請依題號順序將題號及答案清楚寫在答案卷上 （10 題共 100 分）

1~5:單選題：每題恰有一解, 答對一題得五分不倒扣（共 25 分）

1. The Laplace transform of t is : (A) $\dfrac{1}{s}$ (B) $\dfrac{1}{s^2}$ (C) $\dfrac{1}{s+1}$ (D) $\dfrac{1}{(s+1)^2}$.

2. The Laplace transform of e^t is : (A) $\dfrac{1}{(s-1)}$ (B) $\dfrac{1}{(s+1)}$ (C) $\dfrac{1}{(s-1)^2}$ (D) $\dfrac{1}{(s+1)^2}$.

3. The Laplace transform of $e^t \cos t$ is : (A) $\dfrac{1}{s^2+2s+2}$ (B) $\dfrac{1}{s^2-2s+2}$ (C) $\dfrac{s-1}{s^2+2s+2}$ (D)

$\dfrac{s-1}{s^2-2s++2}$.

4. The inverse Laplace transform of $\dfrac{2}{(s-3)^3}$ is : (A) te^t (B) $2te^t$ (C) $t^2 e^t$ (D) $t^2 e^{2t}$.

5. The inverse Laplace transform of $\dfrac{1}{s^4-s^2}$ is : (A) $\cosh t + t$ (B) $\cosh t - t$ (C) $\sinh t + t$

(D) $\sinh t - t$.

計算題: （共 75 分）

6. 求 $x^2 y'' - 5xy' + 9y = 0$ 之解 (10%)

7. 求 $y''' + 3y'' + 3y' + y = 30e^{-x}$, $y(0)=3, y'(0)=-3, y''(0)=-47$ 之解 (15%)

8. Please find the general solutions of the first order partial differential equation? (16%)

$$2\frac{\partial z}{\partial x} + 3\frac{\partial z}{\partial y} = 1$$

9. Matrix $B = \begin{bmatrix} 5 & 10 \\ 10 & 20 \end{bmatrix}$, please calculate (a) eigenvalues(特徵值)(b) eigenvectors (特徵向量) of the matrix? (16%)

10. Find the frequency of oscillation of a pendulum of length L, neglecting air resistance and the weight of the rod, and assuming θ to be so small that $sin\ \theta$ practically equals θ.

(Hint: based on physical model using force balance to develop mathematical model; ordinary differential equation and solve the ODE) (18%)