

國立彰化師範大學九十六學年度碩士班招生考試試題

系所：顯示技術研究所

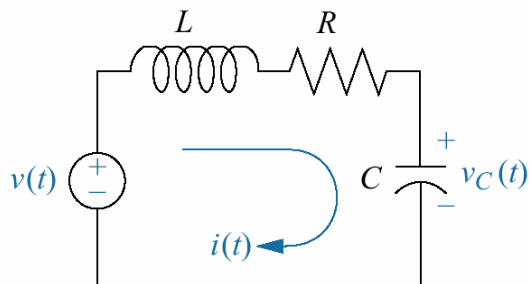
科目：工程數學

請在答案紙上作答

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每題十分。總分一百分。

1. Find the transfer function relating the capacitor voltage, $V_{C(s)}$, to the input voltage, $V(s)$, in the figure.



2. Evaluate $\iint_S z dS$, where the surface S is the portion of the paraboloid $z = 4 - x^2 - y^2$ lying above the x - y plane.

3. Show that $\oint_C (f\nabla g + g\nabla f) \cdot d\mathbf{r} = 0$ for any closed curve C and twice differentiable functions f and g .

4. Solve the given initial value problem and describe the resulting motion of the mass-spring system it represents.

$$2y'' + 4y' + y = \sin(2t) - \sin(t); \quad y(0) = y'(0) = 2$$

5. Use convolutions to write a formula for the solution of the initial value problem.

$$y'' + 10y' + 24y = f(t); \quad y(0) = 1, \quad y'(0) = 0$$

6. Write out the first six nonzero terms of a series solution about 0 by expanding the right side in a Taylor series and comparing coefficients of like powers of x on both sides.

$$y'' - e^x y = \sin(x) + 1$$

7. Solve the system $y'' = AY$, with $A = \begin{bmatrix} -2 & 0 & 0 \\ 1 & 1 & 2 \\ 0 & 1 & 0 \end{bmatrix}$

8. Write the Fourier series of $f(x) = \begin{cases} 2x, & -\pi \leq x < 0 \\ \cos(x), & 0 < x \leq \pi \end{cases}$

9. Compute both the Fourier sine and cosine integrals of $f(x) = \begin{cases} 2x+1, & 0 \leq x \leq \pi \\ 2, & \pi < x \leq 3\pi \\ 1, & 3\pi < x \leq 10\pi \\ 0, & x > 10\pi \end{cases}$

10. Let A and B be symmetric, $n \times n$ matrices. Prove that, in general, AB is symmetric if and only if $AB = BA$.