No. of Printed Pages : 5

BIEL-007

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

00813 **December, 2016**

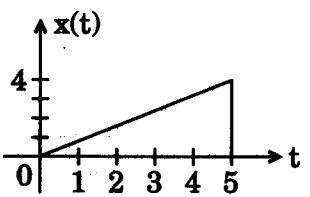
BIEL-007 : SIGNALS AND SYSTEMS

Time : 3 hours *Maximum Marks : 70*

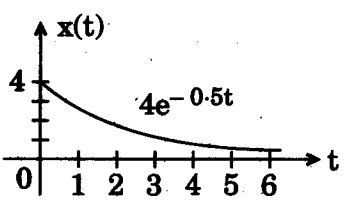
Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is allowed. All the questions are to be answered in English language only.*

1. Sketch and label the even and odd components of the signals shown in Figure 1. *10*

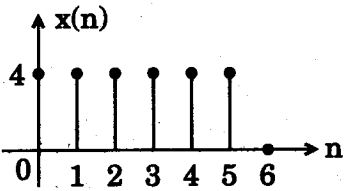
(a)



(b)



(c)



(d)

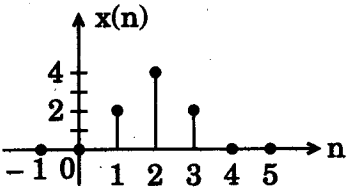


Figure 1

2. (a) Show that the complex exponential signal

$$x(t) = e^{i\omega_0 t}$$

is periodic and that its fundamental period is $2\pi/\omega_0$. *5*

(b) Show that the complex exponential sequence

$$x(n) = e^{j\Omega_0 n}$$

is periodic only if $\frac{\Omega_0}{2\pi}$ is a rational number. *5*

3. Consider the system shown in Figure 2. Determine whether it is (a) memoryless, (b) causal, (c) linear, (d) time-invariant, or (e) stable. *10*

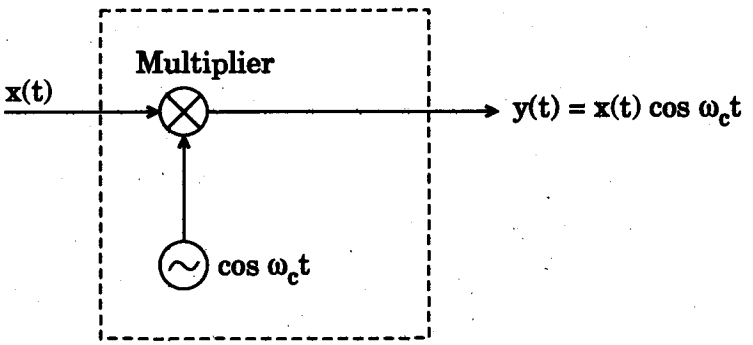


Figure 2

4. (a) The step response s(n) of a discrete-time LTI system is given by

$$s(n) = \alpha^n u(n), \; 0 < \alpha < 1.$$

Find the impulse response h(n) of the system. *5*

(b) Show that if the input x(n) to a discrete-time LTI system is periodic with period N, then the output y(n) is also periodic with period N. *5*

5. Compute $v_1(t) * v_2(t)$, given that

$$v_1(t) = \begin{cases} 4t, & t \geq 0 \\ 0, & t < 0 \end{cases}$$

$$v_2(t) = \begin{cases} e^{-2t}, & t \geq 0 \\ 0, & t < 0 \end{cases}$$ *10*

6. The continuous-time system shown in Figure 3 consists of two integrators and two scalar multipliers. Write a differential equation that relates the output y(t) and the input x(t). *10*

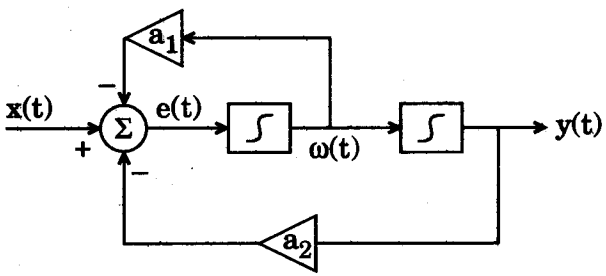


Figure 3

7. Determine the complex exponential Fourier series representation for each of the following signals : *10*

(a) $x(t) = \cos \omega_0 t$

(b) $x(t) = \sin (t - \pi/2)$

(c) $x(t) = \cos (2t + \pi/4)$

(d) $x(t) = \cos 4t + \cos 6t$

(e) $x(t) = \sin^2 \omega_0 t$

8. A causal discrete-time LTI system is described by

$$y[n] - \frac{3}{4}\, y[n-1] + \frac{1}{8}\, y[n-2] = x[n],$$

where x[n] and y[n] are the input and output of the system, respectively.

(a) Determine the frequency response $H(\Omega)$ of the system.

(b) Find the impulse response h[n] of the system. *10*

9. Find the inverse z-transform of

$$X(z) = \frac{2z^3 - 5z^2 + z + 3}{(z-1)(z-2)}, \quad |z| < 1. \qquad \textit{10}$$

10. Consider the discrete-time system shown in Figure 4. For what values of k, is the system BIBO stable ? *10*

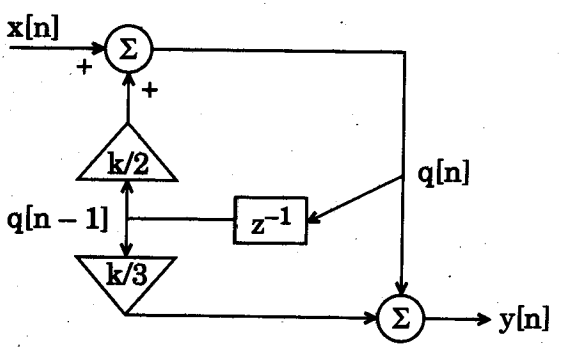


Figure 4