國立臺灣師範大學 107 學年度碩士班招生考試試題

科目：工程數學　　　　　　　　　　　　　　適用系所：電機工程學系

注意：1.本試題共　1　頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

1.(10 分) Find the general solution of this homogeneous differential equation (1+x)dy-ydx=0

2.(10 分) Find the general solution of this homogeneous differential equation y "-6y'+9=0

3.(20 分) Newton's law of cooling describes that the heat loss rate of a body is proportional to the temperature difference between the body and the environment. Define $T(t)$ as the temperature of a body with respect to the time, R as the environment temperature, and k as the constant of heat loss. Please express the Netwon's law of cooling, and solve this differential equation.

4.(20 分)Prove the following Laplace transforms:

a. $L\{e^{at}\} = \frac{1}{s-a}$

b. $L\{f''(t)\} = s^2 L\{f'(t)\} - sf(0) - f'(0)$

5. (15 分) For $E(t) = 60\ V$, $L = 1h$, $R = 50\Omega$ $C = 10^{-4}f$, $i_1(0) = i_2(0) = 0$. Please solve $i_1(t)$ and $i_2(t)$ of the following circuits by using Laplace transform.
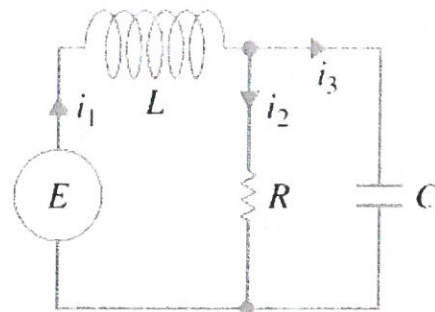
6. (15 分) For an $n \times n$ matrix A has a basis of eigenvectors x_i, i = 1, . . . , n, prove that $D=X^{-1}AX$, where D is a diagonal matrix with eigenvalues of A on the diagonal line.

7. (10 分) Compute the inverse of the matrix

$$\begin{bmatrix} -4 & 0 & 0 \\ 0 & 8 & 13 \\ 0 & 3 & 5 \end{bmatrix}$$