

國立臺灣科技大學 108 學年度碩士班招生試題

系所組別：自動化及控制研究所碩士班

科目：工程數學

(總分為 100 分)

1. Use the Fourier transform to solve (15%)

$$y'' + 6y' + 5y = \delta(t-3)$$

2. Solve (15%)

$$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2} \text{ for } x > 0, t > 0$$

$$u(x, 0) = 0, u(0, t) = t^2, \lim_{x \rightarrow \infty} u(x, t) = 0$$

3. Let (20%)

$$p(z) = (z - z_1)(z - z_2) \cdots (z - z_n)$$

with z_1, \dots, z_n distinct complex numbers. Let γ be a positively oriented closed path enclosing each z_j . Evaluate

$$\oint_{\gamma} \frac{p'(z)}{p(z)} dz$$

first by using the residue theorem and then by using the argument principle.

4. Use the matrix exponential to solve the initial value problem (15%)

$$Y' = AY, \quad Y(0) = Y_0,$$

$$\text{where } A = \begin{bmatrix} 3 & 4 \\ 3 & 2 \end{bmatrix}, \quad Y_0 = \begin{bmatrix} 6 \\ 1 \end{bmatrix}.$$



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5. Find a power series solution for the differential equation (20%)

$$(x^2 + 1)y'' + xy' - y = 0.$$

6. Suppose the capacitor in the circuit of Figure P6 initially has a charge of zero and there is no initial current. At time $t=2$ second, the switch is thrown from position B to A , held there for 1 second, and then switched back to B . Please find the output voltage E_{out} on the capacitor. (15%)

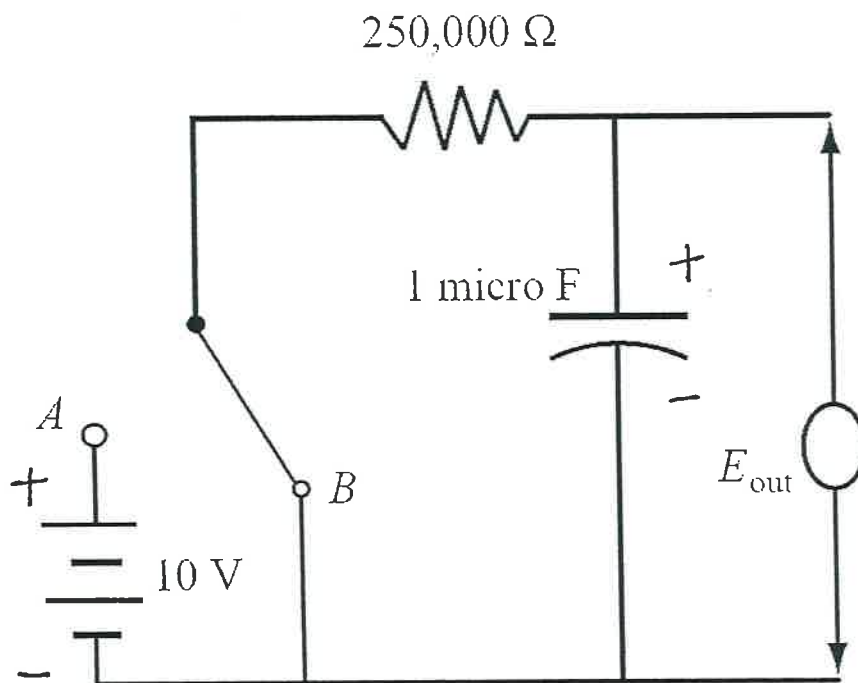


Figure P6

