國立高雄大學九十七學年度研究所碩士班招生考試試題

系所：
應用物理學系碩士班磁性與半導體組
應用物理學系碩士班奈米組
應用物理學系碩士班光電組

科目：工程數學
考試時間：100 分鐘

是否使用計算機：是

本科原始成績：100 分

1. Let $\bar{A}$ be constant vector and $\bar{R} = x\hat{i} + y\hat{j} + z\hat{k}$.

   Calculate (a) $\bar{\nabla}(\bar{R}\cdot\bar{A})$ (b) $\bar{\nabla}\cdot(\bar{R}-\bar{A})$ (c) $\bar{\nabla}\times(\bar{R}-\bar{A})$. (15%)

2. Find a solution of $y''+2y'-3y = 4e^{x}$. (15%)

3. Use the ***Matrix Methods*** to solve the system as below.

$$\begin{cases} x_1 - 3x_2 + x_3 - 7x_4 + 4x_5 = 0 \\ x_1 + 2x_2 - 3x_3 = 0 \\ x_2 - 4x_3 + x_5 = 0 \end{cases}. \quad (15\%)$$

4. Find the ***Fourier transform*** of the function.

   Let $f(x) = 2x+1$, for $-3 \le x \le 3$. (15%)

5. Evaluate $\oint_C \frac{e^{z}\cos(z^2)dz}{(z-i)(z+4)^2}$. (15%)

6. Use ***Laplace transform*** to solve the given system, subject to the given conditions.

$$\begin{cases} x''-2x'+3y'+2y = 4 \\ 2y'-x'+3y = 0 \end{cases}, \quad x(0) = x'(0) = y(0) = 0. \quad (15\%)$$

7. Consider the problem of finding the charge $Q(t)$ in the RLC circuit of Figure 1 if the electromotive force is k until time $t = 2$ and then has constant value zero. Analytically, $E(t) = k[1-u(t-2)]$ as shown in Figure 2. Use ***Laplace transform*** to solve it. (10%)

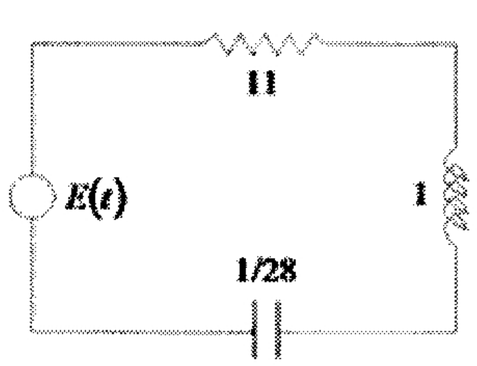

Figure 1

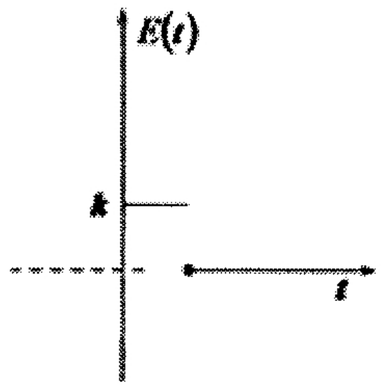

Figure 2