科目	工程數學（微分方程、拉氏轉換、線性代數）	適用系所	電子工程學系固態電子組、電路與系統組	時間	100 分鐘

※請務必在答案卷作答區內作答。

一、 1. Find the inverse Laplace transform of $\dfrac{2 \cdot e^{-5s}}{s^2 - 4}$ 10%

　　 2. Solve the following by Laplace transform for   10%

$$y''(t) - 7y'(t) + 12y(t) = e^{2t}, \quad y(0) = 0, \quad y'(0) = 0$$

二、 Find the standard matrix A for the linear Transformation $T : R^3 \to R^3$ defined by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} 3x + y \\ x - 2y \\ 5z \end{bmatrix}, \text{ such that } T(x,y,z) = A\begin{bmatrix} x \\ y \\ z \end{bmatrix}.   10\%$$

三、 Find the eigenvalues and corresponding eigenvectors of the matrix.

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 3 & 4 \\ 0 & 0 & 1 \end{bmatrix}   20\%$$

四、 Consider the following heat-equation: (10%×3=30%)

$$\frac{\partial u}{\partial t} = 9 \frac{\partial^2 u}{\partial x^2}$$

1. Solve the equation by separation of variable method (變數分離法)
   with boundary conditions: $u_x(0,t) = 0, u_x(3,t) = 0$
   initial conditions: $u(x,0) = 2 + 3\cos 3\pi x + 4\cos 4\pi x$

2. Solve the equation by separation of variable method (變數分離法), for $-\infty < x < \infty$

   Initial conditions: $u(x,0) = \begin{cases} e^{-3x}, & x > 0 \\ 0 & , x < 0 \end{cases}$

3. Solve the equation by Fourier **sine** transform in x
   with boundary condition $u(0,t) = 0$, $0 < x < \infty$

   initial condition: $u(x,0) = e^{-x}, x > 0$

五、 Consider the following differential equation (20%)

$$y'' + 6y' + 9y = 3e^{-3t}$$

1. $y_h(t) = ?$ $y_p(t) = ?$ (5%)

2. If $y(0) = 1, y'(0) = 0$, determine $y(t) = ?$ (5%)

3. Verify your answer in (3) by using Laplace transform. (10%)