

口述試験(午前1)
工学基礎

23 大修

時間 9:00~10:00

注意事項

1. 問題は全部で3題ある。この全てについて解答せよ。
2. 答案用紙は全部で3枚ある。
3. 各答案用紙には、必ず受験番号を記入せよ。
4. 計算機能のみの電卓を使用してもよい。

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Answers to questions can be given in Japanese or English.

1. Obtain the general solution of the ordinary differential equation,

$$\frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0, \quad (1)$$

by assuming a solution in the form of a power series with unknown coefficients a_m ,

$$y = \sum_{m=0}^{\infty} a_m x^m, \quad (2)$$

and give the first six non-zero terms of the power series.

2. Find the eigenvalues (固有値) and normalized eigenvectors (正規化された固有ベクトル) of the matrix,

$$\mathbf{A} = \begin{bmatrix} 6 & 4 & 0 \\ 4 & 6 & 0 \\ 0 & 0 & -2 \end{bmatrix}. \quad (3)$$

3. Consider two right-handed Cartesian coordinate systems xyz and $x'y'z'$. The $x'y'z'$ coordinate system is obtained from the xyz coordinate system by a 60° clockwise rotation about the z -axis. The unit vectors in the x -axis, y -axis and z -axis directions are $\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3$, respectively. The unit vectors in the x' -axis, y' -axis and z' -axis directions are $\mathbf{e}'_1, \mathbf{e}'_2, \mathbf{e}'_3$, respectively. Determine the components of the vector $\mathbf{v} = \mathbf{e}_1 + 2\mathbf{e}_2 + \mathbf{e}_3$ in the $x'y'z'$ coordinate system. (That is, if $\mathbf{v} = \mathbf{e}_1 + 2\mathbf{e}_2 + \mathbf{e}_3 = v'_1 \mathbf{e}'_1 + v'_2 \mathbf{e}'_2 + v'_3 \mathbf{e}'_3$, determine v'_1, v'_2, v'_3 .)

