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長庚大學107學年度研究所碩士班招生考試試題

系所：生物醫學工程研究所碩士班

考試科目：工程數學

醫療機電工程組

注意：請詳細閱讀下列試題，並請標明題號依試題順序將答案書寫於答案卷上。

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1. (20%) $\frac{d^2 y(x)}{dx^2} + \left(\frac{dy(x)}{dx}\right)^2 y(x) = 15$

- a. Order of the O.D.E.?
- b. Degree of the O.D.E.?
- c. Linear or non-linear?
- d. Homogeneous or non-homogeneous?

2. (10%) Find the solution of the $(6xy - y^3)dx + (4y + 3x^2 - 3xy^2)dy = 0$

3. (10%) Find the solution of the $\frac{dy}{dx} = -6xy$, $y(0) = 7$

4. Solve the initial value problem $y'' - 3y' + 2y = 3e^{-x} - 10\cos 3x$, $y(0) = 1$, $y'(0) = 2$

(5%) (a) General solution

(15%) (b) Particular solution

5. Find the Laplace transform of

(5%) (a) $\mathcal{L}\{t^3\}$

(5%) (b) $\mathcal{L}\{3e^{2t} + 1 - \cos 6t\}$

6. Find the Inverse Laplace transform of

(5%) (a) $\mathcal{L}^{-1}\left\{\frac{1}{s+2}\right\}$

(5%) (b) $\mathcal{L}^{-1}\left\{\frac{s^2 + 1}{s^3 - 2s^2 - 8s}\right\}$

7. (20%) Find the Fourier series for the periodic function $f(x + 2\pi) = f(x)$ where $f(x) = \begin{cases} 0 & \text{if } -\pi < x < 0 \\ x^2 & \text{if } 0 \leq x \leq \pi \end{cases}$