國立彰化師範大學 100 學年度碩士班招生考試試題

系所：電子工程學系　　組別：甲、乙組　　科目：工程數學

☆☆請在答案紙上作答☆☆　　

1. Solve the following differential equations.

   (a) $-3ydx+4xdy=0$ (10%)

   (b) $8y''(x)-6y'(x)+6y(x)=0$ (10%)

   (c) $x^2y''(x)+6xy'(x)+6y(x)=0$ (10%)

2. Find the Laplace transforms of the following functions.

   (a) $t^2\cos t$ (5%)

   (b) $\left(t^3-2\right)^2$ (5%)

3. Find the Inverse Laplace transforms of the following functions.

   (a) $\dfrac{4s-1}{\left(4s^2-1\right)}$ (5%)

   (b) $\dfrac{e^{-as}}{s(s+2)}$ (5%)

4. Given a periodic function $f(x)=\begin{cases}0, & -L<x<0\\ L, & 0<x<L\end{cases}$ with $f(x+2L)=f(x)$ for all x.

   (a) Please find the Fourier series for this periodic function. (10%)

   (b) From the Fourier series of (a), please deduce the value of the sum of the series

   $1-\dfrac{1}{3}+\dfrac{1}{5}-\dfrac{1}{7}+\cdots$ (10%)

5. The Laguerre differential equation is $xy''+(1-x)y'+\lambda y=0$.

   (a) Show that $x=0$ is a regular singular point. (10%)

   (b) Determine the indicial equation, its roots, the recurrence relations and one solution$(x>0)$.

   (10%)

   (c) Shows that if $\lambda=m$, a positive integer, this solution will reduce to a polynomial. (10%)