國立高雄第一科技大學 101 學年度 碩士班 招生考試 試題紙

系 所 別：機械與自動化工程系　　組　別：不分組

考科代碼：2132　　考　科：工程數學（二）

注意事項：

1、本科目得使用本校提供之電子計算器。

2、請於答案卷上規定之範圍作答，違者該題不予計分。

1. Please find the general solution of the given linear system: (15%)

$$\begin{aligned} x_1 - x_2 + 3x_3 - x_4 &= 1 \\ x_2 - 3x_3 + 5x_4 &= 2 \\ x_1 - x_3 + x_4 &= 0 \\ x_1 + 2x_3 - x_4 &= -5 \end{aligned}$$

2. Please find (a) an orthogonal matrix that (b) diagonalizes the given maxtrix A: (15%)

$$A = \begin{bmatrix} 3 & 0 & -2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$$

3. Please find the angle between the two surfaces at the given point of intersection. (15%)

$$S_1 : x^2 + y^2 + z^2 = 4; \quad S_2 : z^2 + x^2 = 2; \quad at \quad (1, \sqrt{2}, 1)$$

4. Please find the flux of $\vec{F} = x\vec{i} + y\vec{j} + z\vec{k}$ across the part of the sphere $x^2 + y^2 + z^2 = 4$ lying between the planes $z = 1$ and $z = 2$. (15%)

5. (a) Please solve for all z such that $e^z = 1 + 2i$. (10%)

(b) If the three roots for $z^3 = 1$ are z_1, z_2, z_3, please find $z_1 + z_2 + z_3 = ?$ (10%)

6. Please find the temperature $u(x, t)$ in a laterally insulated copper bar 80 cm long if the initial temperature is 100 $\sin(\pi x/80)$ ℃ and both ends are kept at 0 ℃. How long will it take for the maximum temperature in the bar to drop to 50 ℃? (density for copper is ρ= 8.92 gm/cm^3, specific heat σ= 0.092 cal/gm ℃, and thermal conductivity k = 0.95 cal/cm sec ℃) Please solve the problem with one dimensional heat equation: $\partial u/\partial t = c^2 \partial^2 u/\partial x^2$, where $c = k/\rho\sigma$. (20%)

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