

國立臺灣科技大學

九十三學年度碩士班招生考試試題

系所組別：電機工程系甲組、電機工程系乙二組

科目：工程數學

總分 100 分

- (1) Find the general solution of the following differential equation:

$$x^3 y''' - 2x^2 y'' + 5xy' - 5y = 0. \quad (15\%)$$

- (2) Suppose that matrix
- A^2
- is diagonalizable, prove that
- A
- is also diagonalizable.

(10%)

- (3) Prove that a real symmetric matrix
- A
- is positive if and only if there is a nonsingular matrix
- P
- such that
- $P^T P = A$
- .

(10%)

- (4) Prove that
- $|F(\omega)| \leq \frac{1}{|\omega^2|} \int_{-\infty}^{\infty} |f''(t)| dt$
- , where
- $F(\omega)$
- is the Fourier transform of
- $f(t)$
- .

(15%)

- (5) If
- $f(t) = \sin t$
- , calculate the Laplace transforms of
- $f(t)$
- and
- $df(t)/dt$
- , respectively. (10%)

- (6) If
- $\vec{A} = x\vec{a}_x - 3\vec{a}_y + 2y\vec{a}_z$
- , calculate the line integral
- $\int_C \vec{A} \cdot d\vec{\ell}$

where C is the first quadrant part of $x^2 + y^2 = 1$ in the x - y plane.

(10%)

- (7) If
- $\vec{A} = \sin x\vec{a}_x + \cos y\vec{a}_y + 3z^2\vec{a}_z$
- and

$$\vec{B} = xyz\vec{a}_x - 2y^2\vec{a}_z, \text{ calculate } [\nabla(\nabla \cdot \vec{A})] \times [\nabla \times \vec{B}]. \quad (15\%)$$

- (8) Calculate the complex variable integral
- $\oint_C \frac{dz}{z(z-2)^3(z-4)}$
- ,

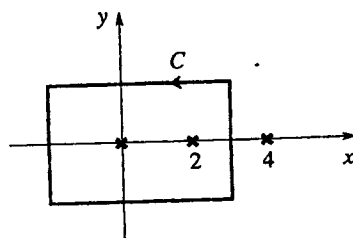
where C is the closed curve in the complex variable plane as shown in Figure 1. (15%)

Figure 1

