

國立高雄應用科技大學
102 學年度研究所碩士班招生考試
土木工程系土木工程與防災科技碩士班
工程數學 (甲組)

試題 共 2 頁，第 1 頁

- 注意：a. 本試題共 7 題，共 100 分。
b. 作答時不必抄題。
c. 考生作答前請詳閱答案卷之考生注意事項。

1. Applying $y' + P(x)y = Q(x)$ ODE type, solve the general solution of $xy' - 2y = x^2$ (10%)
2. Assuming that the free fall velocity v is proportional to the air resistance, find the free fall velocity which satisfied the differential equation $\frac{dv}{dt} + \frac{kv}{m} = g$ where k is proportional constant, g is gravitation acceleration, and m is mass. Notice that when $t = 0$, $v = 0$ for a free fall object. (10%)
3. Find the general solution of the homogeneous differential equation $(x^2 - y^2) dx + 3xy dy = 0$. (10%)
4. Consider a 3X3 matrix,
$$A = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
 - (a) Find the eigenvalues (5%)
 - (b) Find the eigenvectors. (15%)
5. IF the XY orthogonal coordinate system rotated 45°
 - (a) What is the transformation matrix T? (5%)
 - (b) Consider a single shear element, i.e. the stress field $\sigma = \begin{bmatrix} 0 & \pi \\ \pi & 0 \end{bmatrix}$.
Calculate the stress field matrix in the rotated coordinate system. (10%)
6. Let function $f(x, y, z) = 2xyz$, vector function $V = x^2\vec{i} + (y - z)^2\vec{j} + xy\vec{k}$
 - (a) Find $\nabla f(2, 1, 4)$ (5%)
 - (b) Find $\nabla^2 f(x, y, z)$ (5%)
 - (c) Calculate $D_{\vec{v}}f(1, 1, 1)$ (5%)

【背面尚有試題】

7. Given the coordinate of the vertices $A(a,0,0), B(0,b,0), C(0,0,c)$ as shown.

(a) Find the normal vector of plane ABC. (5%)

(b) Find the area of plane ABC (5%)

(c) Find the equation of plane ABC. (10%)

