

臺灣綜合大學系統

108 學年度 學士班

轉學生聯合招生考試

試 題

類組：D36

科目名稱：工程數學

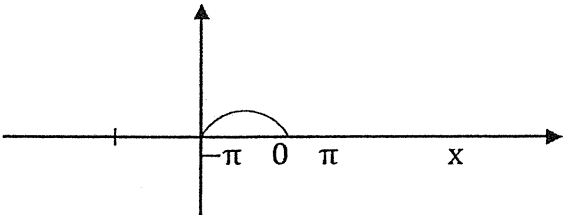
科目代碼：D3691

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※本項考試依簡章規定各考科均「不可以」使用計算機 本科試題共計 1 頁

- Find the angle between the surfaces $xy^2z = 3x + z^2$ and $3x^2 - y^2 + 2z = 1$ at the point $(1, -2, 1)$. (10%)
- Use Laplace Transformation (with respect to t) to solve the partial differential equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ $u(x, 0) = 0$ $0 < x < \infty, 0 < t < \infty$ and $u(0, t) = -\int_0^t u(0, s) ds + e^{-2t} - 1$. (10%)
- Prove $\nabla \times (\nabla \phi) = 0$. (10%)
- To solve a PDE, we need to have boundary and initial conditions. There are also three types of boundary conditions: Dirichlet, Neumann, and Robin (mixed) conditions. Please clearly describe each type of boundary conditions. (10%)
- Find the Fourier series of the periodic function $f(x)$,

$$f(x) = \begin{cases} 0, & -\pi < x \leq 0 \\ \sin x, & 0 < x \leq \pi \end{cases} \quad (10\%)$$

- Use Cramer's rule to solve the system of linear equation,

$$\begin{cases} -x + 2y - 3z = 1 \\ 2x + z = 0 \\ 3x - 4y + 4z = 2 \end{cases} \quad (10\%)$$
- Find the eigenvalues and corresponding eigenvectors for matrix A . What is the dimension of the eigenspace of each eigenvalue?

$$A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix} \quad (10\%)$$
- Solve $\begin{cases} y_1''(t) = -y_1(t) - y_2(t) + 1 \\ y_2'(t) = y_1(t) + y_2(t) \end{cases}; y_1(0) = y_1'(0) = y_2(0) = 0$ (10%)
- Find $yy''(x) + (y + 1)\{y'(x)\}^2 = 0$ (10%)
- Prove that, the Fourier sine series $\frac{\pi-x}{2} = \sum_{n=1}^{\infty} \frac{\sin nx}{n}; (0 \leq x \leq \pi)$ (10%)