

淡江大學 103 學年度碩士班招生考試試題

系別:電機工程學系通訊與電波組 科目:工程數學

考試日期:3月2日(星期日) 第2節

本試題共5大題, 1頁

1. Solve the initial value problem: (20%)

$$y'' + y' - 2y = 0, \quad y(0) = 4, \quad y'(0) = -5$$

2. Find the eigenvalues and the eigenvectors of the matrix A: (20%)

$$A = \begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$$

3. Find the Fourier series of the periodic function f(x): (20%)

$$f(x) = \begin{cases} -k, & \text{if } -\pi < x < 0 \\ k, & \text{if } 0 < x < \pi \end{cases} \text{ and } f(x + 2\pi) = f(x)$$

4. Find the integral $\oint_C \frac{z^2+1}{z^2-1} dz$

(a) C is the closed path of the circle $|z - 1| = 1$ (10%)

(b) C is the closed path of the circle $|z| = 3$ (10%)

5. The autocorrelation function of a stationary process is defined as

$$R_x(\tau) = E[X(t + \tau)X(t)]$$

A sinusoidal signal with random phase

$X(t) = A \cos(2\pi f_c t + \Theta)$ where A the f_c are constants and Θ is a random variable with uniform distribution

$$f_\Theta(\theta) = \begin{cases} \frac{1}{2\pi}, & -\pi < \theta \leq \pi \\ 0, & \text{elsewhere} \end{cases}$$

Find the autocorrelation function of X(t): (20%)