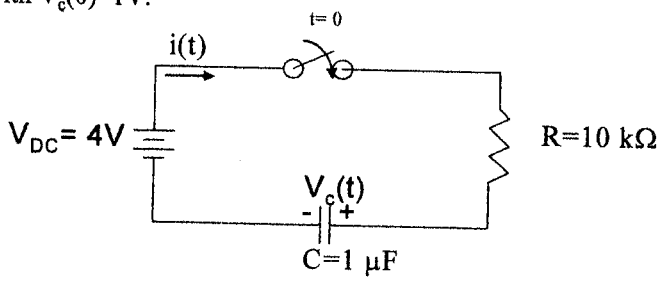
所別：電機工程學系碩士班 丙組(一般生) 科目：信號與系統

Question 1: (25%)

Please use Laplace transform to solve the current i(t) in the following circuit, when the switch is closed at t=0 with $V_c(0)=1V$.



Question 2: (25%)

When the input to an LTI (Linear time-invariant) system is

$$\mathbf{x[n]}=\left(\frac{1}{2}\right)^{n}\mathbf{u[n]}+(2)^{n}\mathbf{u[-n-1]}$$

, and its corresponding output is

$$\mathbf{y[n]}=5\left(\frac{1}{2}\right)^{n}\mathbf{u[n]}-5\left(\frac{2}{3}\right)^{n}\mathbf{u[n]}$$

(a) Find the Z-transform, H(z), of the system function (i.e., H(z)=Y(z)/X(z), where X(z) and Y(z) are the Z-transforms of x[n] and y[n], respectively). (5%)

(b) Plot the pole(s) and zero(s) of H(z) and indicate the region of convergence. (5%)

(c) Find the impulse response, h[n], of the system. (5%)

(d) Write a difference equation that is satisfied by the given input and output. (5%)

(e) Is the system stable? (3%)

(f) Is the system causal? (2%)

Question 3: (25%)

A moving-average system h[n] is defined as

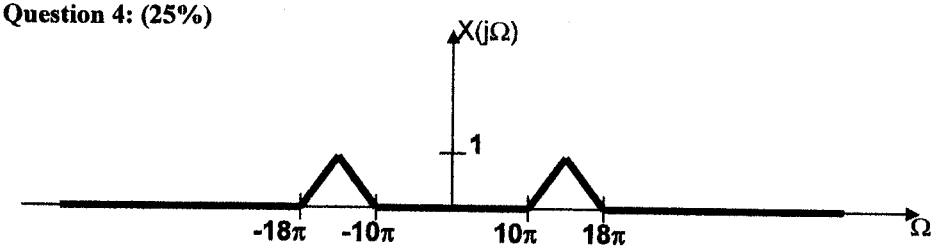
$$\mathbf{h[n]}=\begin{cases}\frac{1}{M_1+M_2+1}, & -\mathbf{M_1}\le\mathbf{n}\le\mathbf{M2}\\ \mathbf{0,\ \ otherwise}\end{cases}$$

(a) Determine the Fourier transform, $H(e^{j\omega})$, of h[n]. (15%)

(b) Plot the magnitude and phase of $H(e^{j\omega})$ for M_1=0 and M_2=4. (10%)

注意：背面有試題

Question 4: (25%)



An analogous signal x(t) has the Fourier transform indicated in the figure. The signal is sampled to obtain the discrete time signal

$$\mathbf{x[n] = x(nT)}$$

or equivalently

$$\mathbf{x_T(t) = \sum_{-\infty}^{\infty} x(nT)\delta(t - nT)},$$

where T is the sampling period and δ(t) is the Dirac delta function.

(a) Sketch the Fourier transform of $x_T(t)$ for T=1/10. (10%)
(b) Can x(t) be recovered from x[n], when T=1/10? (5%)
(c) How to recover x(t) from x[n]? (5%)
(d) What is the maximum value of T so that x(t) can be recovered? (5%)