

科目	工程數學	適用系所	資訊與通訊產業研發碩士專班 半導體產業研發碩士專班 機電整合產業研發碩士專班	時間	一〇〇分鐘
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※請務必在答案卷作答區內作答。

共1頁第1頁

一、(20%) If $f(x) = \cos\left(\frac{x}{2}\right)$ and $f(x+2\pi) = f(x); T = 2\pi$;

1. Find the Fourier series expansion of $f(x)$. (15%)

2. By using Parseval's Theorem: $\int_{-\pi}^{\pi} f^2(x) dx = \pi \left(2a_0^2 + \sum_{n=1}^{\infty} (a_n^2 + b_n^2) \right)$

To evaluate $\sum_{n=1}^{\infty} \frac{1}{(4n^2-1)^2} = ?$ (5%)

二、(20%) $f(x) = \begin{cases} e^{-4x} & x > 0 \\ 0 & x < 0 \end{cases}$

1. Determine the Fourier integral representation of $f(x)$ (15%)

2. By using the result in (1), evaluate $\int_0^{\infty} \frac{1}{\omega^2+16} d\omega = ?$ (5%)

三、(10%) Consider the following differential equation

$$y''(x) + 2y'(x) + \lambda y(x) = 0$$

with boundary conditions $y(0) = 0$ and $y(5) = 0$

Please determine eigenvalues and eigenfunctions of the equation.

四、(15%) Calculate $\frac{d^9}{dx^9}(x \sin x) = ?$

五、(15%) Evaluate $\int_0^{2\pi} (\sin^8 \theta) d\theta = ?$

六、(20%) Solve $y = x \frac{dy}{dx} + \sqrt{\left(\frac{dy}{dx}\right)^2 + 1}$