

## 國立臺灣科技大學103學年度碩士班招生試題

系所組別：材料科學與工程系碩士班乙組

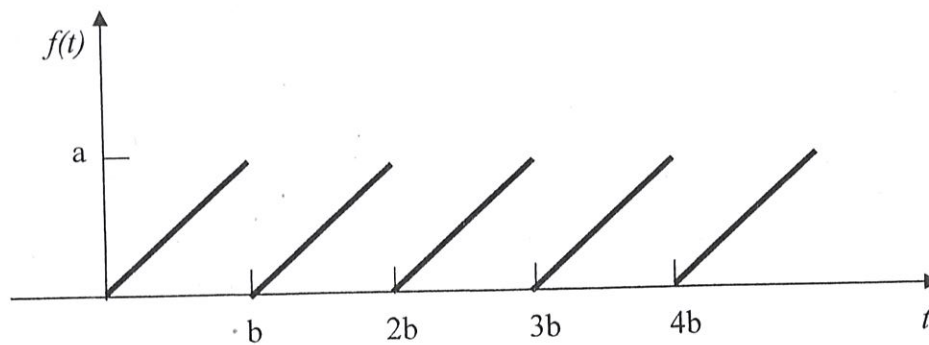
科目：工程數學

(總分為100分)

1. Solve the given initial value problem. (15%)

$$y'' + y = \delta(t - 2\pi), \quad y(0) = 0, \quad y'(0) = 1$$

2. If a periodic function  $f(t)$  is shown as follow, find its Laplace transform. (15%)



3. Solve the given equation by Power series method. (20%)

$$y'' - xy' + 2y = 0$$

4. (1) What is the Laplace transform  $F(s)$  of the function  $f(t)$  shown in Fig.(a)? (10%)

- (2) Find the limiting value of  $F(s)$  as  $a$  approaches zero. (5%)

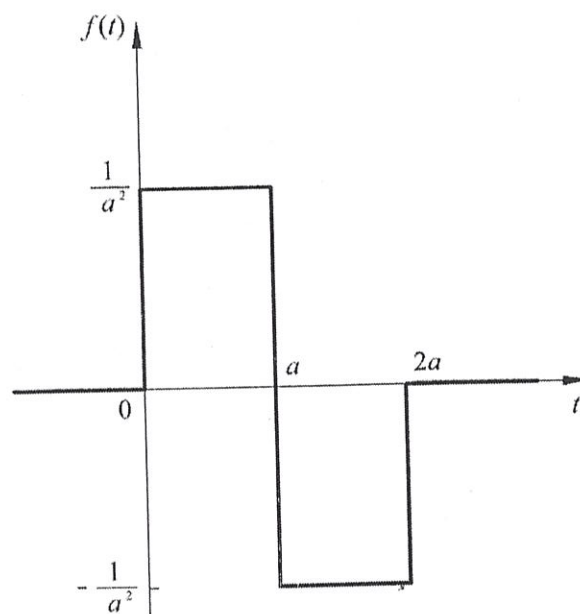


Fig. (a) Function  $f(t)$ .



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5. Find the inverse Laplace transform of

$$F(s) = \frac{s^4 + 2s^3 + 3s^2 + 4s + 5}{s(s+1)} \quad (10\%)$$

6. The equations of motion of the system are

$$\ddot{u}_1 + 2u_1 - u_2 = 0$$

$$\ddot{u}_2 - u_1 + 2u_2 = 0$$

The following initial conditions are imposed on the system:

$$u_1(0) = \dot{u}_1(0) = \dot{u}_2(0) = 0$$

$$u_2(0) = u_0$$

Determine the subsequent free vibration motion,  $u_1(t)$  and  $u_2(t)$ .

(15%)

7. A parachutist (跳傘者) is falling with speed 176 ft/sec when his parachute (降落傘) opens. If the air resistance is  $Wv^2/256$  lb, where  $W$  is the total weight of the man and parachute, find his speed  $v$  as a function of the time  $t$  after the parachute opened. (10%)

