

國立臺灣科技大學

114學年度碩士班招生

試題

系所組別：1200自動化及控制研究所碩士班

科 目：工程數學

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(總分為 100 分；所有試題務必於答案卷內頁依序作答)

1. (10%) Solve the following first-order ordinary differential equation with initial values.

$$y' + 3y = 5e^{2x} - 6; y(0) = 2$$

2. (10%) Write the general solution for the following second-order ordinary differential equation.

$$y'' - 2y' + 10y = 0$$

3. (10%) Compute the following Laplace transform. f has period of 6, and

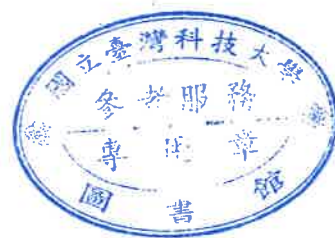
$$f(t) = \begin{cases} 5 & \text{for } 0 < t \leq 3 \\ 0 & \text{for } 3 < t \leq 6 \end{cases}$$

4. (12%) Find the recurrence relation and use it to generate the first five terms of a power series solution about 0.

$$y' - xy = 1 - x$$

5. (8%) Determine whether the vectors are linearly independent or dependent in the appropriate R^n .

$$2\mathbf{i}, 3\mathbf{j}, 5\mathbf{i}-12\mathbf{k}, \mathbf{i}+\mathbf{j}+\mathbf{k} \quad \text{in } R^3$$



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6. (15%) Consider a matrix A

$$A = \begin{bmatrix} 1 & -3 \\ 2 & -4 \end{bmatrix}$$

(1) (8%) Find the eigenvalues and the corresponding eigenvectors of A .(2) (7%) Use Cayley-Hamilton theorem to compute A^{50} .7. (15%) Write the Fourier cosine and sine series for $f(x)$ on the interval. Determine the sum of each series.

$$f(x) = 1 - x^3, 0 \leq x \leq 2$$

8. (10%) Use the Fourier transform to solve the following differential equation.

$$y'' + 6y' + 5 = \delta(t - 3)$$

9. (10%) Consider the following complex equation, find u and v so that $f = u + iv$. Determine whether the Cauchy-Riemann equations hold for all points (x, y) and determine whether f is differentiable for all z .

$$f(z) = z^2 - iz$$

