

國立成功大學  
110學年度碩士班招生考試試題

編 號：185

系 所：電腦與通信工程研究所

科 目：電磁數學

日 期：0203

節 次：第 3 節

備 註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (15%) Find all roots of  $\cos z + \sin z = 2$ .
2. (20%) Find the eigenvalues and eigenfunctions for a given Sturm-Liouville problem.

$$x^2 y'' + xy' + \lambda y = 0, \quad 1 \leq x \leq 3, \quad y'(1) = 0 \text{ and } y(3) = 0$$

3. (15%) Find the inverse Laplace transform of the function

$$F(s) = \frac{2s^2 - s}{(s^2 + 4)^2}.$$

4. (20%) Suppose that  $B$  is a  $5 \times 4$  real-valued matrix. Let  $S = BB^T$ , and  $T = B^T B$ . Choose the true statement(s) from the following.
  - (a) It is possible that  $S$  is an invertible matrix.
  - (b) It is possible that  $T$  is an invertible matrix.
  - (c) Both  $S$  and  $T$  are diagonalizable.
  - (d)  $I + S$  is an invertible matrix, where  $I$  is the identity matrix of the same size as  $S$ .
5. Consider two transformations  $T$  and  $S$ . The domain is the space of  $n \times n$  real-valued matrices, while the co-domain is the space of real numbers. Define  $T(A) = \det(A)$ , where  $\det(A)$  is the determinant of  $A$ , and define  $S(T) = \text{tr}(A)$ , where  $\text{tr}(A)$  is the trace of  $A$ .
  - (a) (10%) Is  $T$  a linear transformation? Is  $S$  a linear transformation?
  - (b) (10%) Is  $T$  a one-to-one transformation? Is  $S$  a one-to-one transformation?
  - (c) (10%) Is  $T$  an onto transformation? Is  $S$  an onto transformation?