中　華　大　學

九十六學年度轉學生招生入學考試試題紙

系別：電機工程學系及通訊工程學系三年級　科目：工程數學　共一頁第一頁

本科目可使用計算機

1. (15%) Find a general solution of the following equations:
   (a) $\ddot{y}-3\dot{y}+2y=e^{x}$ (b) $\ddot{y}+4y=\sin x+\sin 2x$ (c) $\ddot{y}-2\dot{y}+y=e^{x}+x$

2. (10%) Solve the simultaneous differential equation $\begin{cases}\frac{dx}{dt}+\frac{dy}{dt}+x+y=1\\ \frac{dy}{dt}-2x-y=0\end{cases}$ where $\begin{cases}x(0)=0\\ y(0)=1\end{cases}$.

3. (10%) Using the Laplace transforms approach to find the following functions:
   (a) $\int_0^{\infty}\frac{\sin t}{t}dt$ (b) $\int_0^{\infty}\frac{e^{-t}\sin t}{t}dt$

4. (15%) Find the inverse Laplace transforms of the following functions:
   (a) $\frac{1}{(s^2+1)^2}$ (b) $\frac{1}{(s+1)(s^2+2s+5)}$ (c) $\ln(1+\frac{1}{s})$

5. (10%) Given $A=\begin{bmatrix}2 & 1\\ 0 & 2\end{bmatrix}$, find (a) eigenvaules and eigenvectors (b) e^{A}

6. (5%) Given $f(t)=f(t+2\pi)$ and $f(t)=\begin{cases}1 & 0<t\le\pi\\ 0 & \pi<t\le 2\pi\end{cases}$, find its Fourier series.

7. (20%) Given (a) $f(t)=\begin{cases}1 & 0<t\le 2\\ 0 & else\end{cases}$ (b) $g(t)=f(t-2)$ (c) $h(t)=f(t)e^{jt}$ (d) $k(t)=\int_{-\infty}^{t}f(\tau)d\tau$,
   find their Fourier transform. Hint: $F(\omega)=\int_{-\infty}^{\infty}f(t)e^{-j\omega t}dt$

8. (15%) Given $f(x,y,z)=x^2\sin y\tan z$ find (a) $\nabla f(x,y,z)$ (b) $\nabla\times\nabla f(x,y,z)$ (c) $\nabla\cdot\nabla f(x,y,z)$