

淡江大學九十一年度碩士班招生考試試題

系別：航空太空工程學系

科目：工程數學

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本試題共 / 頁

1. Write the complex Fourier series of the following periodic function f and determine what this series converges to.

$$f(x) = \begin{cases} x^2, & 0 \leq x < 1, \\ f(x+1) & \text{for all } x. \end{cases} \quad (20\%)$$

2. Use the Laplace transform to solve the following system

$$\begin{cases} x' + y' - x = \cos(2t), \\ x' + 2y' = 0, \end{cases} \quad x(0) = y(0) = 0. \quad (20\%)$$

3. Consider the regular Sturm-Liouville problem

$$(r(x)y'(x))' + (q(x) + \lambda p(x))y(x) = 0,$$

$$A_1y(a) + A_2y'(a) = 0, \quad B_1y(b) + B_2y'(b) = 0.$$

If λ_n and λ_m are distinct eigenvalues of this problem, with corresponding eigenfunctions φ_n and φ_m respectively, then prove

$$\int_a^b p(x)\varphi_n(x)\varphi_m(x) dx = 0. \quad (20\%)$$

4. Evaluate the integral

$$\int_{-\infty}^{\infty} \frac{\cos(4x)}{(x^2+1)^2} dx. \quad (20\%)$$

5. Solve the system $X' = AX$, with

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & -2 & -2 \\ 0 & 2 & 0 \end{bmatrix}. \quad (20\%)$$