

※ 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. Consider the series RLC in Fig 1. Please find the input/output differential equation when the following conditions are met.
 - a. The output is the voltage $V_C(t)$ across the capacitor. (10%)
 - b. The output is the current $i(t)$ in the loop. (10%)

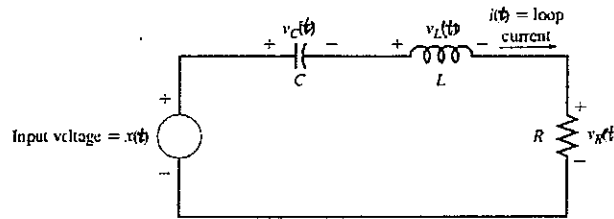


Figure 1

2. Consider the rectangular pulse train $x(t)$ shown in Figure 2. This signal is periodic with fundamental period $T_0=2$. Please find the trigonometric Fourier series (10%).

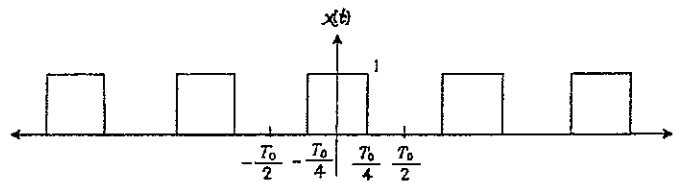


Figure 2

3. Suppose the Laplace transform of $x(t)$ is $X(s) = \frac{s+1}{s^2+5s+7}$, please determine the Laplace transform $V(s)$ of the following signals
 - a. $v(t) = e^{-3t} x(t)$ (10%)
 - b. $v(t) = x(t) * x(t)$ (10%)
4. Please determine the inverse Laplace transform of each if the functions that follow. (20%)

a. $X(s) = \frac{s+2}{s^3+4s^2+3s}$

b. $X(s) = \frac{s^2+2s+1}{s^3+3s^2+4s+2}$

5. Consider the discrete-time system given by input/output difference equation:

$$y[n] + 0.7y[n-1] = u[n]; \quad y[-1]=1$$

Please find an analytical expression for $y[n]$? (20%)

6. A discrete-time signal $x[n]$ has z-transform $X(z) = \frac{z+1}{z(z-1)}$, compute $x[0]$, $x[1]$, $x[1000]$, and $x[10000]$? (10%)