

## 科目：工程數學(線性代數+微分方程)

編號：352 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。

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(一) (25分；每小題 5分) Let  $F(\mathbf{R})$  denote the set of all functions from  $\mathbf{R}$  to  $\mathbf{R}$ . Choose the following subsets of  $F(\mathbf{R})$  which are linear independent.

(a)  $\{t^2 + 3t - 5, -2t^2 - 6t + 10\}$

(b)  $\{t^2 + 3t - 5, 2t^2 - 6t + 10, t^2\}$

(c)  $\{\sin t, \cos t, t \sin t\}$

(d)  $\{\sin t, \cos^2 t, \sin^2 t, 1\}$

(e)  $\{e^t, e^{2t}, e^{3t}, \dots, e^{nt}, \dots\}$

(二) (25分；每小題 5分) Consider the following system of three linear equations in three unknowns:

$$y_1 + y_2 + ay_3 = 1$$

$$y_1 + ay_2 + y_3 = 3$$

$$ay_1 + y_2 + y_3 = 2a$$

Where  $a \in \mathbf{R}$

- (a) Find condition on  $a$  such that the system has a unique solution.
- (b) Find condition on  $a$  such that the system has no solution.
- (c) Find condition on  $a$  such that the system has many solutions.
- (d) Under the condition obtained in (a), use Cramer's rule to solve the system.
- (e) Under the condition obtained in (c), find solutions of the system.

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第 2 頁(三) (50 分; 每小題 5 分) ODE:  $y'' + 3y' + 2y = r(t)$ ;(a) Determine the Order and Homogeneous of the above ODE.(b)  $r(t) = 0$ , Let  $y = e^{\lambda t}$  to find the general solution of the above ODE.(c)  $r(t) = 0$ , Transform the above ODE to 1<sup>st</sup>-order ODE system.(d) Same as (c), Use eigenvalue/eigenvector method to solve 1<sup>st</sup>-order ODE system.(e) Define Laplace transform of  $y(t)$ (f) If  $L\{y(t)\} = Y(s)$ ; Prove  $L\{y'(t)\} = sY(s) - y(0)$ (g)  $r(t) = 0$ , Use Laplace transform to solve the above ODE.[ Let  $y(0) = a, y'(0) = b$  ](h)  $r(t) = 2e^{-t}$ , Solve the above ODE.(i)  $r(t) = u(t-1) - u(t-2)$ ,  $y(0) = 0, y'(0) = 0$ , Solve the above ODE.(j)  $r(t) = \delta(t-1)$ ;  $y(0) = 0, y'(0) = 0$ , Solve the above ODE.