15. a) i) Obtain the parallel realization of the system given by
$y(n) - 3y(n-1) + 2y(n-2) = x(n)$. **(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 $X(z) = \dfrac{az^{-1}}{\left(1 - az^{-1}\right)^2}; |z| > |a|$

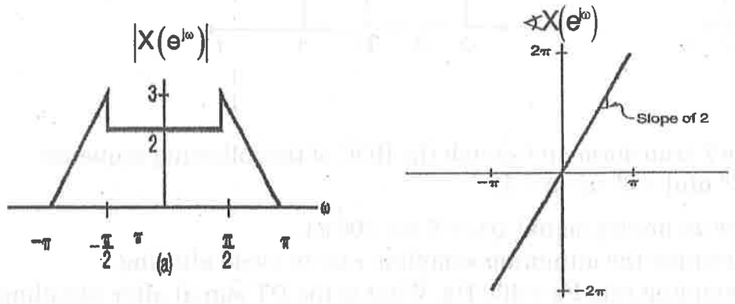
ii) Check whether the system function is causal or not

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

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

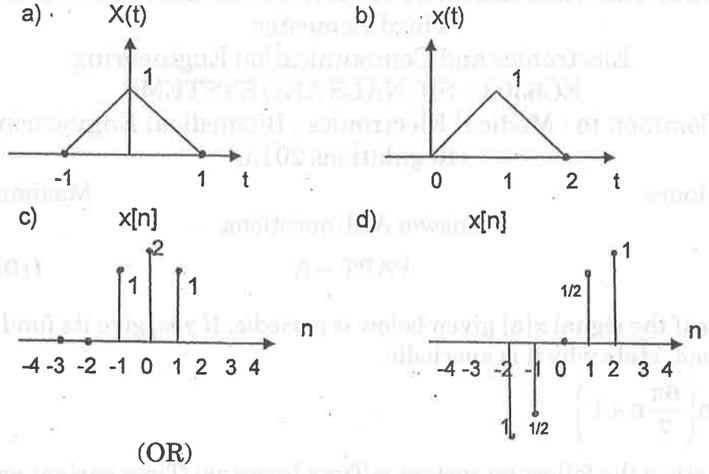
Answer ALL questions.

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 $H(s) = \dfrac{1}{(s+1)(s+3)}$ 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)**

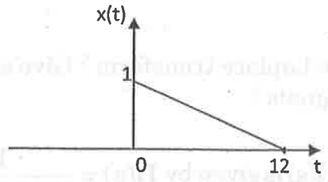


(OR)

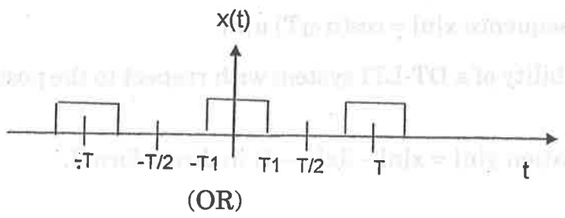
b) Determine whether the following system is Linear and Causal.

   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)

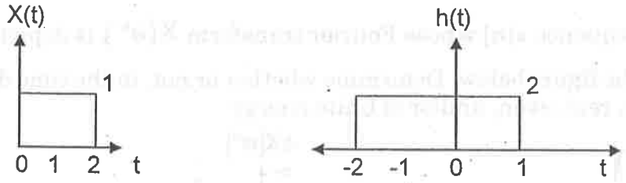
   b) i) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-a|t|}, a > 0$. Also draw its amplitude and phase spectra. **(7)**
   ii) Obtain the inverse Laplace transform of the function **(6)**

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

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)**

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