

國立高雄應用科技大學  
九十七學年度碩士班招生考試  
土木工程與防災科技研究所(甲組、乙組)

准考證號碼  (考生必須填寫)

## 工程數學

試題有 7 題，共 1 頁

1. If  $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$  is a position vector and  $\nabla$  is the differential operator, please find the value of (1)  $\nabla \cdot \vec{r}$  and (2)  $\nabla \times \vec{r}$ . (10%)
2. Evaluate  $\iint_S \vec{F} \cdot d\vec{S}$  where  $\vec{F} = x\vec{i} + y\vec{j} + z\vec{k}$  and  $S$  is the sphere  $x^2 + y^2 + z^2 = 9$ . (20%)
3. Find the principal directions of the elastic deformation  $\mathbf{y}=\mathbf{A}\mathbf{x}$  with given matrix  $\mathbf{A}$  :  

$$\mathbf{A} = \begin{bmatrix} 3.0 & 1.5 \\ 1.5 & 3.0 \end{bmatrix}$$
(10%)
4. Solve the ordinary differential equation  $y''+4y'+4y = 3xe^{-2x}$ . (15%)
5. Solve  $y''+y = 4\delta(t-2\pi)$  subject to  $y(0)=1$ ,  $y'(0)=0$ , where  $\delta(t)$  = unit impulse function. (15%)
6. The usual form of Fourier series is  

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left( a_n \cos \frac{n\pi}{L} x + b_n \sin \frac{n\pi}{L} x \right)$$
Please write down (1) the amplitude and phase angle form and (2) the complex form of the Fourier series. (15%)
7. Evaluate the counterclockwise integration  $\int_C \frac{\cos z}{z} dz$  around the circle  $C: |z|=1$ . (15%)