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國立臺灣大學 111 學年度碩士班招生考試試題

科目：工程數學(A)

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1. For a matrix $A = \begin{bmatrix} -7 & 0 & -7 & -3 \\ 21 & -1 & 24 & 7 \\ 11 & 0 & 11 & 3 \\ -3 & 0 & -3 & 1 \end{bmatrix}$
- (a) (5%) Compute the inverse of A if possible
 - (b) (16%) Find the eigenvalues and eigenvectors of A
 - (c) (9%) Diagonalize A if possible.
 - (d) (5%) Determine the rank of A
2. (20%) Solve $(1 - x)y'' + xy' - y = 0$
3. (20%) Find the Fourier cosine series of the function $|\sin x| + \cos x$ in the interval $(-\pi, \pi)$
4. Consider the equation $u_{tt} = 4u_{xx} + \cos x$, $u(x, 0) = \sin x$, $u_t(x, 0) = 1 + x$
- (a) (20%) Find the solution
 - (b) (5%) Sketch the solutions for $t = \pi$ and $t = 2\pi$. Discuss your findings.

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