編號： 161

國立成功大學 108 學年度碩士班招生考試試題

系　　所：生物醫學工程學系

考試科目：工程數學

考試日期：0224，節次：1

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10 %) $x^2\ddot{y} - x\dot{y} + y = 0$, $y(1) = 1, \dot{y}(1) = 2$. Find y(x)
   (Hint: Euler-Cauchy equations)
2. (10 %) Solve by Laplace Transform,
   $$y(t) - \int_0^t y(\tau) sin2(t-\tau) d\tau = sin2t$$
3. (10 %) Find the Laplace Transform of following functions
   $te^{-t}cost + t^2 sint$
4. (30 %) The differential equation, $\ddot{y} + 4y = f(t)$ and $y(0) = \dot{y}(0)=0$
   (a) Find the transfer function. Hint $H(s) = \frac{Y(s)}{F(s)}$ (10%)
   (b) When $f(t) = u(t) - u(t-1)$, To solve the $y(t)$ (10%)
   Hint: $u(t)$ is a unit step function
   (c) When $f(t) = sint$, To solve the $y(t)$ (10%)
5. (20 %) When $f(t) = u(t) - u(t-1)$
   (a) Find the Laplace transform of the function f(t) (5 %)
   (b) Find the Fourier transform of the function f(t) (5 %)
   (c) Using half-range expansion (odd or even periodic extension) then find it Fourier series. (10 %)
   Hint: $F(s) = \int_0^\infty f(t)e^{-st}dt$　　$F(\omega) = \int_{-\infty}^\infty f(t)e^{-i\omega t}dt$
6. (20 %) Find the following plate's moment of inertia with vertical axis at center of gravity.
   (a) A homogeneous round plate with radius R, thickness h and total mass M.(10%)
   (b) A homogeneous square plate with side length 2R, thickness h and total mass M.(10%)
   (Hint; $I = \int r^2 dm$)