

# 國立高雄師範大學 101 學年度碩士班招生考試試題

系所別：電子工程學系

科 目：工程數學（全一頁）

※注意：1. 作答時請將試題題號及答案依序寫在答案卷上，於本試題上作答者，不予計分。  
2. 請以藍、黑色鋼筆或原子筆作答，以鉛筆或其他顏色作答之部份，該題不予計分。

1. Find the divergence of  $\vec{A} = \hat{a}_x yz - \hat{a}_y x^2 + \hat{a}_z 3xz$ . (10%)

2. Prove the identity  $\nabla \times (\nabla V) = 0$ . (10%)

3. Given

$$\vec{A} = \hat{a}_x - \hat{a}_y 2 + \hat{a}_z 3$$

$$\vec{B} = \hat{a}_x + \hat{a}_y - \hat{a}_z 2$$

find the expression for a unit vector  $\vec{C}$  that is perpendicular to both  $\vec{A}$  and  $\vec{B}$ . (10%)

4. Determine the value of the following integral:

$$\oint_C \tan(\pi z) dz, \quad c: |z|=1. \quad (10\%)$$

5. Find the Fourier integral representation of the following non-periodic function:

$$f(\theta) = \begin{cases} \cos(\theta), & -\frac{\pi}{2} < \theta < \frac{\pi}{2} \\ 0, & \text{otherwise} \end{cases} \quad (10\%)$$

6. Find the (a) eigenvalues and (b) eigenvectors of  $A = \begin{bmatrix} 5 & -2 \\ 9 & -6 \end{bmatrix}$  (10%)

7. Find the inverse transformation. (10%)

$$y_1 = x_1 - 2x_2$$

$$y_2 = 4x_1 - 3x_2$$

8. Please find the Laplace Transform of  $f(t) = \frac{d}{dt}(e^{-at} \sin \omega t)$  (10%)

9. Please solve the initial value problem of  $y'' + y' - 2y = 0$

$$\text{where } y(0) = 4, y'(0) = -5 \quad (10\%)$$

10. Please give a general solution of the given nonhomogeneous ODE of

$$x^2 y'' - 2xy' + 2y = x^3 \cos x \quad (10\%)$$