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 $X(z) = \dfrac{az^{-1}}{(1-az^{-1})^2}\ ; |z| > |a|$

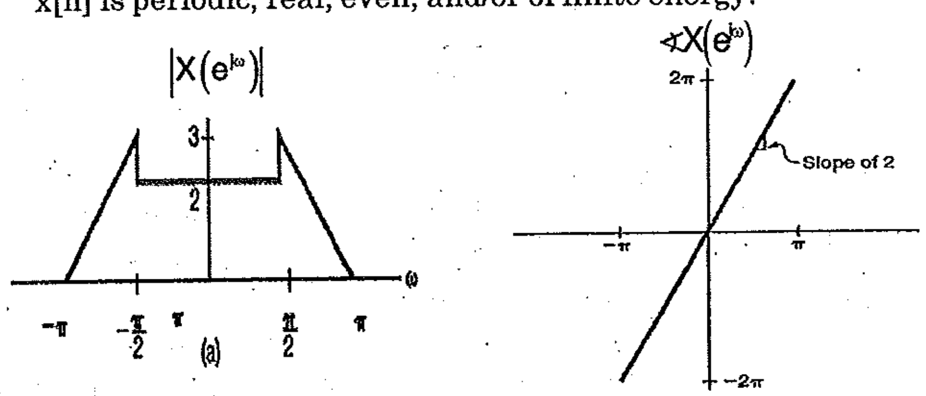
ii) Check whether the system function is causal or not

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

iii) Consider a system with impulse response $H(s) = \dfrac{e^{s}}{S+1}; \mathrm{Re}\{s\} > -1$. 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

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 $H(s) = \dfrac{1}{(s+1)(s+3)}$ Re(s)>3; determine h(t).

7. List the ROC properties of Laplace transform.

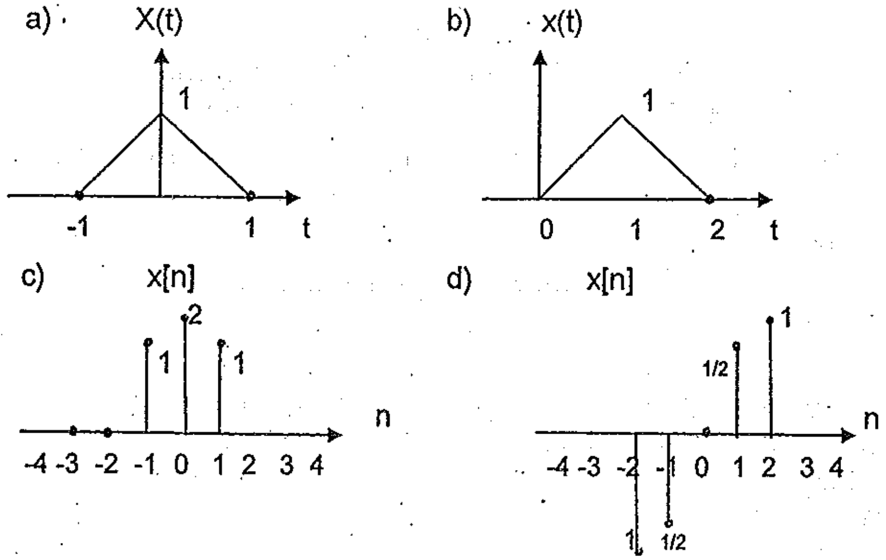
8. Find the Z transform of a sequence $x[n] = \cos(n\omega T)\,u[n]$.

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.

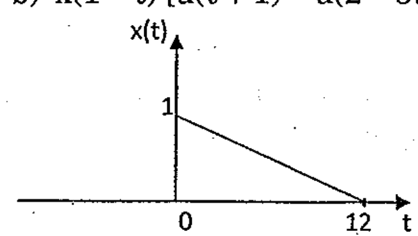
PART – B (5×13=65 Marks)

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)

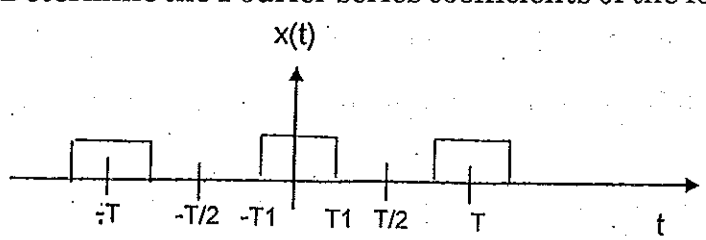


(OR)

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)

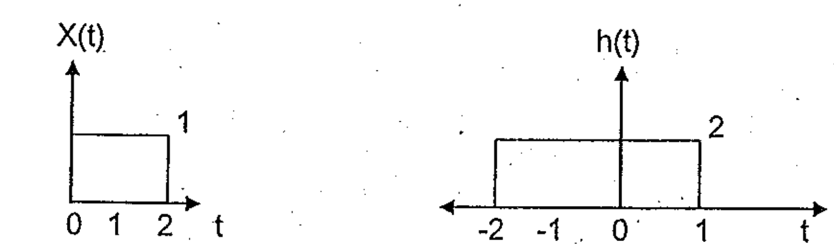
b) i) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-a|t|}, a > 0$. Also draw its amplitude and phase spectra. (7)
   ii) Obtain the inverse Laplace transform of the function (6)

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

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)

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