編號： 170 國立成功大學107學年度碩士班招生考試試題

系　所：生物醫學工程學系

考試科目：工程數學　　考試日期：0205，節次：3

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※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (40 points)The function described as following; $f(t)=\begin{cases} t & 0\le t<1 \\ 2-t & 1\le t\le 2 \\ 0 & 2\le t \end{cases}$

   Answer the following questions

   (a) (5 points) Plot the function f(t)

   (b) (10 points) Find the Laplace transformation of f(t)

   (c) (10 points)　Find the Fourier transformation of f(t)

   (d) (15 points) If the signal f(t) passing through the following elements, s, 1/s and e^{-2s} , plot the output signals, respectively.

   Hint: $F(s)=\int_0^\infty f(t)e^{-st}dt$　　$F(\omega)=\int_{-\infty}^{\infty} f(t)e^{-i\omega t}dt$

2. (10 points) Find the directional derivative of $f=x^2+y^2+z^2$ at P:(2, 2, 1) in the direction $a=[1 \quad 1 \quad 1]$

3. (20 points) The differential equation $\ddot{y}+4y=sin2t$ and $y(0)=\dot{y}(0)=0$

   (a) (10 points) Find the $y(t)$

   (b) (10 points) What is resonant phenomena? Please explain this phenomena from the mathematical point of view.

4. (30 points) For a matrix A, answer the following:

   (a) (5 points)Please write down the definition of eigenvalues and eigenvectors of A

   (b) (10 points) Write down the procedure to get eigenvalues and eigenvectors.

   (c) (5 points) if $A\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}1\\0\\6\end{bmatrix}$ and $A\begin{bmatrix}4\\5\\6\end{bmatrix}=\begin{bmatrix}1\\0\\7\end{bmatrix}$, can you find the matrix A? Explain your reasons.

   (d) (10points) Can you find $A\begin{bmatrix}7\\8\\9\end{bmatrix}$ =?, Why? Explain your reasons.