[06 – 2205]

II/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

SIGNALS AND SYSTEMS

(Common with ECE, Dual Degree program in ECE and EEE)

(Effective from the admitted batch of 1999–2000)

Time : Three hours   Maximum : 70 marks

Question No. 1 is compulsory.
Answer any FOUR from the remaining.
All questions carry equal marks.

$(7 \times 2 = 14)$

1. (a) List any two properties of z-transform.

    (b) Define the relationship between z-transform and Fourier transform.

    (c) Find the impulse response $f(n)$ for the following casual LTI discrete time system.

    $$y(n) = x(n) - 2x(n - 2) + x(n - 3).$$

(d)   List the modulation and duality property of DTFT.

(e)   Define unit step function.

(f)   Write about the basic operations signals.

(g)   Find the Fourier transform of $x(t) = e^{i\omega_0 t}$.

2.   (a)   Find the fundamental period T of the following:

       (i) $x(t) = je^{ist}$

       (ii) $x(t) = 20\cos(10\pi t + \pi/6)$

       (iii) $x(t) = 4\cos 5\pi t$

       (iv) $x(t) = \sin 10\pi t$.   (7)

(b)   Determine whether the following signals are energy signals, power signals or neither

       (i) $x(n) = (-0.5)^n u[n]$

       (ii) $x(n) = 2e^{i3n}$

       (iii) $x(t) = A\cos(\omega_0 t + \theta)$.   (7)

3. (a) State whether the following systems are :
      (i) Static or dynamic
      (ii) Linear/non linear
      (iii) Time invariant or time variant.
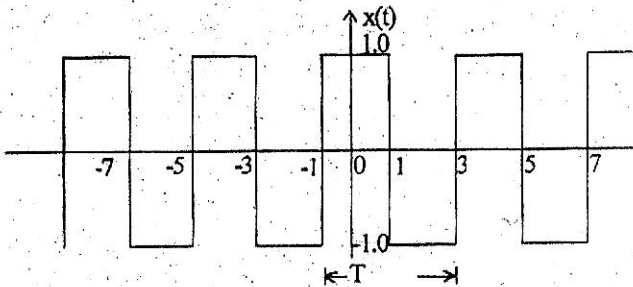
$$(1) \quad Y(n) = 2x(n) + \frac{1}{x(n-1)}$$

$$(2) \quad Y(t) = at^2 x(t) + btx(t-2). \quad (7)$$

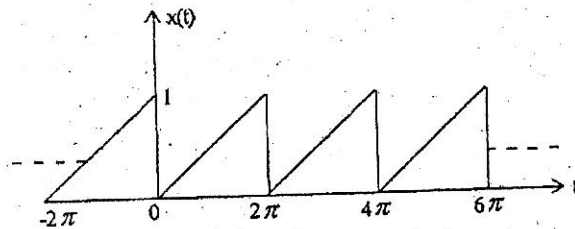   (b) If $\quad x(n) = x_1(n) * x_2(n) \quad$ where $x_1(n) = \left(\frac{1}{3}\right)^n u(n)$ and $x_2(n) = \left(\frac{1}{5}\right)^n u(n)$, find $X(Z)$ by using convolution property for z-transform. (7)

4. (a) Find the trigonometric Fourier series for the periodic signal $x(t)$ given below : (7)

3   [06 – 2205]

(b) Find the cosine representation Fourier series for the signal. (7)

5. (a) Find the Fourier transform of the following signals $x(t) = \sin(\Omega_o t)$. (6)

(b) Find the Fourier transform of the following and sketch the magnitude and phase spectrum. (8)

(i) $x(t) = \delta(t)$

(ii) $x(t) = e^{-at}\, u(t)$.

4 [06 – 2205]

6. (a) Find the frequency response of the following causal system

$$Y(x) = \frac{1}{2}x(n) + x(n-1) + \frac{1}{2}x(n-2).$$ (7)

(b) What is the relationship between z-transform and DTFT and state the multiplication property of the z-transform. (7)

7. (a) Find the z-transform of following signals : (7)

(i) $x(n) = u(n)$

(ii) $x(n) = \delta(n)$

(iii) $x(n) = \left(\frac{1}{2}\right)^n u(-n).$

(b) Find the z-transform of ROC of the following : (7)

(i) $x(n) = a^{|n|}; \ |a| < 1$

(ii) $x(n) = (\sin \omega_0 n) \, u(n).$

8. (a) Find the output the system whose input and output are related by (7)

$$y(n) = 7y(n-1) - 12y(n-2) + 2x(n) - x(n-2).$$

(b) Write short note on sampling theorem and give example. (7)

_____