考試科目：工程數學　　　　　所別：機械工程學系　　　　第全頁

註：本次考試　<u>不可以參考自己的書籍及筆記</u>；　<u>不可以使用字典</u>；　<u>不可以使用計算器</u>。

1. (10%) Solve $2xydx + (x^2 - 1)dy = 0$

2. (10%) Solve $(x^2 + y^2)dx + (x^2 - xy)dy = 0$

3. (10%) Find a particular solution of $y'' - 5y' + 4y = 8e^x$

4. (10%) Find the inverse of $\mathbf{A} = \begin{pmatrix} 2 & 0 & 1 \\ -2 & 3 & 4 \\ -5 & 5 & 6 \end{pmatrix}$

5. (10%) Find the eigenvalues and eigenvectors of $\mathbf{A} = \begin{pmatrix} 5 & -1 & 0 \\ 0 & -5 & 9 \\ 5 & -1 & 0 \end{pmatrix}$

6. (10%) Compute the inverse Laplace transform of $\dfrac{16}{s(s-4)^2}$

7. (10%) Determine $f(t)$ such that $f(t) = 2t^2 + \int_0^t f(\tau)d\tau$.

8. (15%) Let $f(x) = -5\sin\dfrac{3\pi x}{2} + 3e^{|x|}$ for $-2 \le x \le 2$. Write the Fourier series of $f(x)$ on [-2, 2].

9. (15%) Solve the boundary value problem

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2} \text{ for } 0 < x < L,\, t > 0$$

$$u(0,t) = 0,\, u(L,t) = 0 \text{ for } t > 0$$

$$u(x,0) = x + 1 \text{ for } 0 \le x \le L$$