

科目：工程數學 適用：土木系(結構與應力組)

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

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1. (20%) Solve the ODE $y'' - 4y' + 4y = e^{2t}$ with $y(0) = 0$ and $y'(0) = 0$.

2. (20%) The line integral $\int_C 3x^2 dx + 2yz dy + y^2 dz$ is path independent, find the value of the integral for a path from $A(0,1,2)$ to $B(1,-1,7)$.

3. (20%) Find the eigenvalues and eigenvectors of the following matrix:

$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 2 & 0 & 3 & 0 \\ 1 & 4 & 2 & 1 \end{bmatrix}$$

4. (20%) Find the Fourier series of the function:

$$f(x) = \begin{cases} -k & \text{if } -3 < x < 0 \\ k & \text{if } 0 < x < 3 \end{cases}, \quad f(x) = f(x+6)$$

5. (20%) Solve the PDE $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$, where $u = u(x, t)$ for $0 \leq x \leq L$ and $t \geq 0$,

with the boundary conditions: $u(0, t) = u(L, t) = 0$ and the initial conditions:

$$u(x, 0) = \sin(\pi x/L).$$

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