

國立宜蘭大學

102 學年度研究所碩士班考試入學

工程數學試題

(電子工程學系碩士班)

准考證號碼：

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《作答注意事項》

1. 請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
2. 考試時間：100 分鐘。
3. 本試卷共有單選題 11 題，一題 5 分，計算題 3 題，一題 15 分，共計 100 分。
4. 請將答案寫在答案卷上。
5. 考試中禁止使用大哥大或其他通信設備。
6. 考試後，請將試題卷及答案卷一併繳交。
7. 本試卷採雙面影印，請勿漏答。
8. 應試時不得使用電子計算機。

**Part I.** 單擇題 (共55分, 每題五分)

- $\int_0^{\infty} f(t)\delta(t-a)dt = ?$  (A) 0 (B)  $f(0)$  (C)  $f(a)$  (D)  $a$  (E)  $f(\infty)$ .
- The general solution of  $y' + y = 2$ , is (A)  $-1 + cx^3$  (B)  $c(1+x)e^x$  (C)  
 $y = 4e^{-2x}(\cos 2x + \sin 2x)$  (D)  $ce^{-x} + 2$  (E)  $2x - 1 + ce^{-x}$ .
- Which of the following differential equations is not exact? (A)  $ydx + xdy = 0$  (B)  
 $4ydx - xdy = 0$  (C)  $xy' + y + 4 = 0$  (D)  $2x \ln ydx + y^{-1}x^2dy = 0$  (E)  $(1+x^2)dy + 2xydx = 0$ .
- The inverse Laplace transform of the given function  $\mathcal{L}^{-1}\left(\frac{2s-12}{s^2+16}\right) = ?$  (A)  $-2e^{-16t}$  (B)  
 $2e^{-16t} - 12$  (C)  $y = 2e^{-4x} \cos 3x$  (D)  $y = 2e^{-4x} \sin 4x$  (E)  $y = 2 \cos 4x - 3 \sin 4x$ .
- Let  $M(f)$  be the Fourier transform of  $m(t)$ , the Fourier transform of  $m(2t)\cos(2\pi \cdot f_c t)$  is  
(A)  $\frac{1}{4}[M(\frac{f}{2} + f_c) + M(\frac{f}{2} - f_c)]$  (B)  $\frac{1}{2}[M(f + f_c) + M(f - f_c)]$  (C)  $M(2f)\cos(2\pi \cdot f_c f)$  (D)  
 $[M(2f + f_c) - M(2f - f_c)]$  (E)  $2[M(2f + f_c) + M(2f - f_c)]$ .
- Which of the following statements is not true?  
(A)  $AB = 0$  then  $|A| = 0$  or  $|B| = 0$ .  
(B) If  $|A - B| = 0$  then  $|A| = |B|$   
(C) Let  $f(x) \in P_2$ , then  $T(f(x)) = xf(x)$  is a linear transformation.  
(D)  $\text{Rank}(A) \geq \text{Rank}(AB)$  for any  $n \times n$  matrix  $A, B$ .  
(E)  $T(0) = 0$  for any linear transformation  $T$ .
- Let  $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & -1 & 3 \\ 0 & 0 & 2 \end{bmatrix}$ , then  $\det\{2A^t(A^{-1})^2\} = ?$  (A) 1 (B) -1 (C) 2 (D) 1/2 (E) -4.
- If  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^3$  be a linear transformation such that  $T(1,2) = (1,0,-1)$  and  $T(0,-1) = (2,1,0)$ .  
Let  $T(x,y) = (ax + by, cx + dy, ex + fy)$  then (A)  $a = -2$  (B)  $b = 5$  (C)  $c = 2$  (D)  $d = 1$  (E)  
 $e = 1$ .
- For what value  $a$ , does the system  $\begin{cases} x + 4y - 3z = 0 \\ 3x + 2y + z = 10 \\ y + az = -2 \end{cases}$  have no solution?  $a =$  (A) -1 (B) 1  
(C) 2 (D) -2 (E) 3.
- Which one of the following is a spanning set of  $\mathbb{R}^3$ ? (A)  $\{(1,0,0), (0,1,0)\}$  (B)  $\{(1,1,3), (0,2,1)\}$  (C)  $\{(1,2,3), (1,1,-1), (2,3,2)\}$  (D)  $\{(1,0,0), (0,1,1), (1,1,1)\}$  (E)  $\{(2,1,-2), (-2,-1,2), (4,2,-4)\}$ .

(翻頁仍有試題)

**背面尚有試題**

11. Given that  $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 1 & 3 & 5 & 7 \\ 1 & 0 & -1 & -2 \end{bmatrix}$ , the rank of  $A$  equals (A)1 (B)2 (C)3 (D)4 (E)0.

**Part II. 計算題 (共45分, 每題15分)**

1. Let the solution of a differential equation  $(D^2 + aD + b)y = 0$ ,  $y(0) = 2$ ,  $y'(0) = -3$  is given as  $y = e^{-x}(c \cos \sqrt{2}x + d \sin \sqrt{2}x)$ . Determine the values of  $a$ ,  $b$ ,  $c$  and  $d$ .
2. Determine the response of  $i(t)$  for the circuit of Fig.1 and  $V(t) = e^{-at}$ ,

$$V_c(t) = v_0 \circ \text{ (Hint: } i(t) = C \frac{dV_c(t)}{dt} \text{)}$$

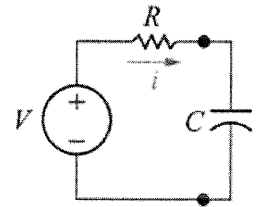


Fig. 1

3. Let  $A = \begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$ , find all the eigenvalues and corresponding eigenvectors.

※ 注意：請在答案卷上作答，寫在試題卷之答案不予採計。