Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91443

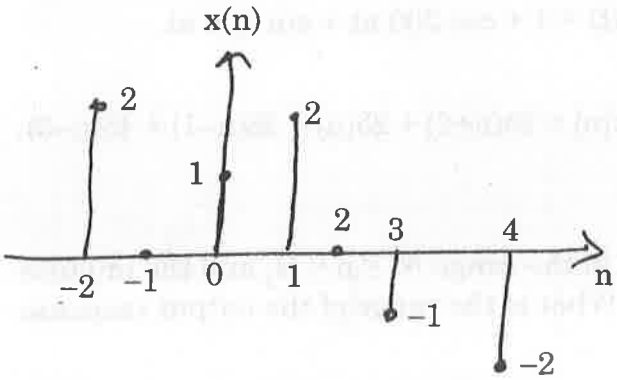
B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Third Semester
Electronics and Communication Engineering
EC 6303 – SIGNALS AND SYSTEMS
(Common to Biomedical Engineering/Medical Electronics)
(Regulations 2013)
(Also common to : PTEC 6303 – Signals and Systems for B.E. (Part-Time) – Second Semester – Electronics and Communication Engineering – Regulations 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. The graphical representation of a signal x(n) is given below



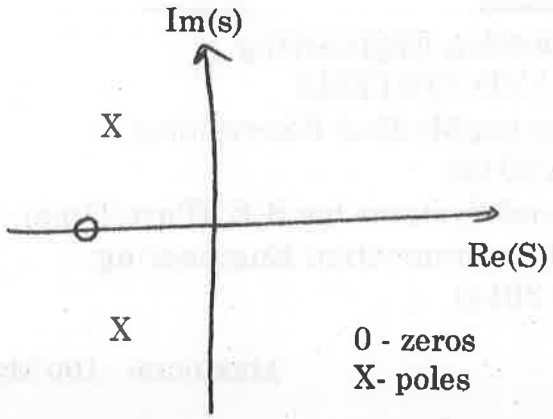
Represent x(n) in terms of impulse functions.

2. Determine whether the following signal $x(t) = e^{-at}\,u(t)$, $a > 0$ is an energy signal or power signal.

3. Given the Fourier series coefficients of a signal x(t), $a_1 = a_{-1} = \frac{1}{2}$ and the fundamental frequency of the signal is $\Omega_0 = \frac{2\pi}{3}$. Determine the signal x(t).

4. State initial value theorem of laplace transform.

5. Given the pole zero diagram of a continuous time system. Determine whether the system is causal and stable.



6. Given the differential equation representation of a continuous time system $2\frac{d^2y(t)}{dt^2} - 3\frac{dy(t)}{dt} + y(t) = 3x(t)$. Find the frequency response $H(j\Omega)$.

7. Find the Nyquist rate for the signal $x(t) = 1 + \cos 200\,\pi t + \sin 500\,\pi t$.

8. Find the z-transform of the sequence $x[n] = 2\delta(n+2) + 2\delta(n) - 3\delta(n-1) + 4\delta(n-3)$. Also specify its ROC.

9. If the input x(n) has non-zero samples in the range $N_1 \le n \le N_2$ and the impulse response h(n) has a range $N_3 \le n \le N_4$. What is the range of the output response y(n) of an LTI system ?

10. If the frequency response $H(e^{j\omega})$ of a system is given by

$H(e^{j\omega}) = 2e^{2j\omega} + 3e^{j\omega} + 4 + 2e^{-j\omega} + 3e^{-3j\omega}$. Determine the impulse response h(n) of the system.

PART – B (5×13=65 Marks)

11. a) i) Plot the signal, $x(t) = 2u(t) - u(t-3)$. (3)

ii) With relevant examples, explain how the continuous time signals are classified based on their properties. (10)

(OR)

b) i) Consider an LTI system with input $x_1(t)$ and output $y_1(t)$, Determine and sketch the response of the system for the input $x_2(t)$ shown in Figure 1. (5)

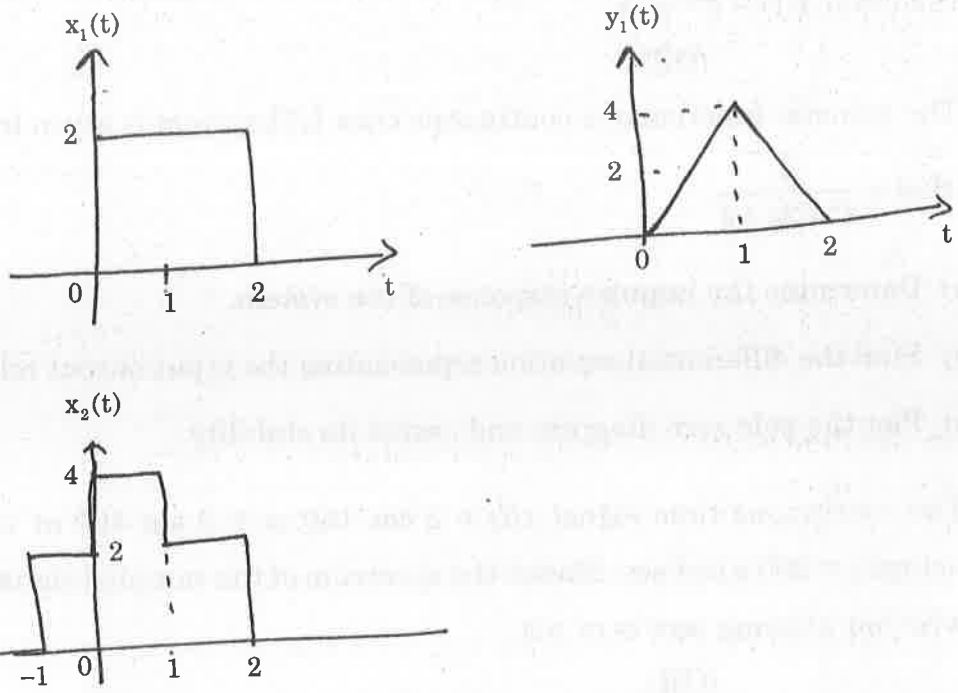


Figure 1

ii) Determine whether the system $y(n) = 2x[n+1] + 3$ is causal, memoryless, linear and time invariant. (8)

12. a) i) The spectrum $X(j\Omega)$ of a signal $x(t)$ is shown in Figure 2. Determine the equivalent time domain signal $x(t)$ and plot. (7)

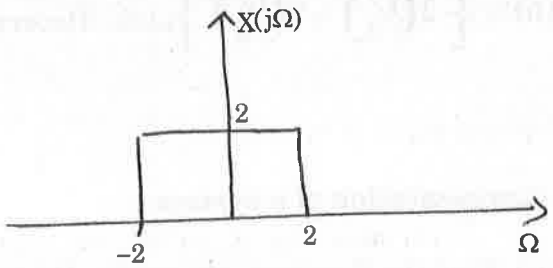


Figure 2

ii) Find the Laplace transform of $x(t) = e^{-2t}\,u(t) - e^{2t}\,u(-t)$ and specify its ROC. (6)

(OR)

b) i) Find the Fourier transform of the periodic signal $x(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$. **(7)**

ii) Find the inverse Laplace transform of $X(s) = \frac{2s+1}{s+3}$ ROC : Re{s} > –3. **(6)**

13. a) Compute the response of the system with impulse response h(t) = u(t + 2) for the input $x(t) = e^{-2t}u(t)$. **(13)**

(OR)

b) The transfer function of a continuous time LTI system is given by

$$H(s) = \frac{2}{s^2 + 3s + 2}.$$

i) Determine the impulse response of the system. **(4)**

ii) Find the differential equation representing the input-output relationship. **(5)**

iii) Plot the pole zero diagram and assess its stability. **(4)**

14. a) The continuous time signal x(t) = 2 cos 150 πt + 2 sin 400 πt is sampled, using $\Omega_s = 200\,\pi$ rad/sec. Sketch the spectrum of the sampled signal. Indicate whether aliasing occurs or not. **(13)**

(OR)

b) i) State and prove Parseval's relation for discrete aperiodic signal. **(6)**

ii) Find the z-transform of $x(n) = \left(\frac{1}{3}\right)^{n+1} u(n+2)$ and also specify its ROC. **(7)**

15. a) Given $x(n) = (0.25)^n u(n)$ and $h(n) = \left\{2\left(\frac{1}{3}\right)^n + 3\left(\frac{1}{2}\right)^n\right\}u(n)$. Determine the response, y(n) of the system. **(13)**

(OR)

b) Given the difference equation representation of a system

$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n)$. Find the Frequency response $H(e^{j\omega})$ and the impulse response h(n) of the system. **(13)**

PART – C

(1×15=15 Marks)

16. a) A system is characterized by the difference equation $y(n) = -0.2y(n-1) + 0.4y(n-2) + x(n) - 0.25x(n-1) + 0.5x(n-2)$. Draw the direct form – I, direct form – II, cascade and parallel realization structures. **(15)**

(OR)

b) Find the Fourier series coefficients of the signal given in Figure 3.

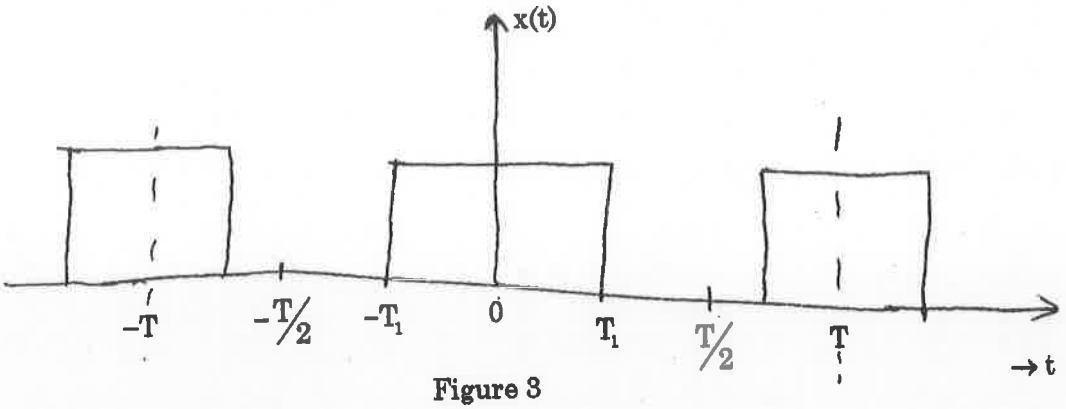


Figure 3

Also plot the spectrum of the signal. **(15)**