國立嘉義大學九十四學年度
生物機電工程學系碩士班招生考試試題

科目：工程數學

1. Solve the initial value problem: $y''-2y'-8y = f(t)$, with $y(0)=1$, $y'(0)=0$, and $f(t)=\begin{cases}0, & for\ 0 \le t < 3\\ 5, & for\ t \ge 3\end{cases}$ (25%)

2. An object of 90°C is placed into an environment kept at 20°C. Ten minutes later, the object has cooled to 80°C. Apply Newton's Law of Cooling $\frac{dT}{dt} = k(T - T_\infty)$ and carry out the following questions. (25%)
   (a) What will be the temperature of the object after it has been in the environment for 20 minutes?
   (b) How long will it take for the object to cool to 30°C?

3. Evaluate $\int_{-\infty}^{\infty} \frac{\sin^2 \omega}{\omega^2} d\omega$, if $f(x)=\begin{cases}2, & |x|<1\\ 0, & |x|>1\end{cases}$. (25%)

4. What is the residue of $f(z)=\frac{1}{z-\sin z}$ at $z=0$? (25%)