國立高雄第一科技大學 100 學年度 碩士班 招生考試 試題紙

系 所 別：機械與自動化工程系　　組　別：不分組

考科代碼：1131　　考　科：工程數學（一）

注意事項：

1、**本科目應使用符合考選部公告核定之國家考試電子計算器。**

2、請於答案卷上規定之範圍作答，違者該題不予計分。

1. Please find the general solution for the following differential equations: (40%)

   (a) $(e^{x+y}+ye^{y})dx+(xe^{y}-1)dy=0$

   (b) $yy''=y^{2}y'+(y')^{2}$

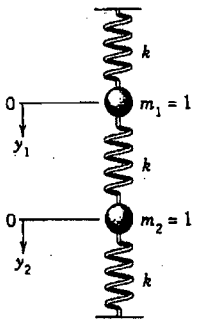
   (c) $xy''+2y'+xy=0$; $y_1(x)=x^{-1}\cos x$

   (d) $x^{2}y''+xy'+4y=\sin(2\ln(x))$

2. Please determine the Laplace transform and inverse transform for the following: (10%)

   (a) $\mathcal{L}[t\sin(\omega t)]$　　(b) $\mathcal{L}^{-1}[\ln(1+\frac{\omega^{2}}{s^{2}})]$

3. The mechanical system in the figure showing in the right consists of two bodies of mass 1 on three springs of the same spring constant $k = 1$ and of negligible mass, and y_1 and y_2 are the displacements of the bodies from their position of static equilibrium. Neglect damping and assume zero initial displacements and velocities. The external forces acting on the two bodies are $f_1(t) = 1 - u(t - 2)$ and $f_2(t) = 0$. Please solve for the displacement functions of the two bodies for the system. (15%)



4. Please find the complex Fourier series of $|E\sin(\lambda t)|$ with $p = \pi/\lambda$ and also the amplitude spectrum (15%)

5. Please find the Fourier transform and inverse transform of the given functions: (20%)

   (a) $f(x)=\begin{cases}4-x^{2} & for \quad -2\le x\le 2\\ 0 & for \quad |x|\ge 2\end{cases}$　　(b) $\hat{f}(\omega)=\frac{1}{(4+\omega^{2})(9+\omega^{2})}$

   For Reference:

   $\Im[e^{-a|t|}](\omega)=\frac{2a}{a^{2}+\omega^{2}}$, $\Im[H(t)e^{-at}](\omega)=\frac{1}{a+i\omega}$.