國立高雄應用科技大學
101 學年度碩士班招生考試
電子工程系

准考證號碼□□□□□□□□□□ （考生必須填寫）

工程數學（乙組）

注意：a. 本試題共分選擇題及填充題兩種。第 1-4 題為選擇題(單選)，每題均為 10 分，第 5-9 題為填充題，第 5-8 題每題均為 10 分，第 9 題為 20 分，共 100 分。

b. 作答時不必抄題。

c. 考生作答前請詳閱答案卷之考生注意事項。

d. 選擇題做答時各題答案需寫題號並且必須依題號順序寫在答案卷，未寫題號而做答者不予計分。填充題做答時除了寫題號而做答外，需另做詳解，未寫詳解而做答者不予計分。

1. If the Laplace transform of $y(t)$ is Y(s), the inverse Laplace transform of Y(s) $=\ln\left(1+\frac{9}{s^2}\right)$ is (A) $\frac{2}{t}(1+\cos 3t)$. (B) $-\frac{2}{t}(1+\cos 3t)$. (C) $\frac{2}{t}(1-\cos 3t)$. (D) $\frac{2}{t}(\cos 3t-1)$. (E) $\frac{1}{t}(1+\cos 3t)$.

2. In the following period functions, which one has its Fourier series is a Fourier sine series: (A) $f(x) = x$ if $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$. (B) $f(x) = |x|$ if $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$. (C) $f(x) = x^2$ if $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$. (D) $f(x) = e^{-|x|}$ if $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$. (E) $f(x) = x^2|x|$ if $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$.

3. If the Fourier transform of $f(x)$ is $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(x)e^{-i\omega x}dx$, the Fourier transform of $f(x)$ $= \begin{cases} 1, & if\ |x|<1 \\ 0, & if\ |x|>1 \end{cases}$ is (A) $\frac{1}{\sqrt{\pi}}\frac{\sin\omega}{\omega}$. (B) $\frac{2}{\sqrt{\pi}}\frac{\sin\omega}{\omega}$. (C) $\sqrt{\frac{2}{\pi}}\frac{\sin\omega}{\omega}$. (D) $\frac{\sin\omega}{\pi\omega}$. (E) $\frac{2\sin\omega}{\pi\omega}$.

4. From the answer of problem 3, the integral $\int_0^\infty \frac{\sin^2 \omega}{\omega^2} d\omega$ is (A) $\sqrt{\pi}$. (B) π. (C) $\frac{\pi}{2}$. (D) $\frac{\sqrt{\pi}}{2}$. (E)2π.

5. Solve the initial value problem: $y''+y = 2t$, $y(\frac{\pi}{4}) = \frac{\pi}{2}$, $y'(\frac{\pi}{4}) = 2-\sqrt{2}$. Then the general solution of $y(t)$ is _____.

6. The general solution of differential equation $x^2y'' - 4xy' + 6y = \frac{21}{x^4}$ is _____.

7. The Fourier sine integral of $f(x) = \begin{cases} 1, & if\ 0 < x < \pi \\ 0, & if\ \ x > \pi \end{cases}$ is_____.

8. From the answer of problem 7, the integral $\int_0^\infty \frac{1-\cos \pi\omega}{\omega} \sin x\omega \ \ d\omega$ is _____.

9. If matrix **A**= $\begin{bmatrix} 1 & 0 \\ 3 & 2 \end{bmatrix}$ and **X** is the matrix with its eigenvectors. Hence
   (1) matrix **X** = _____,
   (2) matrix $\mathbf{A}^{100}$ = _____.