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Question Paper Code : 52908

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to : Biomedical Engineering/Medical Electronics)

(Regulation 2013)

(Also common to : PTEC 6303 – Signals and Systems for B.E. (Part-Time) – Second Semester – Electronics and Communication Engineering Regulation 2014)

Time : Three hours

Maximum : 100 marks

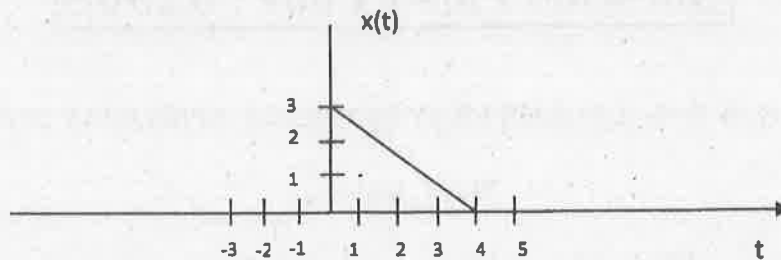
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch the signal $x(t) = \delta(t - t_0)$.
2. Find whether the described, as system $y[n] : x = nx[n]$ $y(n) = nx(n)$ is time invariant or not.
3. State the importance of Fourier series.
4. Find Laplace transform for the signal $x(t) = e^{-at}u(t)$, $a > 0$.
5. Find the system function for the given LTI differential equation.
$$\frac{dy(t)}{dt} + 2y(t) = x(t) + \frac{dx(t)}{dt}$$
6. Show that $x(t) * \delta(t - t_0) = x(t - t_0)$.
7. State the condition for baseband sampling.
8. State the frequency shifting theorem of DTFT.
9. Write down the expression of convolution sum operation of two signals $x_1[n]$ and $x_2[n]$.
10. Define recursive and non recursive system.

PART B — (5 × 13 = 65 marks)

11. (a) (i) A continuous time signal $x(t)$ is shown below. Sketch and label each of the following signals. (8)



- (1) $x(t-2)$
 (2) $x(2t)$
 (3) $x(t/2)$
 (4) $x(-t)$.

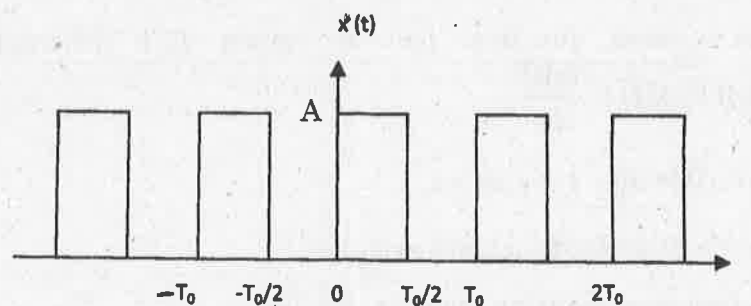
- (ii) Determine whether or not each of the following signal is periodic. If periodic find its fundamental period. (5)

- (1) $x(t) = \sin\left(\frac{2\pi}{3}\right)t$
 (2) $x[n] = \cos\left(\frac{n}{8} - \pi\right)$.

Or

- (b) A system has the input output relation given by $y[n] = x[n] + n x[n+1]$. Determine whether or not the given system is (i) Causal (ii) Static (iii) Time invariant (iv) Linear (v) Stable. (13)

12. (a) Consider the periodic square wave $x(t)$ shown below. (13)



Determine the complex exponential Fourier series of $x(t)$.

Or

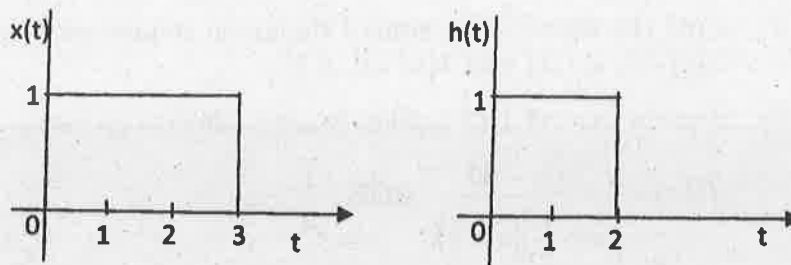
(b) (i) Find the Fourier transform of the given signal $x(t) = e^{-at}u(-t)$, $a > 0$. (5)

(ii) Find the inverse Laplace transform of the following $X(s)$. (8)

(1) $X(s) = \frac{s}{s^2 + 4}, \text{Re}(s) > 0$

(2) $X(s) = \frac{s+1}{(s+2)^2 + 4}, \text{Re}(s) > -1.$

13. (a) Evaluate $y(t) = x(t) * h(t)$, by analytical method where $x(t)$ and $h(t)$ are shown in figure below. (13)



Or

(b) (i) Consider a continuous time LTI system described by $\frac{dy(t)}{dt} + 2y(t) = x(t)$. Using Fourier transform, find the output $y(t)$ for the given input signal $x(t) = e^{-at}u(t)$. (5)

(ii) The output $y(t)$ of a continuous time LTI system is found to be $2e^{-3t}u(t)$ when the input $x(t)$ is $u(t)$. Determine the impulse response $h(t)$ of the system. (8)

14. (a) State and prove the following properties of DTFT. (13)

- (i) Linearity.
- (ii) Time shifting.
- (iii) Frequency shifting.
- (iv) Complex Conjugation.
- (v) Time reversal.

Or

(b) (i) Find the z-transform and associated ROC for each of the following sequences (8)

(1) $x[n] = \delta(n - n_0)$

(2) $x[n] = u(n - n_0)$

$$(3) \quad x[n] = u(-n)$$

$$(4) \quad x[n] = a^{-n}u(-n)$$

(ii) Verify the convolution property of Z-transform. (5)

15. (a) A causal DT 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. (13)

(i) Determine the system function $H(z)$

(ii) Find the impulse response $h(n)$ of the system.

Or

(b) (i) Find the convolution sum of the given sequences using Z-transform $x[n] = [1, 1, 1, 1]$ and $h[n] = [1, 1, 1]$. (6)

(ii) A recursive DT LTI system function $H(z)$ is given by

$$H(z) = \frac{z(3z-4)}{\left(z - \frac{1}{2}\right)(z-3)} \quad \text{ROC: } \frac{1}{2} < |z| < 3.$$

Determine whether the system is causal or not. (7)

PART C — (1 × 15 = 15 marks)

16. (a) A unit step input applied to an LTI system at rest results in the response $y(t) = \frac{1}{2}tu(t) - \frac{1}{20}(1 - e^{-10t})u(t)$

Determine the following

(i) Transfer function of the system

(ii) Impulse response of the system

(iii) Response of the system to $x(t) = 2\cos(10t)u(t)$

Use Laplace transform analysis. (15)

Or

(b) Find the output response of a recursive DT system described by the following difference equation $y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n]$, the initial

conditions are $y[-1] = 0$, $y[-2] = 1$ and the input $x[n]$ is $x[n] = \left[\frac{1}{2}\right]^n$. Use Z-transform analysis. (15)