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

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

(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

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

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 $y(t)=\frac{1}{2}tu(t)-\frac{1}{20}\left(1-e^{-10t}\right)u(t)$

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)

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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 $y[n]: x=n\,x[n]$ $y(n)=nx(n)$ 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.

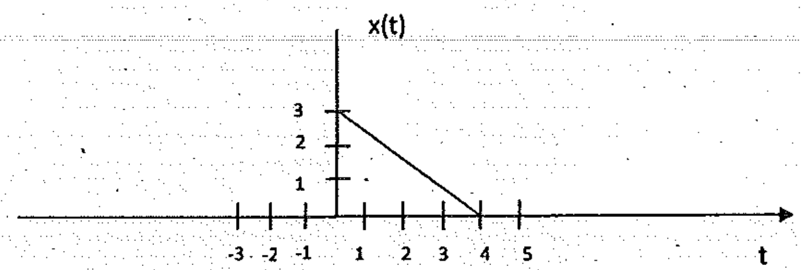
8. State the frequency shifting theorem of DTFT.

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)

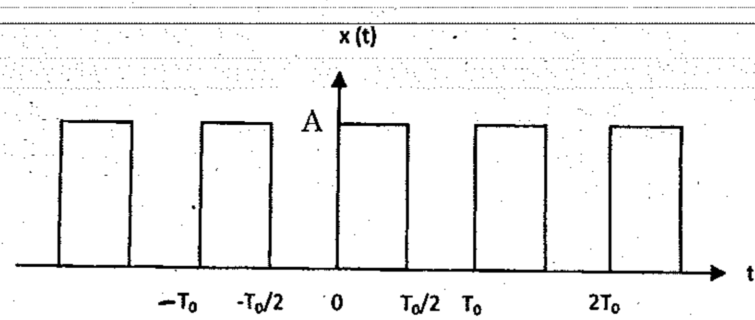
(1) $x(t)=\sin\left(\frac{2\pi}{3}\right)t$

(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

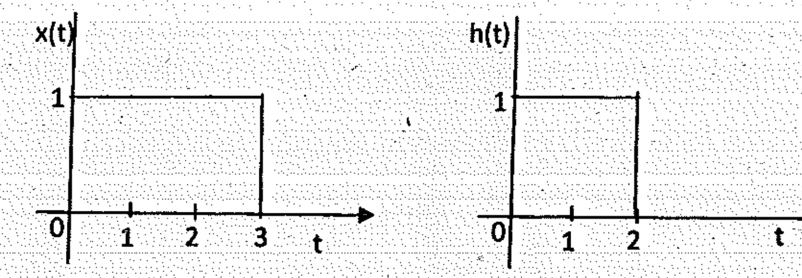
(b) (i) Find the Fourier transform of the given signal $x(t)=e^{-at}u(-t)$, $a>0$. (5)

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