

科目：工程數學二(微分方程)

適用：電機系

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本 試 題

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(一) Solve the following ODEs (50%; each 10%)

(a)  $y'' + 9y = 15e^x$

(b)  $y''' - y'' + 100y' - 100y = 0$

(c)  $y^{(iv)} - 5y'' + 4y = 10e^{-3x}$ ;  $y'''(0) = y''(0) = y'(0) = y(0) = 0$

(d)  $\begin{cases} y_1' = -y_1 - y_2 \\ y_2' = y_1 - y_2 \end{cases}$ ;  $y_1(0) = 0$ ;  $y_2(0) = 1$

(e)  $y'' + 3y' + 2y = \delta(t-1)$ ;  $y(0) = 0$ ;  $y'(0) = 0$

(二) Non-linear ODE:  $y' + xy = xy^{-1}$  (20 %)

(a) Transform the above non-linear ODE into a linear ODE. (8%)

(b) Find the general solution. (8%)

(c) If  $y(0) = 3$ , Find the particular solution. (4%)(三) A differential equation for unknown function  $y(x)$  (30 %)

$$y'' + 9y' = 0$$

(a) Let  $y = e^{\lambda x}$ , Find the general solution for  $y(x)$ . (6%)(b) Use Laplace Transform Method to find the general solution for  $y(x)$ . (6%)(c) Use Power Series Method to find the general solution for  $y(x)$ . (6%)(d) Let  $y' = p$ , reduce to 1<sup>st</sup>-order ODE and use Separable Variable Method to find the general solution for  $y(x)$  (6%)(e) If  $y(0) = 10$ ,  $y'(0) = 9$ , Find the particular solution. (6%)