

Date: 06.03.2014

MID-SEMESTER EXAMINATION

Duration: 90 Minutes

Marks: 100

Note: Start answering every question from a fresh page

1. (i) Find whether following signals are periodic or not. If periodic then find their [3+3]
 fundamental period.

(a) $x[n] = 3e^{j3\pi\left[\frac{n+1}{2}\right]}$; (b) $y(t) = \sin(2t) - \cos(2\pi t)$

- (ii) Determine whether the following systems are linear or not. [3+3]

(a) $y[n] = n^2 x[n-1]$; (b) $y[n] = x^*[n]$, $x^*[n] = \text{complex conjugate of } x[n]$

- (iii) Determine whether the following signals can be classified as an energy signal or as a power signal. [3+3]

(a) $x[n] = u[n]$; (b) $x[n] = nu[n]$

- (iv) Locate the following signals in the complex frequency plane. [3+3]

(a) $e^{0.25} \cos 5t$; (b) $\cos 2t$

- (v) A discrete-time signal $x[n]$ is sketched below in figure 1. Sketch the following discrete-time signals. [3+3]

(a) $x[n]u[n-1]$; (b) $x[n]\delta[n-1]$

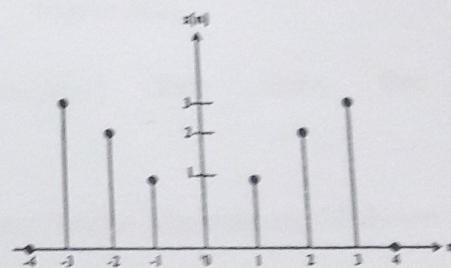


Figure 1

2. (a) Signals $x_1(t) = 10 \cos(100\pi t)$ and $x_2(t) = 10 \cos(50\pi t)$ are both sampled at a rate [5] of 75 Hz. What will be the discrete-time signals obtained after sampling?
- (b) Comments on the discrete-time signals obtained in part (a). What optimization you will [2] do?
- (c) Find the discrete-time signal $f[k] = \cos\left[\frac{3\pi}{7}k\right]$ is periodic or not. If periodic find its [2] period.
- (d) What should be the range of normalized frequency for any generalized discrete-time [1] sequence to avoid aliasing?

6.

The Fourier transform of the signal $f(t)$ is expressed as, $F(\omega) = \frac{1}{\omega^2} [e^{j\omega} - j\omega e^{j\omega} - 1]$. [10]
 Find the Fourier transform of the signal $g(t)$ in terms of the Fourier transform of $f(t)$
 as shown in figures 5.

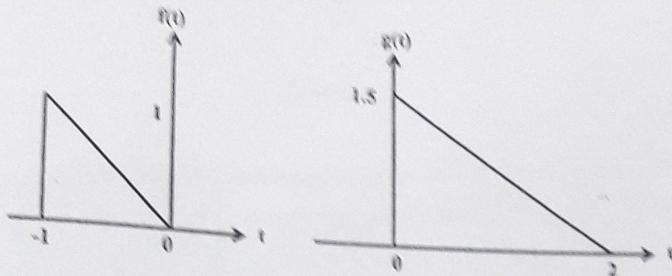


Figure 5

7. (a) Determine the Fourier series coefficients of $x_1(t)$ as shown in figure 6 (a). [7]

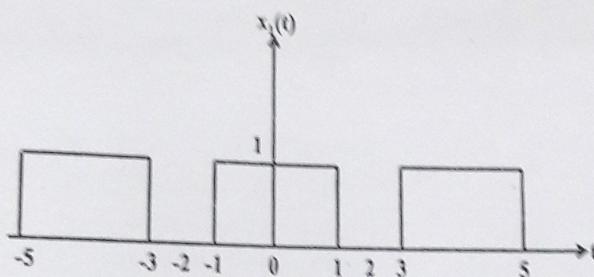


Figure 6(a)

- (b) Using the appropriate property of Fourier series and the result obtained in 7 (a), now [3] find the coefficients of the signal $x_2(t)$ as shown in figure 6 (b).

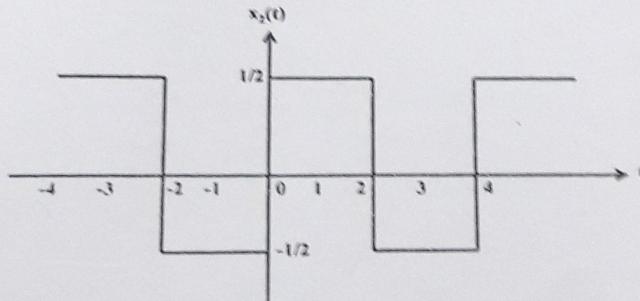


Figure 6(b)

8. (a) If $x_1[n]$ and $x_2[n]$ are represented respectively as: $x_1[n] = \{.., 0, 0, 1, 2, 3, 0, 0, 2, 2, 0, ...\}$ and [4]
 $x_2[n] = \{.., 0, -2, -2, 2, 2, 0, -2, 0, 0, 0, ...\}$. Determine and sketch $x[n]$ if
 $x[n] = x_1[n] + x_2[n]$.

- (b) Let $x_1[n]$ and $x_2[n]$ are two periodic sequences with fundamental periods N_1 and N_2 [6]
 respectively. Show the condition under which the sum $x[n] = x_1[n] + x_2[n]$ is periodic.