113EE03

國立臺北科技大學113學年度碩士班招生考試

系所組別：2131 電機工程系碩士班丙組

第一節　工程數學　試題（選考）

注意事項：

1. 本試題共六題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (10%) Solve the initial value problem $4\sin^2(y)dx-\sec^2(x)dy=0;\ y(\frac{\pi}{4})=1$.

2. Consider the differential equation $y''-4y'+3y=x+e^x+xe^x+e^{3x}$.

   (a) (5%) Find the associate homogeneous solution.

   (b) (15%) Find the general solution.

3. (20%) Solve the differential equation:

   $y''(t)+6y'(t)+10y(t)=f(t);y(0)=y'(0)=0$ where

$$f(t)=\begin{cases}0, & t<2\\ +3, & 2\le t<3\\ -3, & t\ge 3\end{cases}$$

4. (15%) Find the inverse Laplace transform of $(sI-A)^{-1}$ where

$$A=\begin{bmatrix}-4 & 1 & 0\\ 0 & -4 & -6\\ 0 & 0 & -4\end{bmatrix}.$$

5. Consider the matrix $A=\frac{\sqrt{2}}{2}\begin{bmatrix}1 & -1\\ -1 & 1\\ 0 & 0\end{bmatrix}$.

   (a) (5%) Find the eigenvalues of A^TA.

   (b) (10%) Find the expression of all eigenvectors of AA^T.

6. Consider the set $S=\{(1,0,1),\ (2,1,0),\ (2,2,1)\}$.

   (a) (10%) Derive the orthonormal set $\hat{S}$ from S.

   (b) (10%) Express $\mathbf{x}=(2\sqrt{2},0,\sqrt{2})$ as a linear combination of the vectors in the orthonormal set $\hat{S}$.