國立成功大學

110學年度碩士班招生考試試題

編　號：206

系　所：電機資訊學院-資訊聯招

科　目：工程數學

日　期：0202

節　次：第 3 節

備　註：不可使用計算機

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※ 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. (20%) Solve the given differential equation.

(a) $\frac{dy}{dx}=\frac{xy+2y-x-2}{xy-3y+x-3}$ (10%)

(b) $\left(\sqrt{x}+x\right)\frac{dy}{dx}=\sqrt{y}+y$ (10%)

2. (10%) Find the value of m, so that the given differential equation is exact.

$\left(6xy^3+\cos y\right)dx+\left(2mx^2y^2-x\sin y\right)dy=0$

3. (10%) In the following terms, which does not exist the Laplace transform?

$(1)t^{100}(2)\frac{3}{t}(3)\frac{2}{\sqrt{t}}(4)e^{100t}(5)\sin(3t+\frac{1}{3}\pi)(6)e^{t^2}(7)t^{2t}$

4. (10%) Given the Laplace transform of Bessel function J_0(t) ,i.e. $\mathcal{L}\{J_0(t)\}=\frac{1}{\sqrt{s^2+1}}$

Please derive the Laplace transform of Bessel function J_0(3t).

5. (10%) Please find the indicial equation of the following differential equation.

$y''+p(x)y'+q(x)y=0,$

$x=0$ is a regular sigular point.

where $xp(x)=A_0+A_1x+A_2x^2+\ldots$

$x^2q(x)=B_0+B_1x+B_2x^2+\ldots$

6. (10%) Find the serial solutions at x=0 for the following differential equation.

$x(x-1)y''+(3x-1)y'+y=0$

7. (10%) For Legendre's different equation $(1-x^2)y''-2xy'+\lambda y=0$ in which -1≤x≤1, and λ is a real constant, please find the serial solutions at x=0 and explain how to get the Legendre's polynomials.

8. (10%) Find f(t) from the following equation.

$f(t)=e^{-t}+2\int_0^t\frac{f(t-\tau)}{e^{3\tau}}d\tau$

9. (10%) Solve the following equation

$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}e^{-(10x^2+6xy+2y^2)}dxdy$ given $\int_{-\infty}^{\infty}e^{-x^2}dx=\sqrt{\pi}$