國立成功大學

114學年度碩士班招生考試試題

編　號：55

系　所：機械工程學系
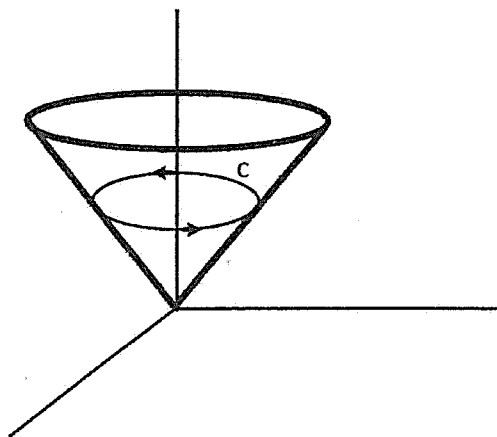
科　目：工程數學

日　期：0210

節　次：第 3 節

注　意：1.不可使用計算機
　　　　2.請於答案卷(卡)作答，於
　　　　　試題上作答，不予計分。

1. Solve $y'''-y''-8y'+12y=7e^{2x}$.   (10%)

2. A surface is given explicitly in the problem. Compute $\int_c F \cdot ds$, where C is the curve in which the cone $z^2=x^2+y^2$ intersects the plane $z=1$. The vector field is given by $F=(-y/2, x/2, z)$. (Oriented counter clockwise viewed from positive z-axis).   (10%)

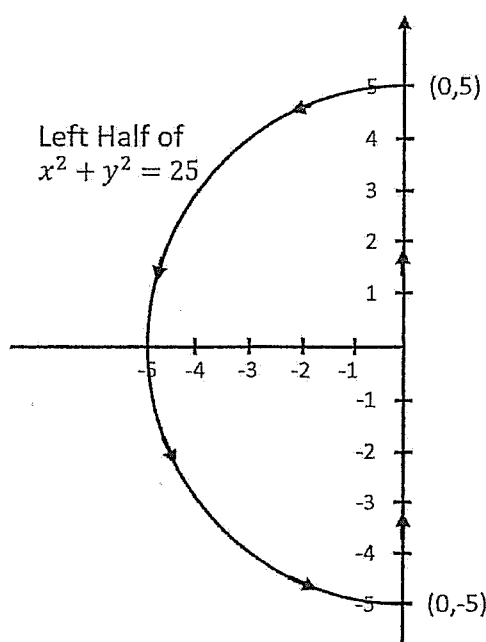3. Find the eigenvalues and eigenvectors for the matrix.   (10%)

$$A = \begin{bmatrix} 5 & -10 & -5 \\ 2 & 14 & 2 \\ -4 & -8 & 6 \end{bmatrix}$$

4. Consider a system of ODE

$$\begin{cases} y1'(t) = -3y1(t) + y2(t) \\ y2'(t) = y1(t) - 3y2(t) \end{cases}$$

Find the eigenvalues and eigenvectors of this system. Determine the fundamental matrix $\omega(t)$ and its inverse $\omega^{-1}(t)$.   (10%)

5. Use Green's Theorem to evaluate $\int_c yx^2dx - x^2dy$ where C is shown below.   (10%)

Left Half of
$x^2 + y^2 = 25$

6.(a)Find the inverse Laplace transform $\dfrac{se^{-10s}}{(s^2+4)^2}$.   (5%)

  (b)Find the inverse Laplace transform $\tan^{-1}\dfrac{1}{s}$ (for $s \geq 0$).   (5%)

7.Find the complex Fourier integral of $f(x) = x\exp(-|x|)$.   (10%)

8.Find the Fourier transform $\dfrac{3e^{it}}{t^2-2t+5}$.   (10%)

9.$\dfrac{\partial u}{\partial x} + x\dfrac{\partial u}{\partial t} = 0$ $u(x,0) = 0, u(0,t) = 4t$.   (10%)

10.Find $\oint_C \{z^2 + 2z^5 + \text{Im}(z)\}dz$,where C is the square with vertices at 0, -2i, 2-2i, 2.(10%)