrix} 3 & -3 & 2 \\ 1 & -1 & 2 \\ 1 & -3 & 4 \end{pmatrix}, \qquad \lambda_1\lambda_2+\lambda_2\lambda_3+\lambda_3\lambda_1=?$$

8. (10%) For $A=\begin{pmatrix} 2 & 2 & 1 \\ 2 & 5 & 2 \\ 1 & 2 & 2 \end{pmatrix}$, Find a matrix P, such that $D=P^{-1}AP$ is diagonal.

9. (10%) $A=\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$, compute A^{10}

10. (10%) Solve the initial-value problem, given $X'=\begin{pmatrix} 4 & -2 \\ 2 & -1 \end{pmatrix}X$, $X(0)=\begin{pmatrix} 7 \\ 5 \end{pmatrix}$

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考試時間：90 分鐘　　本科原始成績：100 分

1. (20%) Consider the circuit in Fig. P1.
   (a) (15%) Write the mesh equations using the assigned currents.
   (b) (5%) Find the mesh current I_1.

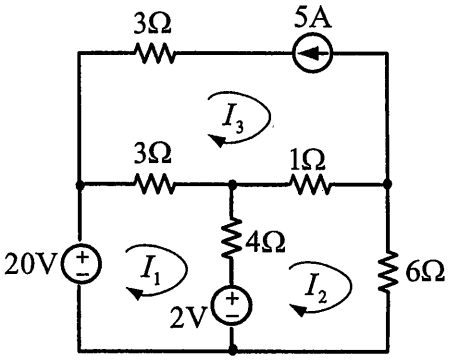

Fig. P1

2. (10%) Determine the Norton equivalent of the network in Fig. P2 at the terminals a-b.

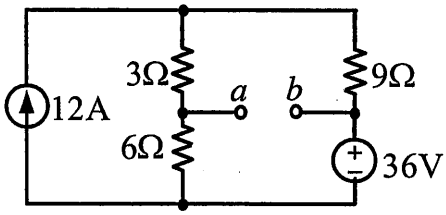

Fig. P2

3. (20%) Assume that the operational amplifier in Fig. P3 is ideal.
   (a) (5%) Find v_A (the voltage at node A).
   (b) (5%) Find the current supplied by the 9-V source.
   (c) (5%) Find R_{in} (the input resistance seen by the 9-V source).
   (d) (5%) Find the output voltage v_2.

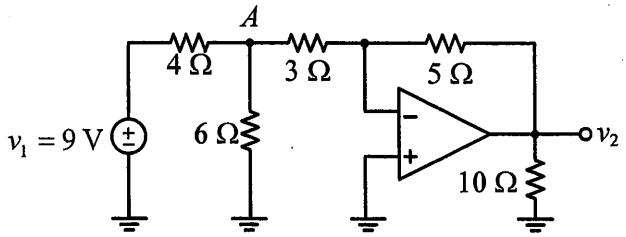

Fig. P3

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4. (10%) Consider the circuit in Fig. P4. The circuit is in steady state prior to time $t = 0$. The switch is opened at time $t = 0$. Obtain the capacitor voltage $v_C(t)$ for time $t > 0$.

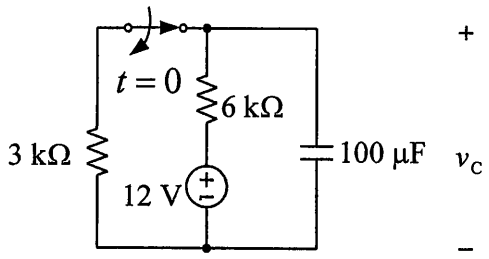

Fig. P4

5. (20%) Consider the two-port network in Fig. P5.
(a) (10%) Find the **z** -parameters.
(b) (10%) Find the **y** -parameters.

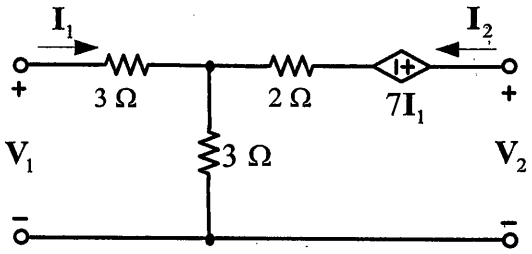

Fig. P5

6. (20%) The circuit shown in Fig. P6 consists of three loads in a series-parallel connection, with each of the loads defined as indicated.
(a) (10%) Find the overall complex power of the circuit.
(b) (5%) Find the overall power factor.
(c) (5%) Find the phasor form of the source current **I**.

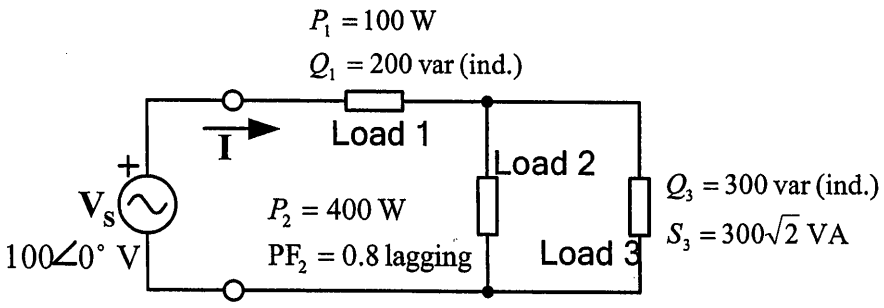

Fig. P6