國立中央大學 108 學年度碩士班考試入學試題

所別： 電機工程學系 碩士班 固態組(一般生)　　共 1 頁 第 1 頁

電機工程學系 碩士班 系統與生醫組(一般生)

科目： 工程數學(不含複變)

本科考試禁用計算器　　＊計算題需計算過程，無計算過程者不予計分

1. **(20%)** Let $A=\begin{bmatrix}0 & 0 & -2\\ 1 & 2 & 1\\ 1 & 0 & 3\end{bmatrix}$ and $B=A^{10}$.

   (a) Compute B. (10%)

   (b) Find the eigenvalues of B. (10%)

2. **(20%)** Let $V=\{(a,b,c,d)\in R^4\}$. Let W_1 be the subspace of V spanned by (-1, 1, -3, 2), (1, 2, 3, 4), (1, 0, 0, 0) and W_2 be the subspace of V spanned by (1, 1, 3, 2), (0, 1, 0, 0), (0, 0, 1, 0)

   (a) Determine the dimension of W_1+W_2 (10%)

   (b) Find a basis for $W_1\cap W_2$ (10%)

3. **(20%)** Find the **Laplace transform** (and show the details of your work) for the following functions:

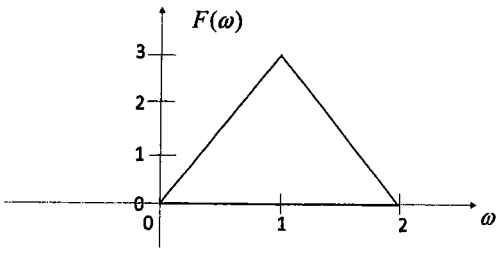
   (a) $te^{-t}cosh(2t)$ (10%)

   (b) $\sinh(at)\sin(at)$ (10%)

4. **(20%)** Solve the following differential equation and show the details of your work:

$$(x^2+1)y(xy'-y)=x^3$$

5. **(20%)** The Fourier transform $F(\omega)$ of one continuous-time signal $f(t)$ is shown below:



Giving the relation of Fourier transform $F(\omega)=\int_{-\infty}^{\infty}f(t)\cdot e^{-j\omega t}dt$, please sketch the Fourier transform of the following signals:

(a) (4%) $f(-t)$

(b) (4%) $f(2t)$

(c) (4%) e^{j4t}

(d) (4%) $f(t)*f(t)$, where * is the time-domain convolution operator

(e) (4%) $-jt\cdot f(t)$