

科目	工程數學	適用 系別	機電系三年級	時間	80分鐘
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※ 請務必在答案卷作答區內作答 ※

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1. (a) Find the Fourier Sine integral representation of the function (10%)

$$f(x) = \begin{cases} 1, & \text{if } 0 < x < a \\ 0, & \text{if } x > a \end{cases}$$

- (b) Use the results of (a) to evaluate the following integral. (10%)

$$\int_0^{\infty} \frac{1 - \cos a\omega}{\omega} \sin a\omega \, d\omega =$$

2. Find $\frac{dw}{dt}$, where $w = \sqrt{x^2 + y^2}$, and $x = e^{2t}$, $y = e^{-2t}$. (15%)

3. Find the work done in moving a particle in the force field $\vec{F} = y^3\vec{i} + x^3\vec{j}$ along the curve defined by $y = 5x^2$ from $A:(0,0)$ to $B:(2,20)$. (15%)

4. Find the general solution of the differential equation. (20%)

$$y'' + 3y' + 2y = e^{-2x} + x^2$$

5. Solve the differential equation. (10%)

$$y' - 2y = 2y^2$$

6. Using the Laplace transform to solve the differential equation. (20%)

$$y'' - 3y' + 2y = 2\cos t, y(0) = 2, y'(0) = -1$$