※ 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 $V_L(t)$ across the capacitor. (10%)
   b. The output is the current $i(t)$ in the loop. (10%)

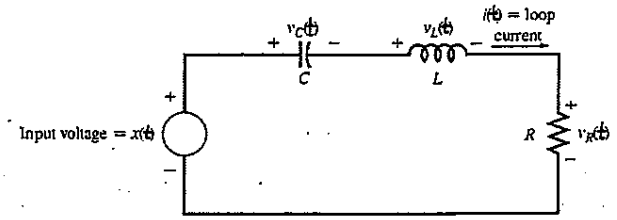

Figure 1

2. Compute the Fourier transform of the following signals. (20%)
   a. $x(t)=(e^{-t}\cos(4t))u(t)$
   b. $x(t)=(\cos 5t)u(t)$

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

4. Please determine the inverse Laplace transform of each if the functions that follow. (10%)

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

5. Please compute the inverse z-transform? (10%)

$$X(z)=\frac{5z+1}{4z^2+4z+1},$$

6. Given two discrete-time signals $x[n]$ and $v[n]$, please proof the convolution property of $X(z)V(z)$? (10%)

7. Compute the DFT of the discrete-time signals shown in Fig. 2. (10%)

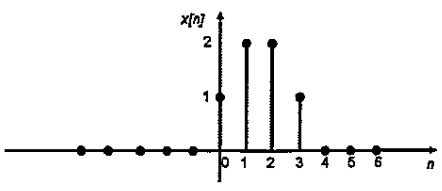

Figure. 2.