

※ 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. Find the following integrals

(30%)

(1)  $\int \ln x \, dx$

(2)  $\int x e^{-x} \, dx$

(3)  $\int x^2 e^{-x} \, dx$

(4)  $\int \sec \theta \, d\theta$

(5)  $\int \frac{x^3}{\sqrt{1-x^2}} \, dx$

2. Find the general/specific solutions of the following ordinary differential equations

(35%)

(1)  $yy' + 36x = 0$

(2)  $y' + y \sin x = \sin x$

(3)  $y'' + 0.4y' + 9.04y = 0$  where  $y(0) = 0, y'(0) = 3$

(4)  $y'' + 2y' + y = 2x \sin x$

(5)  $y'' + 3y' + 2y = 30e^{2x}$

3. Find the solutions of the following ordinary differential equation and the related physical meanings.

(20%)

$$\frac{d^2x}{dt^2} - \omega^2 x = A_0 e^{i\omega_0 t}$$

4. Find the Fourier transform of the following function

(15%)

$$h(t) = 1, -\omega_0 \leq t \leq \omega_0$$

and

$$h(t) = 0, t < -\omega_0, t > \omega_0$$