2 May, 14

BLG 354E SIGNALS AND SYSTEMS

HOMEWORK 3

Question 1 Determine the output of the filter shown in Figure 1 for the following periodic inputs.

a) $x_1[n] = (-1)^n$

b) $x_2[n] = 1 + \sin\left(\frac{3\pi}{8}n + \frac{\pi}{4}\right)$

c) $x_3[n] = \sum_{k=-\infty}^{\infty} \left(\frac{1}{2}\right)^{n-4k} u[n-4k]$

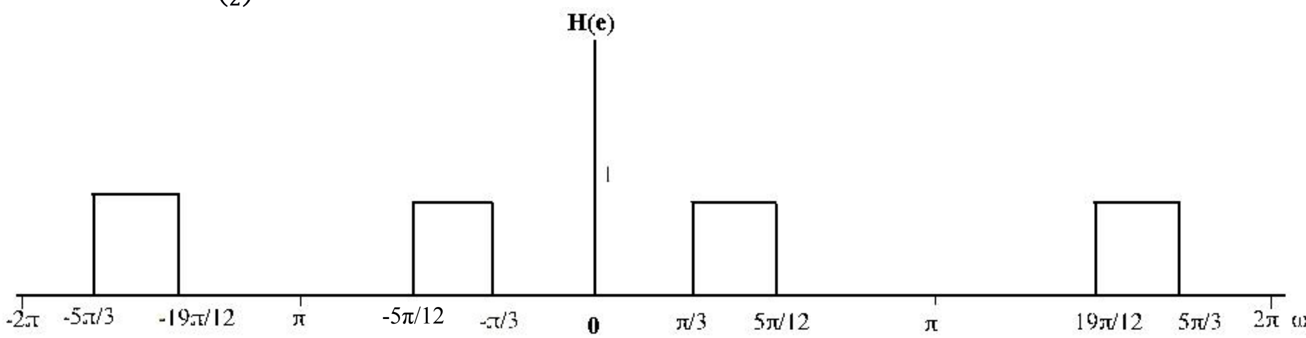

Figure 1

Question 2 A discrete-time LTI system with impulse response is given:

$$h(n) = \begin{cases} 1, & 0 \le n \le 2 \\ -1, & -2 \le n \le -1 \\ 0, & otherwise \end{cases}$$

The input to this system is as follows:

$$x[n] = \sum_{k=-\infty}^{+\infty} \delta[n-4k]$$

Find the Fourier series coefficients of the output y[n].

Question 3 Impulse-train sampling of *x[n]* is used to obtain

$$g[n] = \sum_{k=-\infty}^{\infty} x[n]\delta[n-kN]$$

If $X(e^{jw}) = 0$ for $3\pi/7 \le |\omega| \le \pi$, determine the largest value for the sampling interval *N* which ensures that no aliasing takes place while sampling *x[n]*.

Question 4 The signal y(t) is generated by convolving a band-limited signal $x_1(t)$ with another band-limited signal $x_2(t)$, that is,

$$y(t) = x_1(t) * x_2(t)$$

where

$$X_1(j\omega) = 0 \text{ for } |\omega| > 1000\pi$$
$$X_2(j\omega) = 0 \text{ for } |\omega| > 2000\pi$$

Impulse-train sampling is performed on y(t) to obtain:

$$y_p(t) = \sum_{n=-\infty}^{\infty} y(nT)\delta(t - NT)$$

Specify the range of values for the sampling period T which ensures that $y(t)$ is recoverable from $y_p(t)$.

ATTENTION: You should submit your homework due to **16 May 2014 Friday 17:00**. Homeworks should be submitted to the Signals&Systems box in the Department Secretarial Office.