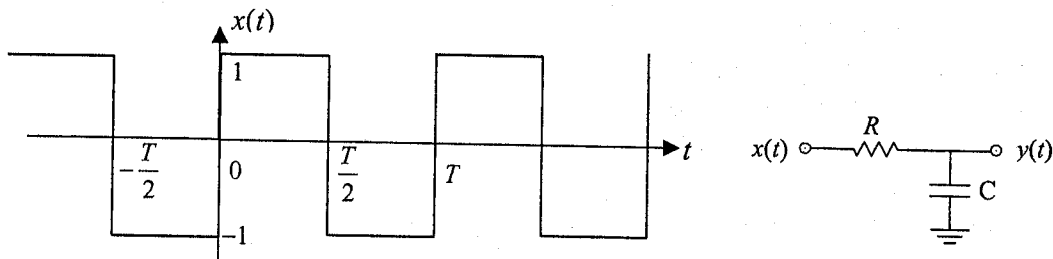所別：**電機工程學系碩士班　丙組**　　　　科目：**信號與系統**

1. (A) (10 %) Calculate the Fourier series representation of the periodical signal $x(t)$ shown below.
   (B) (5 %) Let $y(t)$ be the output of an R-C circuit, shown below, whose input is $x(t)$. What is the Fourier series representation of $y(t)$?
   (C) (5 %) Sketch the waveform of $y(t)$.

2. Let $H(z) = \dfrac{z-1}{1 - \dfrac{2}{3}z^{-1} + \dfrac{5}{9}z^{-2}}$ be the transfer function of an IIR (Infinite-Impulse-Response) system.

   (A) (5 %) Write down the first 5 terms of the unit impulse response.
   (B) (5 %) What is the meaning of causality? Is this a causal system?
   (C) (5 %) Formulate the phase response of this system.
   (D) (5 %) Depending on your answer to Question (B), anser either Question (a) or Question (b) in the following: (a) How to make this system causal if it is non-causal? (b) How to make this system non-causal if it is causal?

3. As shown in the figures below, the digital signals $x(n)$ and $y(n)$ are such that $y(n) = x(n/2)$ if n is an even integer and $y(n) = 0$ if n is an odd integer. The spectrum of $x(n)$ is also shown below, where f_s is the sampling frequency.
   (A) (10 %) Express Y(z) in terms of X(z)?.
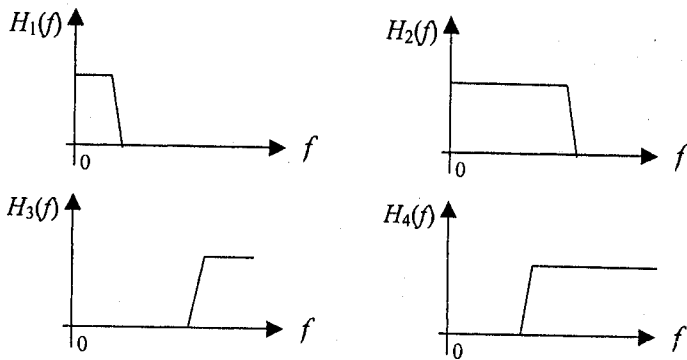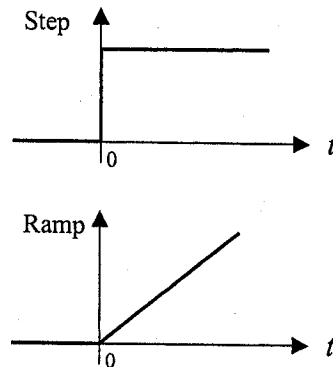   (B) (10 %) Sketch the spectrum of $y(n)$.
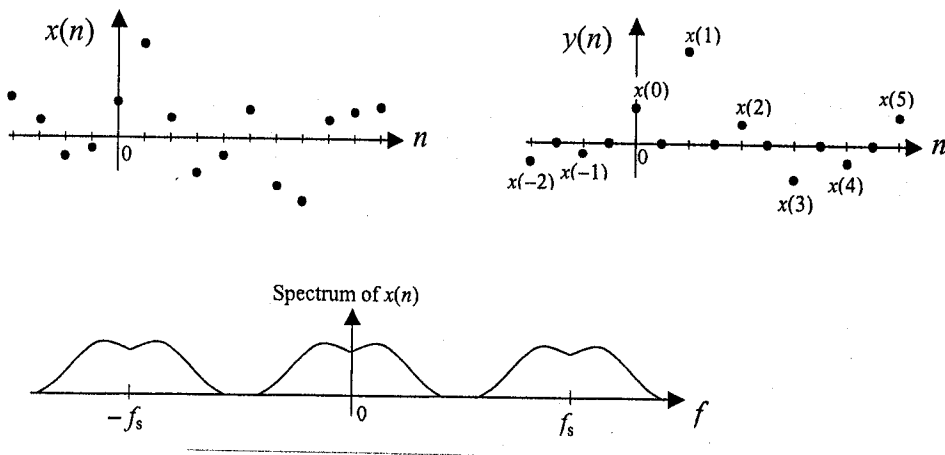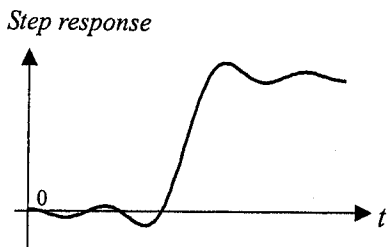
所別：<u>電機工程學系碩士班　丙組</u>　　科目：<u>信號與系統</u>

4. Shown below are the characteristics of two low-pass filters $H_1(f)$ and $H_2(f)$ and two high-pass filter $H_3(f)$ and $H_4(f)$. In the following questions (A) and (B), construct filters of desirable characteristcs by using these filters as components.

(A) <u>(5 %)</u> Depict how to construct a band-pass filter.

(B) <u>(5 %)</u> Depict how to construct a band-reject filter.

(C) <u>(10 %)</u> Depict how to construct a high-pass filter by using a low-pass filter and an all-pass filter.

5. The waveform of the step response of an analog filter is shown below. Also shown below are the waveform of a step and a ramp, respectively.

(B) <u>(10 %)</u> Sketch the impulse response of this filter.

(C) <u>(10 %)</u> Sketch the ramp response of this filter.