元智大學 102 學年度研究所 碩士班 招生試題卷

系(所)別：電機工程學系碩士班　組別：電子工程組　科目：工程數學　用紙第 1 頁共 1 頁

●不可使用電子計算機

1. Solve the following ODEs

(a) $x^2y''+xy+9y=0$, $y(1)=2$, $y'(1)=2.5$ (8%)

(b) $\mathbf{y}'=\begin{bmatrix}0 & -3\\ -3 & 0\end{bmatrix}\mathbf{y}+\begin{bmatrix}-3\\ 9\end{bmatrix}$ (9%)

2. Solve the following ODEs by the assigned methods:

(a) $y''+4y=\sin 2x$, $y(0)=1$, $y'(0)=-2$ (Method of undetermined coefficients) (9%)

(b) $y''-3y'+2y=e^{-4t}$, $y(0)=1$, $y'(0)=5$ (Laplace transforms) (8%)

3. In Fig.1, calculate the Fourier transform of $f(t)$ (8%)

4. In Fig.2, find the work done by force $F=\frac{3}{4}i+\frac{1}{2}j$ along the curve C traced $r(t)=\cos t\,i+\sin t\,j$ from $t=0$ to $t=\pi$ (8%)

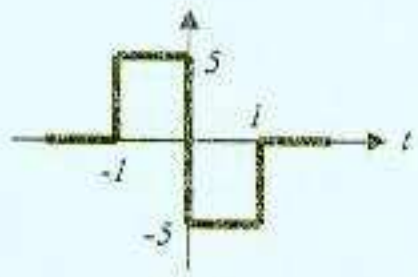

Fig.1

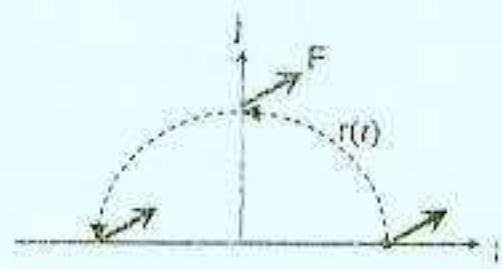

Fig.2

5. Find the determinant of matrix A (10%)

$$A=\begin{bmatrix}0 & 2 & 1\\ 3 & -1 & 2\\ 4 & 0 & 0\end{bmatrix}$$

6. If **u** and **v** are vectors in R^n, prove triangle inequality $\|u+v\|\le\|u\|+\|v\|$ (20%)

7. Prove $\sin^2 z+\cos^2 z=1$, where z is a complex number. (Hint : Euler's formula) (20%)