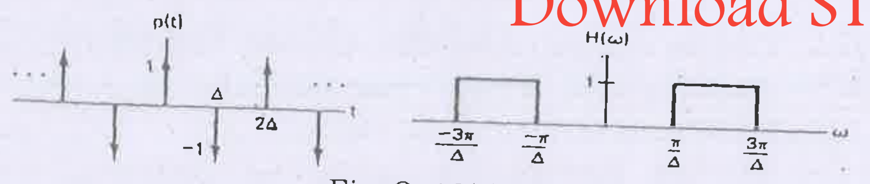


Fig. Q. 16(a)

(1) For $\Delta < \pi/2\omega_M$, sketch the Fourier transform of $x_p(t)$ and $y(t)$

(2) For $\Delta < \pi/2\omega_M$, determine a system that will recover $x(t)$ from $x_p(t)$.

(3) For $\Delta < \pi/2\omega_M$, determine a system that will recover $x(t)$ from $y(t)$.

(4) What is the maximum value of Δ in relation to ω_M for which $x(t)$ can be recovered from either $x_p(t)$ or $y(t)$.

(ii) Using figure 16(a)(i) determine $y(t)$ and sketch $Y(\omega)$ if $X(\omega)$ is given by figure 16 (a) (ii). Assume $\omega_c < \omega_0$. (4)

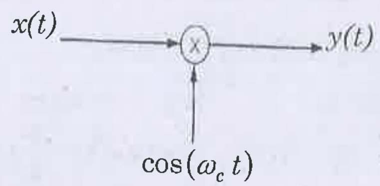


Figure 16(a) (i)

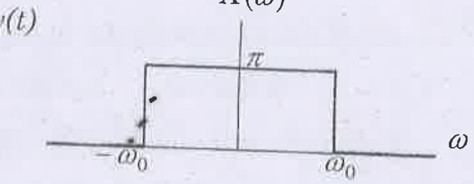


Figure 16(a) (ii)

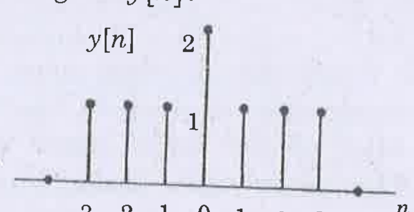
Or

(b) (i) (1) Suppose that the signal $e^{j\omega t}$ is applied as the excitation to a linear, time-invariant system that has an impulse response h(t). By using the convolution integral, show that the resulting output is $H(\omega)e^{j\omega t}$, where $H(\omega) = \int_{-\infty}^{\infty} h(\tau) e^{j\omega\tau} d\tau$.

(2) Assume that the system is characterized by a first-order differential equation $\frac{dy(t)}{dt} + ay(t) = x(t)$.

If $x(t) = e^{j\omega t}$ for all t, then $y(t) = H(\omega)e^{j\omega t}$ for all t. By substituting into the differential equation, determine $H(\omega)$. (8)

(ii) Consider the signal $y[n]$. (7)



(1) Find a signal $x[n]$ such that Even $\{x[n]\} = y[n]$ for $n \geq 0$, and Odd $(x[n]) = y[n]$ for $n < 0$.

(2) Suppose the Even $\{w[n]\} = y[n]$ for all n. Also assume that $w[n] = 0$ for $n < 0$. Find $w[n]$.

Reg. No. :

Question Paper Code : 80112

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

Third Semester

Electronics and Communication Engineering

EC 8352 — SIGNALS AND SYSTEMS

(Common to Medical Electronics/B.E. Biomedical Engineering/Computer and Communication Engineering/Electronics and Telecommunication Engineering)

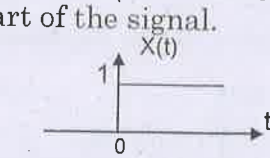
(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

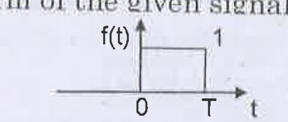
1. Find the even and odd part of the signal.



2. Determine whether the given discrete time sequence is periodic or not. If the sequence is periodic, find the fundamental period. $x[n] = \cos\left(\frac{n}{8}\right)\cos\left(\frac{\pi n}{8}\right)$.

3. Find the Fourier series coefficients for the given signal. $x(t) = [1 + \cos(2\pi t)]\left[\sin\left(10\pi t + \frac{\pi}{6}\right)\right]$.

4. Find the Laplace transform of the given signal.



5. Check whether the given system is causal and stable. $h(t) = (e)^{-4t}\, u(t+10)$.

6. State Dirichlet's condition for Region of convergence.

7. Define Sampling theorem.

8. Write the relationship between DTFT and Z-transform.

9. Determine the Z-transforms of the following two signals. Note that the Z–transforms for both have the same algebraic expression and differ only in the ROC. $x_1[n] = \left(\frac{1}{2}\right)^n u[n]$ and $x_2[n] = -\left(\frac{1}{2}\right)^n u[-n-1]$.

10. Find the initial and final values of the function, $X(z) = \frac{1+z^{-1}}{1-0.25z^{-2}}$.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw the waveforms represented by the following step functions,

$\rightarrow f_1(t) = 2u(t-1)$ $\rightarrow f_2(t) = -2u(t-2)$

$\rightarrow f(t) = f_1(t) + f_2(t)$ $\rightarrow f(t) = f_1(t) - f_2(t)$. (5)

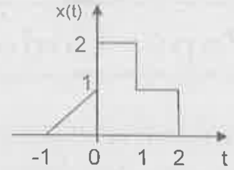
(ii) Determine the energy and power of the given signal $x(t) = t\,u(t)$. (4)

(iii) Check whether the given system is linear or not $y(t) = x^2(t)$. (4)

Or

(b) (i) A continuous time signal $x(t)$ is shown in figure below, Sketch and label each of the following signals.

$x(t-2)$, $x(2t+3)$, $x\left(\frac{3}{2}t\right)$, and $x(-t+1)$. (4)



(ii) Determine the energy and power of the given signal. (4)

$x[n] = \cos\left[\frac{\pi}{4}n\right]$.

(iii) Check whether the given system is Linear/nonlinear, Time Variant /Time Invariant, Causal/Non-causal $y[n] = x[n] - x[n-1]$. (5)

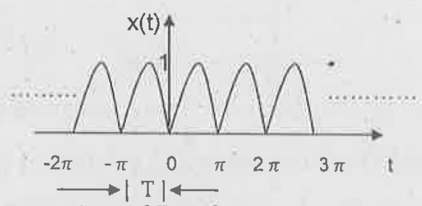
12. (a) Find the Fourier transform of each of the following signals and sketch the magnitude and phase as a function of frequency, including both positive and negative frequencies (13)

(i) $\delta(t-5)$

(ii) $e^{-at}u(t)$ a real, positive.

Or

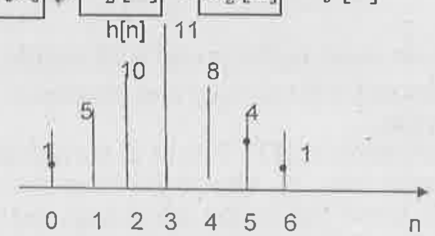
(b) (i) Determine the Fourier Series representation of the given full wave rectifier. (8)



(ii) List the properties of Laplace transform and write its ROC. (5)

13. (a) (i) Consider the cascade interconnection of three stage causal LTI system with impulse response $h_1[n]$, $h_2[n]$ and $h_3[n]$ as shown in figure below. The impulse response $h_2[n] = u[n] - u[n-2]$. The overall impulse response $h[n]$ is given in the figure below.

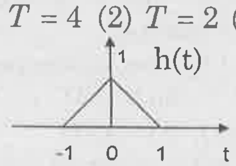
$x[n] \rightarrow \boxed{h_1[n]} \rightarrow \boxed{h_2[n]} \rightarrow \boxed{h_2[n]} \rightarrow y[n]$

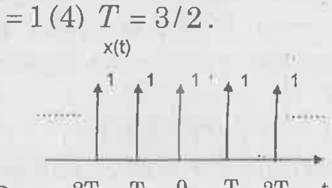


Find the impulse response $h_1[n]$ and the response $y[n]$ of the overall system to the input $x[n] = \delta[n] - \delta[n-1]$. (9)

(ii) Let $h(t)$ be a triangular pulse and let $x(t)$ be the impulse train. Determine and sketch $y(t)$ for the following values of T. (4)

(1) $T = 4$ (2) $T = 2$ (3) $T = 1$ (4) $T = 3/2$.





Or

(b) (i) Find the convolution between $x[n]$ and $h[n]$, where

$x[n] = (\alpha)^n u[n]$; $0 < \alpha < 1$ and $h[n] = u[n]$. (6)

(ii) Find the convolution of $x(t)$ and $h(t)$ (7)

$x(t) = \begin{cases} 2 & for\ -2 \le t \le 2 \\ 0; & \text{otherwise} \end{cases}$ and $h(t) = \begin{cases} 4 & for\ 0 \le t \le 2 \\ 0; & \text{otherwise} \end{cases}$

14. (a) (i) Find the inverse Laplace transform of $\left[\frac{s+4}{2s^2+5s+3}\right]$; Roc : $Re\{s\} > -1$. (4)

(ii) Consider the LTI system with impulse response $h[n] = (\alpha)^n u[n]$; $|\alpha| < 1$ and $x[n] = (\beta)^n u[n]$; $|\beta| < 1$. Find the response of the LTI system. (9)

Or

(b) (i) Consider a discrete-time LTI system with impulse response $h[n] = \left[\frac{1}{2}\right]^n u[n]$. Use Fourier transform to determine the response of the system to the input $x[n] = \left[\frac{3}{4}\right]^n u[n]$. (6)

(ii) A difference equation of the system is given as, $y(n) - y(n-1) + \frac{1}{4}y(n-2) = x(n) + \frac{1}{4}x(n-1) - \frac{1}{8}x(n-2)$.

Determine the transfer function of the inverse system. Check whether the inverse system is causal and stable. (7)

15. (a) (i) Find the inverse Z-transform of

$X(z) = \frac{1-(1/2)z^{-1}}{1+(3/4)z^{-1}+(1/8)z^{-2}}$; $|Z| > \frac{1}{2}$. (8)

(ii) Compute discrete-time Fourier Transform of $x(n) = a^n$ for $0 \le n \le N-1$. (5)

Or

(b) (i) Determine the Z-transform and ROC of the given sequence. (5)

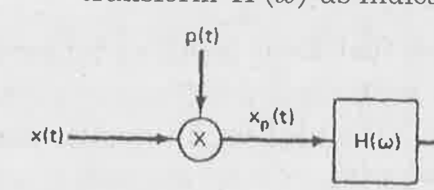
$x[n] = \left(\frac{-1}{3}\right)^n u[n] - \left(\frac{1}{2}\right)^n u(-n-1)$.

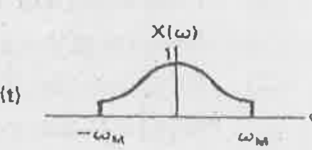
(ii) Obtain the direct form I and direct form II realizations of the LTI system. (8)

$y(n) = -\frac{3}{8}y(n-1) + \frac{3}{32}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$.

PART C — (1 × 15 = 15 marks)

16. (a) (i) A system in which the sampling signal $p(t)$ is an impulse train with alternating sign is given in the figure 16(a). The Fourier transform $x(w)$ of the input signal are $x(t)$ and the Fourier transform $H(w)$ as indicated in the figure 16. (11)





15. (a) Let $y[n]=x[n]*h[n]$

where $x[n]=\left(\frac{1}{3}\right)^n u[n]$ and

$h[n]=\left(\frac{1}{5}\right)^n u[n]$

Find $y(z)$ by using the convolution property of $z-$transform and find $y[n]$ by taking the inverse transform of $y(z)$ using the partial fraction expansion method.

Or

(b) A causal DT LTI system is described by the difference equation

$$y[n-2]-\frac{7}{10}y[n-1]+\frac{1}{10}y[n]=x[n]$$

Determine the system function $H(z)$. Also plot the pole-zero plot and determine whether the system is stable.

PART C — (1 × 15 = 15 marks)

16. (a) Given the impulse response of a discrete time LTI system

$$h[n]=\left[-2\left(\frac{1}{3}\right)^n+3\left(\frac{1}{2}\right)^n\right]u[n]$$

(i) Find the system function $H(z)$ of the system

(ii) Find the difference equation representation of the system

(iii) Find the step response of the system.

Or

(b) The input output relationship of a discrete time system is given by $y[n]-\frac{1}{4}y[n-1]=x[n]$. Find the response $y[n]$ if the Fourier transform of the input $x[n]$ is given as $X(e^{jw})=\dfrac{1}{1-\frac{1}{2}e^{-jw}}$.

———————

01/11/18 (FN)

Reg. No. : [ ]

Question Paper Code : 25073

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Electronics and Communication Engineering

EC 8352 — SIGNALS AND SYSTEMS

(Common to : Electronics and Telecommunication Engineering/ Medical Electronics/ Biomedical Engineering/ Computer and Communication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the mathematical and graphical representations of a discrete time ramp sequence.

2. Evaluate the following integral

$$\int_{-1}^{1}(2t^2+3)\,\delta(t)\,dt.$$

3. State Dirichlet's conditions.

4. If $X(j\Omega)$ is the Fourier transform of the signal $x(t)$, what is the Fourier transform of the signal $x(3t)$ in terms of $X(j\Omega)$?

5. If the system function $H(s)=4-\dfrac{3}{s+2}$; $\mathrm{Re}(s)>-2$, find the impulse response $h(t)$.

6. Two systems with impulse response $h_1(t)=e^{-2t}u(t)$ and $h_2(t)=\delta(t-1)$ are connected in series. What is the overall impulse response $h(t)$ of the system?

7. A continuous time signal $x(t)$ has the following real Fourier transform :

$$X(j\Omega)=\begin{cases}1, & |\Omega|\le 10\pi \\ 0, & \text{otherwise}\end{cases}$$

Is $x(t)$ band limited? If so, find the Nyquist rate.

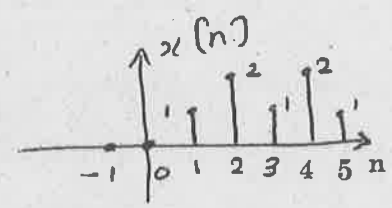
8. The DTFT of a discrete time signal $x(n)$ is given as $X(e^{jw})=2e^{2jw}+3+4e^{-jw}-2e^{-2jw}$. Find the time domain signal $x(n)$.

9. The input $x(n)$ and output $y(n)$ of a discrete time LTI system is given as $x(n)=\{1, 2, 3, 4\}$ and $y(n)=\{0, 1, 2, 3, 4\}$. Find the impulse response $h(n)$.

10. Given the system function $H(z)=\dfrac{z^{-1}}{z^{-2}+2z^{-1}+4}$. Find the difference equation representation of the system.

PART B — (5 × 13 = 65 marks)

11. (a) A discrete time signal $x(n)$ is shown below :



Plot the following signals :

(i) $x[n-2]$ (2)

(ii) $x[n+1]$ (2)

(iii) $x[-n]$ (2)

(iv) $x[-n+1]$ (2)

(v) $x[2n]$ (2)

(vi) $x[-2n+1]$. (3)

Or

(b) A continuous time system has the input-output relation given by $y(t)=tx(t-1)$

Determine whether the system is

(i) Linear (3)

(ii) Time-invariant (3)

(iii) Stable (3)

(iv) Memoryless (2)

(v) Causal. (2)

12. (a) Find the Fourier transform of $x(t)=e^{-a|t|}$, $a>0$ and sketch its corresponding magnitude spectrum.

Or

(b) Find the Laplace transform of $x(t)=e^{-a|t|}$, $a>0$ and its associated ROC and indicate whether the Fourier transform $X(j\Omega)$ exists.

13. (a) Find the output $y(t)$ of the system

$$H(s)=\frac{1}{s+2}\ \text{Re}\{s\}>-2$$

for the input $x(t)=e^{-3t}u(t)$.

Or

(b) A causal LTI system satisfies the linear differential equation

$$\frac{d^2}{dt^2}y(t)+7\frac{d}{dt}y(t)+12y(t)=\frac{d}{dt}x(t)+2x(t)$$

(i) Find the frequency response $H(j\Omega)$ of the system. (6)

(ii) Find the output $y(t)$ of the system for the input $x(t)=e^{-2t}u(t)$. (7)

14. (a) Let $X(e^{jw})$ be the Fourier transform of the sequence $x[n]$. Determine in terms of $x[n]$ the sequence corresponding to the following transforms using the properties of DTFT. Also prove the properties used.

(i) $X(e^{j(w-w_0)})$ (3)

(ii) $X^*(e^{-jw})$ (3)

(iii) $j\dfrac{d}{dw}X(e^{jw})$ (3)

(iv) $\dfrac{1}{2\pi}X_1(e^{jw})\circledN X_1(e^{jw})$ (4)

Or

(b) Derive the z – transform of the following sequence

$x[n]=\sin(w_0 n)\,u[n]$

Also specify its ROC.

Reg. No. :

Question Paper Code : 90175

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Third Semester

Electronics and Communication Engineering

EC 8352 – SIGNALS AND SYSTEMS

(Common to Medical Electronics/Biomedical Engineering/Computer and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations – 2017)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Determine whether the signal $x(t) = \sin\sqrt{2}t$ is periodic or not.
2. Give an example for deterministic and random signals.
3. State Gibbs Phenomenon.
4. Find the Fourier series coefficients of the signal $x(t) = 1 + \sin\frac{\pi}{2}t$.
5. Two systems with impulse responses $h_1(t) = e^{-at}\,u(t)$ and $h_2(t) = u(t-1)$ are connected in parallel. What is the overall impulse response h(t) of the system ?
6. The input – output relationship of a system is given by
   $$\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = \frac{dx}{dt}.$$
   Find the system function H(s) of the system.
7. Find the Nyquist rate of the signal $x(t) = \cos 200\pi t + \sin 400\pi t$.
8. Find the z-transform and its associated ROC for the signal
   $x[n] = \delta[n+1] + 2\,\delta[n] - 3\,\delta[n-2]$.
9. Convolve the following signals
   $x[n] = \{\underset{\uparrow}{1}, 2, 3\}$ $h[n] = \{1, 2\}$
10. Determine whether the following system is a recursive system and justify your answer $y[n] = 2x[n] + 3x[n-1] - 2x[n-2]$.

PART – B

(5×13=65 Marks)

11. a) Plot the following signals, given x[n] :

i) $x[n] = \{1, 2, 1, \underset{\uparrow}{2}, 1, 2, 1\}$

ii) $x[n-1]$ **(2)**

iii) $x[2n]$ **(2)**

iv) $x[n/2]$ **(2)**

v) $x\left[\frac{n}{2}-1\right]$ **(2)**

vi) $x\left[-\frac{n}{2}-1\right]$ **(2)** **(3)**

(OR)

b) Determine whether the following system is Linear, Time Invariant, Causal, Memoryless and Stable.

$y[n] = nx[n]$

12. a) Find the Fourier transform of the signal $x(t) = e^{-\alpha|t|}$, $\alpha > 0$ and plot its spectrum.

(OR)

b) Specify all possible ROC's for the function X(s) given below. Also find x(t) in each case.

$$X(s) = \frac{4s}{(s+2)(s+4)}$$

13. a) Convolve the following signals $x(t) = u(t)$ $h(t) = u(t) - u(t-2)$.

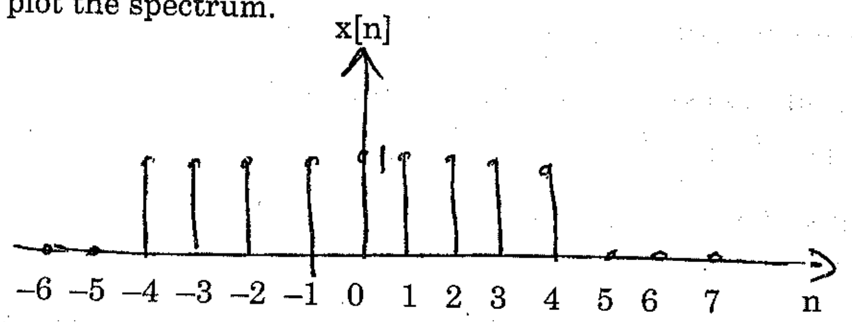
(OR)

b) An LTI system which is initially at rest is described by the differential equation

$$\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = \frac{dx}{dt} + 3x.$$

Find the system function H(s) and the impulse response h(t).

14. a) Find the DTFT of the rectangular pulse sequence shown below and also plot the spectrum.



(OR)

b) Given the z – transform of a sequence x[n] as $X(z) = \frac{z}{z-1}$

Find the z – transform of the following signals in terms of X(z) using properties of z – transform.

i) $x[n-1]$ **(3)**

ii) $x[-n]$ **(3)**

iii) $\alpha^n x[n]$ **(3)**

iv) $nx[n]$ **(4)**

15. a) Convolve the following signals $x[n] = \alpha^n u[n]$ $h[n] = u[n-1]$.

(OR)

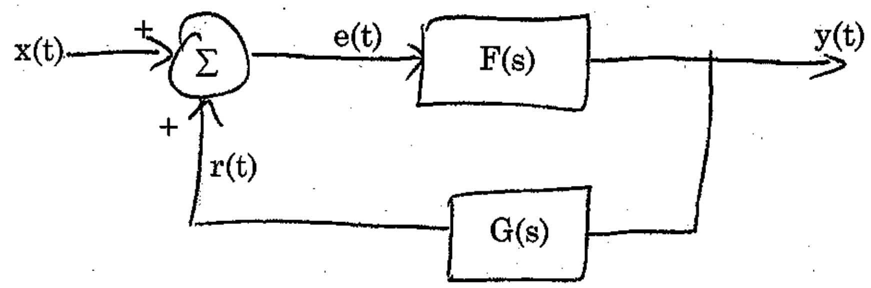
b) Consider a DT LTI system whose system function H(z) is given by $H(z) = \frac{z}{z-0.5}$ $|z| > 0.5$.

Find the step response of the system.

PART – C

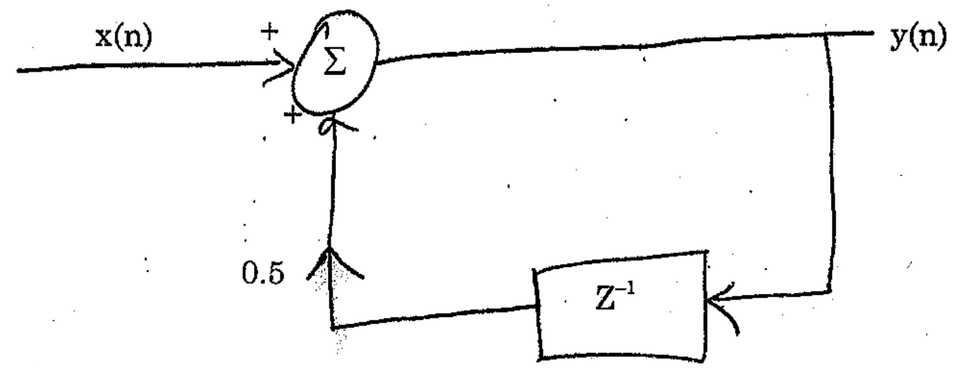
(1×15=15 Marks)

16. a) The feedback interconnection of two causal subsystems with system functions F(s) and G(s) is shown below. Find the overall system function H(s) for this feedback system.



(OR)

b) Consider the discrete time LTI system shown below.



Find the frequency response $H(e^{j\omega})$ and the impulse response h(n) of the system. Sketch the magnitude response $|H(e^{j\omega})|$ for the system.

15. (a) (i) Realise the following system in cascade form (10)

$$H(z) = \frac{1+\frac{1}{5}z^{-1}}{\left(1-\frac{1}{2}z^{-1}+\frac{1}{3}z^{-2}\right)\left(1+\frac{1}{4}z^{-1}\right)}$$

(ii) Convolve $x(n) = \{1, 1, 0, 1, 1\}$ (6)
$\uparrow$

$h(n) = \{1, -2, -3, 4\}$
$\uparrow$

OR

(b) A system is governed by a linear constant coefficient difference equation

$y(n) = 0.7\, y(n-1) - 0.1\, y(n-2) + 2x(n) - x(n-2)$

Find the output response of the system $y(n)$ for an input $x(n) = u(n)$ (16)

Reg. No.

Question Paper Code : 57282

26/05/2016 AN

B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Third Semester

Electronics and Communication Engineering

EC 6303 – SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Sketch the following signals :

$\text{rect}\left(\frac{t+1}{4}\right)$; 5 ramp (0.1t)

2. Given $g(n) = 2e^{-2n-3}$. Write out and simplify the functions

(i) $g(2-n)$ (ii) $g\left(\frac{n}{10}+4\right)$

3. What is the inverse Fourier transform of

(i) $e^{-j2\pi f t_0}$ (ii) $\delta(f - f_0)$

4. Give the Laplace Transform of $x(t) = 3e^{-2t}\, u(t) - 2e^{-t}\, u(t)$ with ROC.

5. Find whether the following system whose impulse response is given is causal and stable $h(t) = e^{-2t}\, u(t-1)$.

6. Realize the block diagram representing the system $H(s) = \frac{s}{s+1}$.

7. Write the conditions for existence of DTFT.

8. Find the final value of the given signal

$$X(z) = \frac{1}{1+2z^{-1}+3z^{-2}}$$

9. From discrete convolution sum, find the step response in terms of h(n).

10. Define the non recursive system.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Find whether the following signals are periodic or aperiodic. If periodic find the fundamental period and fundamental frequency (8)

$x_1(n) = \sin 2\pi t + \cos \pi t$

$x_2(n) = \sin\frac{n\pi}{3} \cdot \cos\frac{n\pi}{5}$

(ii) Find whether the following signals are power or energy signals. Determine power and energy of the signals. (8)

$g(t) = 5\cos\left(17\pi t + \frac{\pi}{4}\right) + 2\sin\left(19\pi t + \frac{\pi}{3}\right)$

$g(n) = (0.5)^n\, u(n)$

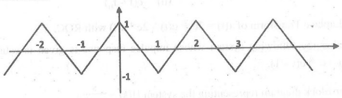
OR

(b) Find whether the following systems are time variant or fixed. Also find whether the systems are linear or nonlinear

$\frac{d^3y(t)}{dt^3} + 4\frac{d^2y(t)}{dt^2} + 5\frac{dy}{dt} + y^2 t = x(t)$ (8)

$y(n) = an^2 \times (n) + bn \times (n-2)$ (8)

12. (a) Obtain the Fourier series coefficients & Plot the spectrum for the given waveform (16)



OR

(b) (i) From basic formula, determine the Fourier transform of the given signals. Obtain the magnitude and phase spectra of the given signals. (5 + 5)

$te^{-at}u(t)$, $a > 0$

$e^{-a|t|}$, $a > 0$

(ii) State and prove Rayleigh's energy theorem. (6)

13. (a) (i) Using graphical convolution, find the response of the system whose impulse response is (8)

$h(t) = e^{-2t}u(t)$

for an input $x(t) = \begin{cases} A, & \text{for } 0 \le t \le 2 \\ 0, & \text{otherwise} \end{cases}$

(ii) Realize the following is indirect form II. (8)

$$\frac{d^3y(t)}{dt^3} + 4\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 8y(t) = 5\frac{d^2x(t)}{dt^2} + 4\frac{dx(t)}{dt} + 7x(t)$$

OR

(b) (i) An LTI system is defined by the differential equation (10)

$$\frac{d^2y(t)}{dt^2} - 4\frac{dy(t)}{dt} + 5y(t) = 5 \times (t)$$

Find the response of the system $y(t)$ for an input $x(t) = u(t)$, if the initial conditions are $y(0) = 1$; $\frac{dy(t)}{dt}\big|_{t=0} = 2$.

(ii) Determine frequency response and impulse response for the system described by the following differential equation. Assume zero initial conditions. (6)

$$\frac{dy(t)}{dt} + 3y(t) = x(t)$$

14. (a) (i) State and prove sampling theorem. (10)

(ii) What is aliasing ? Explain the steps to be taken to avoid aliasing. (6)

OR

(b) State and prove the following theorems :

(i) Convolution theorem of DTFT (8)

(ii) Initial value theorem of z-transform (8)

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

Question Paper Code : 71726

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours — Maximum : 100 marks

(Codes/Tables/Charts to be permitted if any, may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the summation $x(n)=\sum_{n=\infty}^{\infty}\delta(n-1)\sin 2n$.

2. Define a linear system.

3. What is the condition for the existence of Fourier series for a signal?

4. State Parseval's theorem for a continuous time aperiodic signal.

5. Give the expression for convolution integral

6. Given $h(t)$, what is the step response of a CT LTI system.

7. What is the z transform of a unit step sequence.

8. Find $x(\infty)$ of the signal for with the z-transform is given by $X(z)=\frac{z+1}{3(z-1)(z+0.9)}$.

9. What is the necessary and sufficient condition on impulse response for stability of a casual LTI system?

10. What is the difference between recursive and nonrecursive systems?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Find out whether the following signals are periodic or not. If periodic find the period $x(t) = 2\cos(10t+1) - \sin(4t-1)$ $x(n) = \cos(0.1\,\pi n)$.

(ii) Find out whether the following signals are energy or power signal or neither power nor energy. Determine power or energy as the case may be for the signal $x(t) = u(t) + 5u(t-1) - 2u(t-2)$.

Or

(b) Determine the properties viz linearity, causality, time invariance and dynamicity of the given systems

$$y(t) = \frac{d^2y}{dt^2} + 3t\frac{dy}{dt} + y(t) = x(t)$$

$$y_1(n) = x(n^2) + x(n)$$

$$y_2(n) = \log_{10} x(n).$$

12. (a) Obtain the Fourier co-efficient and write the quadrature form of a fully rectified sine wave.

Or

(b) Determine the inverse Laplace Transform of the following

(i) $x(s) = \dfrac{1-2s^2-14s}{s(s+3)(s+4)}$

(ii) $x(s) = \dfrac{2s^2+10s+7}{(s+1)(s^2+3s+2)}$.

13. (a) A causal LTI system having a frequency response $H(j\Omega) = \dfrac{1}{j\Omega+3}$ is producing an output $y(t) = e^{-3t}u(t) - e^{-4t}u(t)$ for a particular input $x(t)$. Determine $x(t)$.

Or

(b) Realize the given system in parallel form $H(s) = \dfrac{s(s+2)}{s^3+8s^2+19s+12}$.

14. (a) State and prove Sampling theorem.

Or

(b) State and prove the following properties of DTFT

(i) Differentiation in frequency

(ii) Convolution in frequency domain.

15. (a) Perform convolution to find the response of the systems $h_1(n)$ and $h_2(n)$ for the input sequences $x_1(n)$ and $x_2(n)$ respectively.

(i) $x_1(n) = \{1, -1, 2, 3\}$ $h_1(n) = \{1, -2, 3, -1\}$

(ii) $x_2(n) = \{1, 2, 3, 2\}$ $h_2(n) = \{1, 2, 2\}$.

Or

(b) For a causal LTI system the input $x(n)$ and output $y(n)$ are related through a difference equation $y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n)$. Determine the frequency response $H(e^{jw})$ and the impulse response $h(n)$ of the system.

PART C — (1 × 15 = 15 marks)

16. (a) Using Laplace Transform determine the response of the system described by the equation $\dfrac{d^2y(t)}{dt^2} + 5\dfrac{dy(t)}{dt} + 4y(t) = \dfrac{dx(t)}{dt}$ with initial conditions $y(0) = 0;\ \dfrac{dy(t)}{dt}\Big|_{t=0} = 1$ for the input $x(t) = e^{-2t}u(t)$.

Or

(b) Determine the steady state response for the system with impulse response $h(n) = [j\,0.5]^n$ for an input $x(n) = \cos(\pi n)\,u(n)$.

Reg. No. :

14/05/18 AN

Question Paper Code : 40953

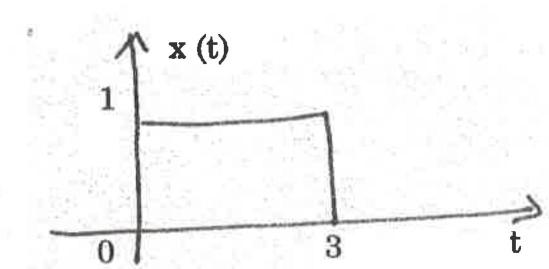
B.E./B.Tech. DEGREE EXAMINATION, APRIL /MAY 2018
Third Semester
Electronics and Communication Engineering
EC 6303 – SIGNALS AND SYSTEMS
(Common to Biomedical Engineering/Medical Electronics)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Represent the following signal in terms of the unit step function.



2. What is a random signal ? Give an example.

3. Find the Fourier series representation of the signal $x(t) = \cos\frac{2\pi}{3}t$.

4. Give Parseval's relation for continuous time Fourier transform.

5. Given the input x (t) = u (t) and h (t) = δ (t – 1). Find the response y (t).

6. Given $X(s) = \frac{3}{s+2}$, ROC : Re {s} > – 2. Find x (t).

7. Find the Nyquist rate for the signal x (t) = 1 + cos 10 πt, in Hz.

8. Find the Inverse DTFT of $X(e^{j\omega}) = 2e^{j\omega} + 1 - 2e^{-2j\omega}$.

9. Draw the block diagram representation of the system given its input output relationship

$$y[n] = \sum_{k=0}^{4} h(k)\, x(n-k).$$

10. Convolve the following signals

$x[n] = \{1, 2, -2\}$ and $h[n] = \{1, 2, 2\}$.

PART – B (5×13=65 Marks)

11. a) i) How the unit impulse function $\delta(t)$, unit step function $u(t)$ and ramp function $r(t)$ can be related ? Also give the Mathematical representation and graphical representation of the above three functions. (6)

ii) Determine whether the following signals is periodic. If a signal is periodic, determine its fundamental period.

a) $x(t) = \cos\frac{\pi}{3}t + \sin\frac{\pi}{4}t$ (4)

b) $x[n] = \cos\frac{n}{4}$ (3)

(OR)

b) Determine whether the system $y[n] = 2x(n-2)$ is memoryless, causal, linear, time invariant, invertible and stable. Justify your answers.

12. a) Find the Fourier series representation for the signal $x(t) = 2 + \cos 4t + \sin 6t$ and plot its magnitude and phase spectrum.

(OR)

b) State and prove any three properties of continuous Time Fourier Transform.

13. a) Given the differential equation representation of a continuous time system.

$$\frac{d}{dt}y(t) + 2y(t) = x(t)$$

Find the response $y(t)$ for the input $x(t) = e^{-3t}u(t)$ using Laplace transform.

(OR)

b) A continuous time LTI system is represented by the following differential equation.

$$\frac{d^2}{dt^2}y(t) + 3\frac{d}{dt}y(t) + 2y(t) = 2x(t)$$

Determine the impulse response of the system using Fourier transform.

14. a) Find the Z- transform of the sequence $x[n] = a^n u[n] + b^n u[-n-1]$. Considering the two conditions $a > b$ and $a < b$.

(OR)

b) If $X(e^{j\omega})$ is the DTFT of $x[n]$. Find the DTFT of $(n-1)^2 x[n]$ in terms of $X(e^{j\omega})$ using DTFT properties.

15. a) Convolve the following sequences

$x[n] = a^n u[n]$, $a < 1$

$h[n] = u[n]$

(OR)

b) The system function $H(z)$ is given by $H(z) = \frac{z^2}{(z-\frac{1}{3})(z-\frac{1}{2})}$ ROC : $|z| > \frac{1}{2}$.

Determine the step response of the system.

PART – C (1×15=15 Marks)

16. a) State and explain sampling theorem with necessary equations and illustrations.

(OR)

b) A discrete time system is both linear and time invariant. The output produced by this system for an impulse input is {1, 2, 3}.

Find the output of this for the following inputs and justify your answer :

i) $\delta[n-2]$ (5)

ii) $\delta[n] - 2\delta[n-1]$ (5)

iii) {1, 2, 3}. (5)

(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)

———————

11/05/19 AN

Reg. No. :

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.

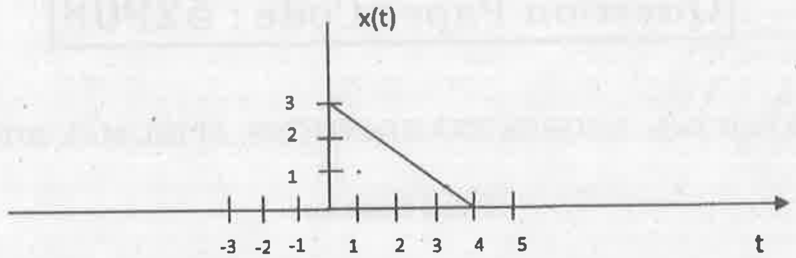
8. State the frequency shifting theorem of DTFT.

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)

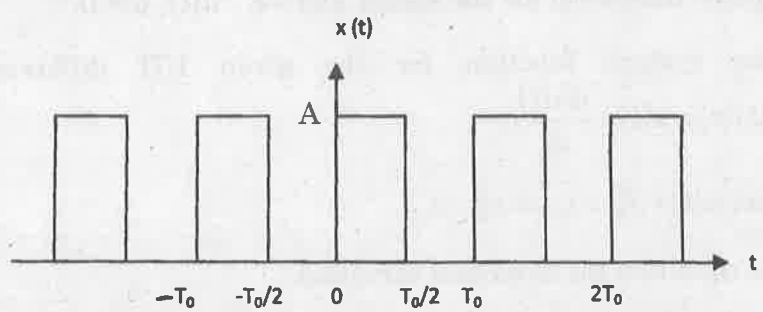
(1) $x(t)=\sin\left(\frac{2\pi}{3}\right)t$

(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

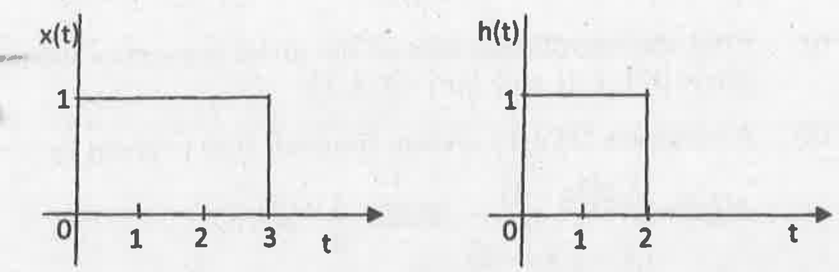
(b) (i) Find the Fourier transform of the given signal $x(t)=e^{-at}u(-t)$, $a>0$. (5)

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

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

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

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

ECE 3/12/16 F.N

Reg. No. :

Question Paper Code : 80334

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Third Semester

Electronics and Communication Engineering

EC 6303 – SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the mathematical and graphical representation of a continuous time and discrete time unit impulse functions.

2. State the difference between causal and non causal system.

3. Find the Fourier series representation of the signal $x(t)=\frac{\cos 2\pi t}{3}$ and determine the Fourier series coefficients.

4. Find the Laplace transform of $x(t)=e^{-at}u(t)$.

5. Convolve the following signals $u(t-1)$ and $\delta(t-1)$.

6. Given $H(s)=\frac{s}{s^2+2s+1}$. Find the differential equation representation of the system.

7. Find the Nyquist rate of the signal $x(t)=\sin 200\pi t-\cos 100\pi t$

8. Find the Z–transform of the signal and its associated ROC $x[n]=\{2,-1,\underset{\uparrow}{3},0,2\}$.

9. Convolve the following sequences

$x[n]=\{1, 2, 3\}$

$h[n]=\{1, 1, 2\}$.

10. Given the system function $H(z)=2+3z^{-1}+4z^{-3}-5z^{-4}$. Determine the impulse response $h[n]$.

PART B — (5 × 13 = 65 marks)

11. (a) Determine whether the system is Linear, Time Invariant, Causal and memoryless $y(t)=\frac{1}{2}\int_{-\infty}^{t}x(z)\,dz$.

Or

(b) Sketch the following signals

(i) $u(-t+2)$

(ii) $r(-t+3)$

(iii) $2\delta[n+2]+\delta[n]-2\delta[n-1]+3\delta[n-3]$

(iv) $u[n+2]\,u[-n+3]$

where $u(t)$, $r(t)$, $\delta[n]$, $u[n]$ represent continuous time unit step, continuous time ramp, discrete time impulse and discrete time step functions respectively.

12. (a) Find the Fourier transform of the signal $x(t)=\cos\Omega_0 t\; u(t)$.

Or

(b) State and prove the multiplication and convolution propert of Fourier transform.

13. (a) Convolve the following signals

$x(t)=e^{-3t}u(t)$

$h(t)=u(t+3)$.

Or

(b) A system is described by the differential equation $\frac{d^2}{dt^2}y(t)+6\frac{d}{dt}y(t)+8y(t)=\frac{d}{dt}x(t)+x(t)$. Find the transfer function and the output signal $y(t)$ for $x(t)=\delta(t)$.

14. (a) (i) Discuss the effects of undersampling a signal using necessary diagrams. (5)

(ii) Find the Z–transform of $x[n]=a^n u[n]-b^n u[-n-1]$ and specify its ROC. (8)

Or

(b) (i) Give the relation between Discrete Time Fourier Transform (DTFT) and Z-transform. (5)

(ii) State and prove the time shifting property and time reversal property of Z-transform. (8)

15. (a) Convolve the following signals

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

$h[n]=(0.5)^n u[n]$.

Or

(b) Determine whether the given system is stable by finding $H(z)$ and plotting the pole-zero diagram

$y[n]=2y[n-1]-0.8y[n-2]+x[n]+0.8x[n-1]$.

PART C — (1 × 15 = 15 marks)

16. (a) A causal system has input $x[n]$ and output $y[n]$. Find the

(i) System function $H(z)$. (4)

(ii) Impulse Response $h[n]$. (6)

(iii) Frequency response $H(e^{jw})$. (5)

$x[n]=\delta[n]+\frac{1}{6}\delta[n-1]-\frac{1}{6}\delta[n-2]$

$h[n]=\delta[n]^6-\frac{2}{3}\delta[n-1]$.

Or

(b) Find the response $y(t)$ of a continuous time system using Laplace transform with transfer function $H(s)=\frac{1}{(s+2)(s+3)}$ for an input $x(t)=e^{-t}u(t)$.

15. a) i) Obtain the parallel realization of the system given by $y(n) - 3y(n-1) + 2\,y(n-2) = x(n)$. (6)

ii) Determine the direct form II structure for the system given by difference equation

$$y(n) = \left(\frac{1}{2}\right)y(n-1) - \left(\frac{1}{4}\right)y(n-2) + x(n) + x(n-1).$$ (7)

(OR)

b) Using the properties of inverse Z-transform solve : (5+5+3)

i) $X(z) = \log(1 + az^{-1}); |z| > |a|$ and $X(z) = \frac{az^{-1}}{(1-az^{-1})^2}; |z| > |a|$

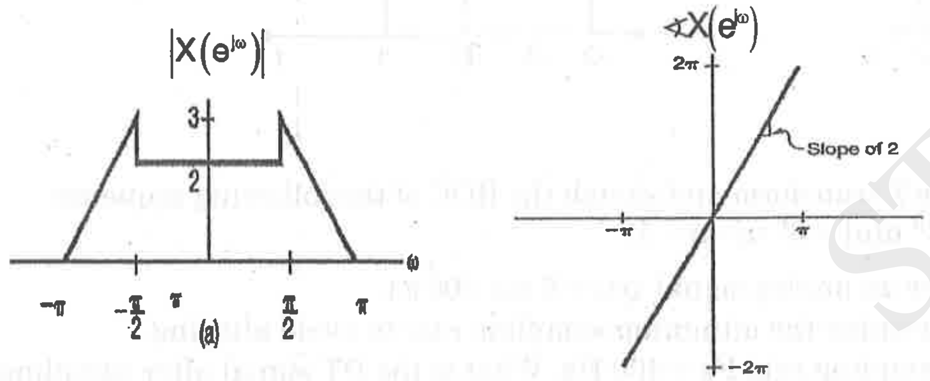
ii) Check whether the system function is causal or not

$$H(z) = \frac{1}{1-(1/2)z^{-1}} + \frac{1}{1-2z^{-1}} \quad ; |z| > 2$$

iii) Consider a system with impulse response $H(s) = \frac{e^s}{S+1}; Re\{s\} > -1$. Check whether the system function is causal or not .

PART – C (1×15=15 Marks)

16. a) i) Consider the sequence x[n] whose Fourier transform $X(e^{j\omega})$ is depicted for $-\pi \le \omega \le \pi$ in the figure below. Determine whether or not, in the time domain, x[n] is periodic, real, even, and/or of finite energy. (6)



ii) What is the transfer function and the impulse response of low pass RC circuit ? (5)

iii) Find the necessary and sufficient condition on the impulse response h[n] such that for any input x[n],

$$\max\{|x[n]|\} \ge \max\{|y[n]|\},$$

where $y[n] = x[n] * h[n]$. (4)

(OR)

b) Analyze on recursive and non-recursive systems with an example. (15)

Reg. No. :

Question Paper Code : 50435

02/11/17 FN

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Third Semester

Electronics and Communication Engineering

EC6303 – SIGNALS AND SYSTEMS

(Common to : Medical Electronics , Biomedical Engineering)

(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Determine if the signal x[n] given below is periodic. If yes, give its fundamental period. If not, state why it is aperiodic.

   $X[n] = \sin\left(\frac{6\pi}{7}n + 1\right)$

2. Check whether the following system is Time Invariant/Time variant and also causal/non causal : $Y(t) = x\left(\frac{t}{3}\right)$.

3. Find whether the following system with impulse response h(t) are stable or not. $h(t) = t\,e^{-t}\,u(t)$.

4. Find the Fourier transform of $x(t) = e^{-at}\,u(t)$.

5. Will there be two different signals having same Laplace transform ? Give an example. How do you differentiate these two signals ?

6. Consider an LTI system with transfer function H(s) is given by $H(s) = \frac{1}{(s+1)(s+3)}$ Re(s)>3; determine h(t).

7. List the ROC properties of Laplace transform.

8. Find the Z transform of a sequence $x[n] = \cos(n\,\omega T)\,u[n]$.

9. Write the condition for stability of a DT-LTI system with respect to the position of poles.

10. Realize the difference equation $y[n] = x[n] - 3x[n-1]$ in direct form I.

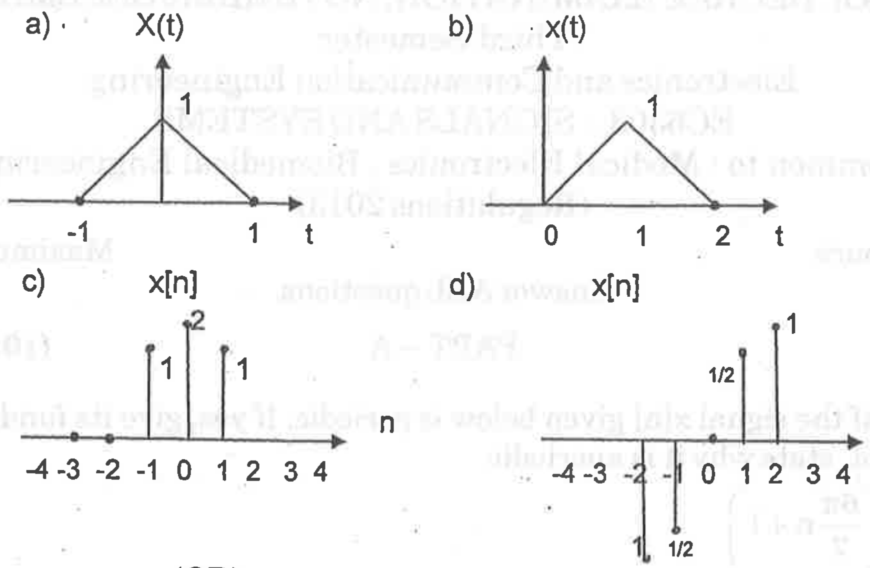
PART – B (5×13=65 Marks)

11. a) Find the whether the signal is an energy signal or power signal.

i) $x(t) = e^{-2t}\,u(t)$. (5)

ii) Draw the waveform for the signal $x(t) = r(t) - 2r(t-1) + r(t-2)$. (4)

iii) For the given signal determine whether it is even, odd, or neither. (4)



(OR)

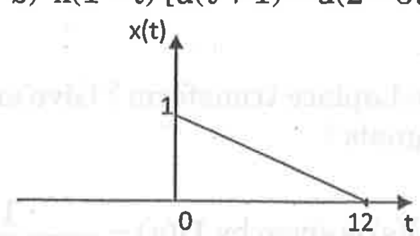
b) Determine whether the following system is Linear and Causal.

i) $y[n] = x[n].\,x[n-1]$ and $y[n] = \left(\frac{1}{3}\right)[x[n-1] + x[n] + x[n+1]]$. (5)

ii) For x(t) indicate in figure sketch the following : (4+4)

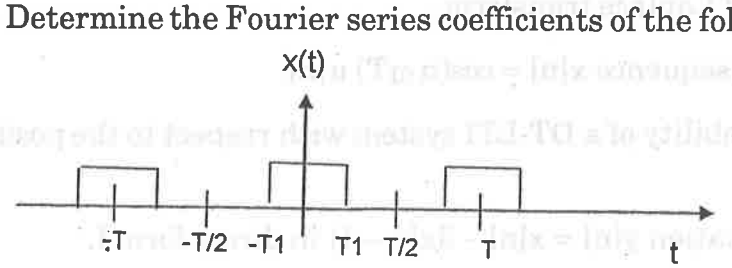
a) $x(1-t)\,[u(t+1) - u(t-2)]$

b) $x(1-t)\,[u(t+1) - u(2-3t)]$.



12. a) i) Find the Fourier transform of a rectangular pulse with width T and amplitude A. (7)

ii) Determine the Fourier series coefficients of the following signal. (6)



(OR)

b) i) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-a|t|}, a > 0$. Also draw its amplitude and phase spectra. (7)

ii) Obtain the inverse Laplace transform of the function (6)

$$X(s) = \frac{1}{s^2 + 3s + 2},\ \text{ROC: } -2 < \text{Re}\{s\} < -1.$$

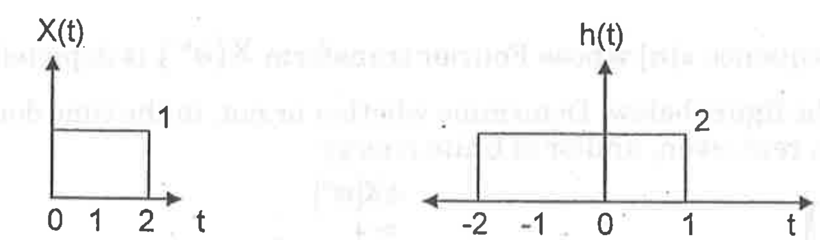
13. a) i) Using Laplace transform of x(t). Give the pole-zero plot and find ROC of the signal x(t). $x(t) = e^{-b|t|}$ for both b>0 and b<0. (6)

ii) Find the condition for which Fourier transform exists for x(t). Find the Laplace transform of x(t) and its ROC. $x(t) = e^{-at}\,u(-t)$. (7)

(OR)

b) i) Using graphical method, find the output sequence y[n] of the LTI system whose response h[n] is given and input x[n] is given as follows.
x[n] = {0.5, 2} ; h[n] = {1, 1, 1}. (6)

ii) Find the response y(t) of an LTI system whose x(t) and h(t) are shown in fig. (Using convolution integral). (7)



14. a) i) Find the Z transform and sketch the ROC of the following sequence $x[n] = 2^n\,u[n] + 3^n\,u(-n-1)$. (7)

ii) Consider an analog signal $x(t) = 5\cos 200\,\pi t$.

a) Determine the minimum sampling rate to avoid aliasing.

b) If sampling rate Fs = 400 Hz. What is the DT signal after sampling ? (6)

(OR)

b) i) Determine unit step response of the LTI system defined by $d^2y/dt^2 + 5dy/dt + 6y(t) = dx/dt + x(t)$. (7)

ii) Find the Inverse z-transform using partial fraction method. (6)

$$X(z) = \frac{3 - (5/6)z^{-1}}{(1 - (1/4)z^{-1})(1 - (1/3)z^{-1})};\ |z| > 1/3$$

Reg. No. :

Question Paper Code : 20409

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

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)

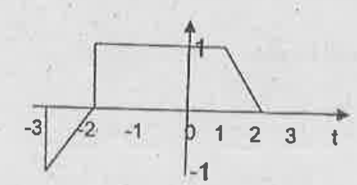
Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compute the average power and energy of the signal $x(t)=r(t)-r(t-2)$, where $x(t)=\begin{cases} t; t \leq 2 \\ 2; t > 2 \end{cases}$

2. Plot $x(3-5t)$ for the signal $x(t)$. (Give the sequence of transformation).

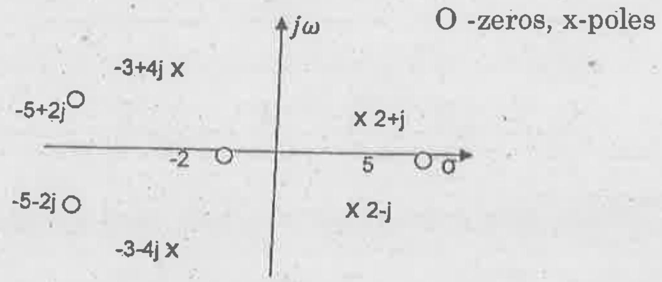


3. Consider a periodic signal $x(t)$ with fundamental frequency 2π and $a_0=1$, $a_1=a_{-1}=1/4$, $a_2=a_{-2}=1/2$, $a_3=a_{-3}=1/3$. Express $x(t)$ in general Fourier series formula.

4. State Dirichlet's condition of Fourier transform.

5. The impulse response $h[n]$ is given below. Check the system is stable/causal. $h[n]=\left[\frac{1}{3}\right]^n u[n]$.

6. The pole zero plot of the transfer function H(s) of a LTI system is given below.



Plot the ROC for the following cases when:

(a) The system is causal

(b) The system is stable.

7. Find the Z-transform of the signal. $x[n] = \cos(n\omega T)u[n]$.

8. Find DTFT of the signal $x[n] = \left[\frac{1}{3}\right]^n u(n)$.

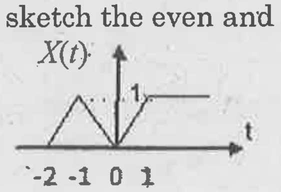
9. Find $x(\infty)$ if $X(z)$ is given by $\frac{z+1}{3(z-1)(z+0.9)}$.

10. Consider the second order system function $H(z) = \frac{1}{\left(1+\frac{1}{2}Z^{-1}\right)\left(1-\frac{1}{4}Z^{-1}\right)}$ implement the system in parallel form.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw the waveform for the signal $x(t) = u(t) + r(t) - 2r(t-1) + r(t-2) - u(t-2)$, where $u(t)$ and $r(t)$ are unit step and ramp respectively. (3)

(ii) Determine and sketch the even and odd part of the signal. (3)



(iii) A continuous time system is given by $y(t) = \int_{-\infty}^{2t} x(t)\,dt$. Check whether the system is Linear / Time variant / Causal / Static. (7)

Or

(b) (i) A continuous time system is given by, $y(t) = \begin{cases} 0 & ; x(t) \geq 0 \\ x(t) + x(t-2); & x(t) < 0 \end{cases}$

Check whether the system is Linear / Time variant/ Causal/Static. (7)

(ii) Draw the waveform for the signal $x(t) = r(t) - 2r(t-1) + r(t-2)$. (3)

(iii) Find whether the signal is periodic or not. (3)

$x[n] = e^{j\left[\frac{2\pi}{3}\right]n} + e^{j\left[\frac{3\pi}{4}\right]n}$.

12. (a) (i) Find Fourier transform of the signal $x(t) = \begin{cases} 1; |t| < T_1 \\ 0; |t| > T_1 \end{cases}$. (5)

(ii) Find the Laplace transform of the signal $x(t) = e^{-2t}u(t) + e^{-t}(\cos 3t)\,u(t)$. (8)

Or

(b) (i) Using properties of Fourier transform find $X(j\omega)$ and $G(j\omega)$.

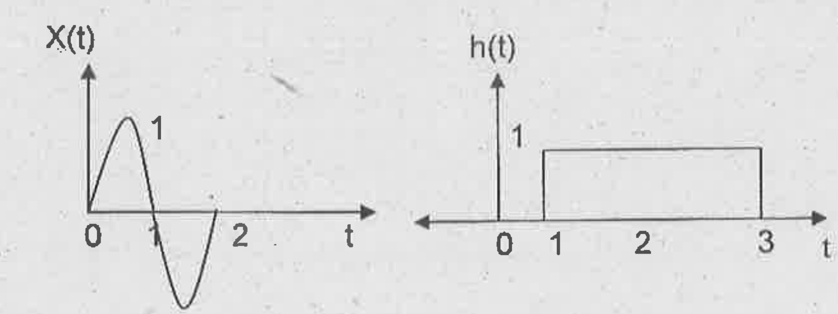
(1) $x(t) = e^{-a|t|}\,u(t); a > 0$ (3)

(2) $g(t) = 2/(1+t^2)$. (3)

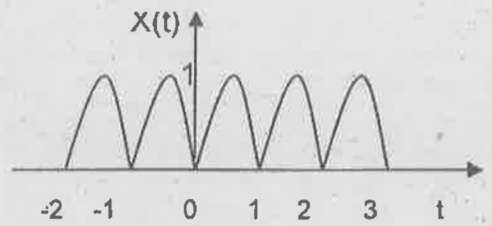
(ii) Find the Inverse Laplace transform of $X(s)$ (7)

$X(s) = \frac{3s^2 + 8s + 6}{(s+2)(s^2 + 2s + 1)}$.

13. (a) (i) Find the convolution for the given signals. (7)

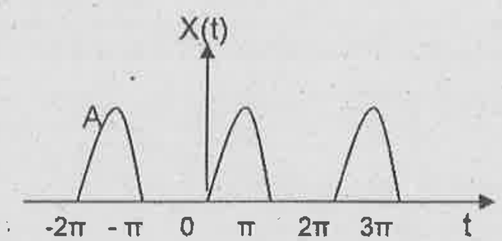


(ii) Determine the exponential Fourier series representation for the full wave rectified sine wave shown in the figure and also plot the line spectrum. (6)



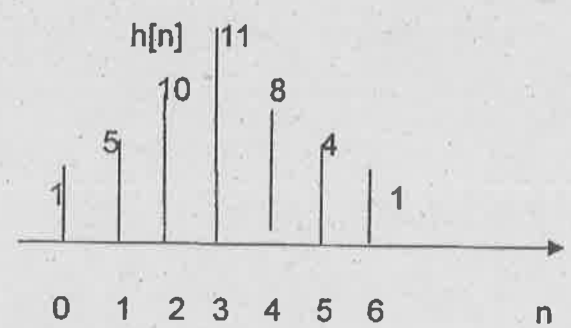
Or

(b) (i) Find cosine Fourier series of half wave rectified sine function. (8)



(ii) Find the convolution between $x[n]$ and $h[n]$, where $x[n]=\alpha^n u[n]$; $0<\alpha<1$ and $h[n]=u[n]$. (5)

14. (a) (i) Consider the cascade interconnection of 3 causal LTI system. The impulse response $h_2[n]=u[n]-u[n-2]$. The overall response is given below. $X[n]\rightarrow h_1[n]\rightarrow h_2[n]\rightarrow h_2[n]\rightarrow y[n]$.



Find the

(1) impulse response $h_1[n]$ (4)

(2) The response of the overall system to the input $x[n]=\delta[n]-\delta[n-1]$. (4)

(ii) Let $h(t)$ be a triangular pulse and let $x(t)$ be the impulse train. Determine and sketch $y(t)$ for the following value of T.

(1) $T=4$

(2) $T=2$

(3) $T=1$

(4) $T=3/2$. (5)

Or

(b) (i) Using partial fraction method, find the inverse of Z-transform

$$X(z)=\frac{z^2}{(1-az)(z-a)};\ Roc: a<|z|<\frac{1}{a}. \quad (7)$$

(ii) Find the discrete time Fourier transform $x(n)=(0.5)^n\ u(n)+2^n u(-n-1)$. (3)

(iii) Find the frequency response of the causal system. (3)

$$y[n]-\left(\frac{1}{4}\right)y(n-1)-\left(\frac{3}{8}\right)y(n-2)=x(n)+x(n-1).$$

15. (a) (i) Consider a continuous time LTI system,

$$\frac{d^2y(t)}{dt^2}-\frac{dy(t)}{dt}-2y(t)=x(t).$$

(1) Find the system function $H(s)$. (3)

(2) Determine the impulse response $h(t)$ for (3)

(A) the system is causal

(B) system is stable

(C) system is neither causal or stable.

(ii) Realize the given system in direct form II

$$\frac{d^3y(t)}{dt^3}+4\frac{d^2y(t)}{dt^2}+7\frac{dy(t)}{dt}+8y(t)=5\frac{d^2x(t)}{dt^2}+4\frac{dx(t)}{dt}+7x(t). \quad (7)$$

Or

(b) (i) Consider the system $H(z)=\frac{0.2z}{(z+0.4)(z-0.2)}$; $ROC; |z|>0.4$. (8)

(1) Find the impulse response function of the system

(2) Is DTFT exists for the system? if so, how?

(3) Find the DTFT.

(ii) Obtain the cascade form realization of the system described by the difference equation.

$$y(n)-\frac{1}{4}y(n-1)-\frac{1}{8}y(n-2)=x(n)+3x(n-1)+2x(n-2).$$ (5)

PART C — (1 × 15 = 15 marks)

16. (a) State and prove the properties of discrete Fourier transform. (15)

Or

(b) Explain the following :

(i) Deterministic and random signals. (8)

(ii) Base band sampling. (7)

Reg. No. :

8/11/19 / AN

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)

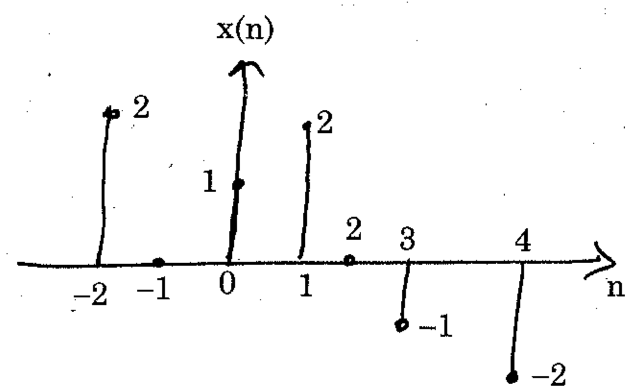
(Also common to : PTEC 6303 – Signals and Systems for B.E. (Part-Time) – Second Semester – Electronics and Communication Engineering – Regulations 2014)

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



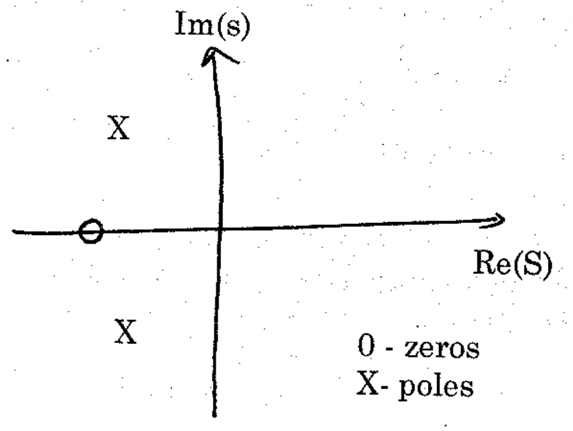
Represent x(n) in terms of impulse functions.

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)**

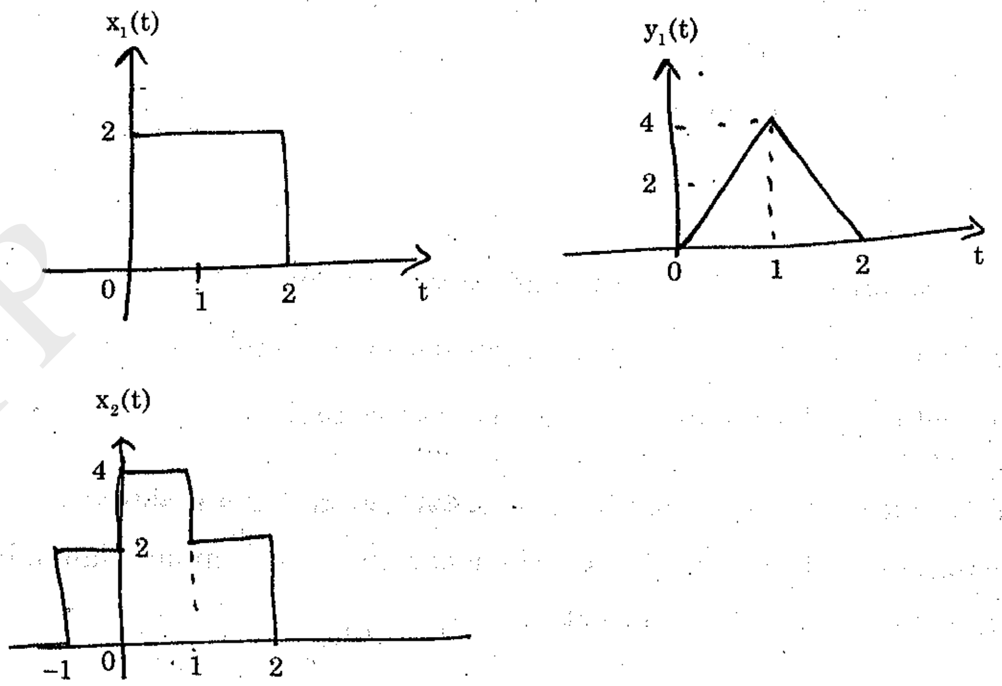


Figure 1

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)**

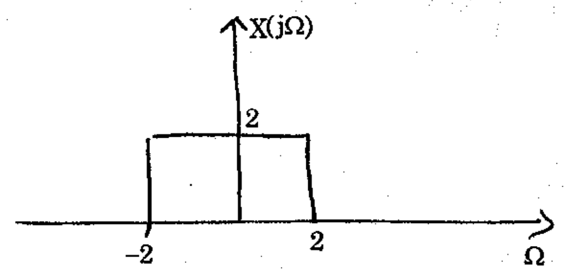


Figure 2

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 $x(t) = 2\cos 150\pi t + 2\sin 400\pi t$ 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.

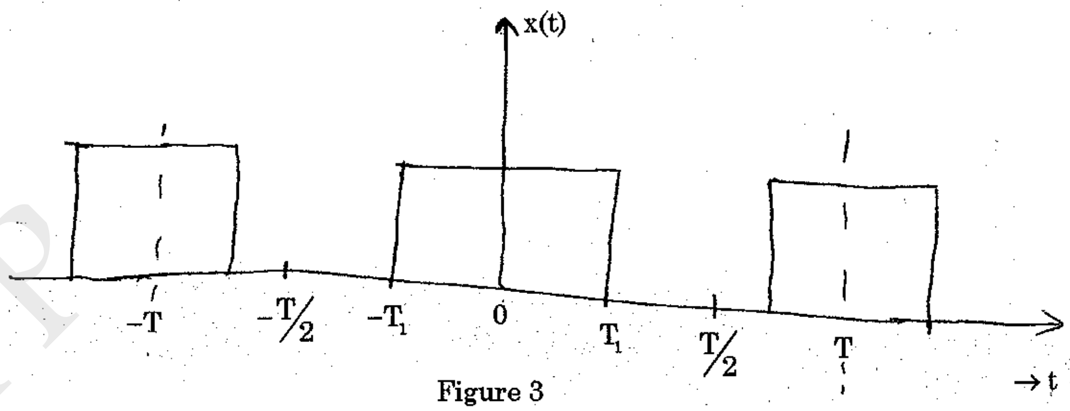


Figure 3

Also plot the spectrum of the signal. (15)