

工程數學
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1. The vector $\mathbf{F} = 8xz \mathbf{i} - y^2 \mathbf{j} + 2yz \mathbf{k}$, and $\mathbf{n}$ is the outward drawn unit normal vector, please evaluate $\iint_S \mathbf{F} \cdot \mathbf{n} \, dS$, where S is the surface of the cube bounded by $x=0, x=1, y=0, y=1, z=0, z=1$. (20%)

2. $y'' + 4y' + 3y = \sin x$. Find the general solution of the equation. (15%)

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3. Using the Laplace Transform to solve the initial value problem
 $y'' - 3y' + 2y = e^t$ $y(0) = 0$, $y'(0) = 1$. (15%)

4. Solve the O.D.E. $(x^2 + 3y)dx + (3x + 2y - 5)dy = 0$. (15%)

5. Determine the Fourier expansion of the following function:

$$f(x) = \frac{1}{2}x^2 \quad -\pi < x < \pi \quad \text{and show that}$$
$$1 - \frac{1}{4} + \frac{1}{9} - \frac{1}{16} + \frac{1}{25} - \frac{1}{36} + \dots = \frac{\pi^2}{12} \quad (20\%)$$

6. Matrix $\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 3 \\ 1 & 2 & 4 \end{pmatrix}$, matrix $\mathbf{T} = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 2 \\ 1 & 2 & 3 \end{pmatrix}$, if there exists a linear system $\mathbf{A}\mathbf{Q} = \mathbf{T}$, find the matrix $\mathbf{Q}$. (15%)

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