Reg. No. :

Question Paper Code : X10353

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Third Semester
Electronics and Communication Engineering
EC8352 – SIGNALS AND SYSTEMS
(Common to Electronics and Telecommunication Engineering / Computer and Communication Engineering / Biomedical Engineering / Medical Electronics)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Determine average power P_∞ for the signal $x(t) = 2\cos(t)$.

2. Express discrete time unit impulse signal in terms of discrete time unit step signal and express discrete time unit step signal in terms of discrete time unit impulse signal.

3. Determine Fourier transform for unit step signal.

4. Determine the Laplace transform for the signal $x(t) = e^{-4t}u(t)$.

5. Define an invertible continuous time system.

6. State Parsevals Theorem.

7. Determine the Nyquist rate for the signal $x(t) = 1 + \cos(4000\pi t)$.

8. Find the Fourier transform for the discrete time signal $x[n] = \delta[n] + \delta[n-1] + \delta[n+1]$ and draw its spectrum.

9. State the characteristic of Region Of Convergence of a Causal LTI system described by its transfer function H(z).

10. Determine Z-transform of unit impulse signal $\delta[n]$ and sketch its ROC.

PART – B **(13×5=65 Marks)**

11. a) i) Consider the system described by the input output relation, $y(t) = [\cos(3t)]x(t)$. Here $x(t)$ stands for input and $y(t)$ for output. State with justification whether the system is linear and/or time invariant. **(4)**

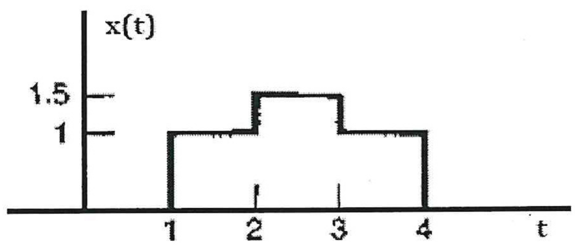
ii) Derive the condition necessary for the impulse response $h[n]$ of an LTI system to be stable and Causal. **(5)**

iii) State whether the LTI system described by impulse response $h[n]=\left(\frac{1}{4}\right)^n u[-n]$ is causal and stable with justification. **(4)**

(OR)

b) i) For the signal $x(t)$ shown in Figure, sketch $x\left(2-\frac{t}{2}\right)$. **(5)**

ii) Sketch the even and odd part of the signal $x(t)$ shown in Figure. **(4)**



Figure

iii) Let $x[n] = u[n + 4]$; $h[n]= \delta[n] - \delta[n-2]$. Sketch the convolution of $x[n]$ and $h[n]$. **(4)**

12. a) i) Consider the periodic signal $x(t) = \sum_{k=-\infty}^{+\infty} a_k e^{jk\omega_0 t}$. Derive the expression for the Fourier series coefficient a_m of the complex exponential $e^{jm\omega_0 t}$. **(7)**

ii) Let $x(t)= \delta(t) - \frac{2}{3} e^{-2t}u(t) + \frac{1}{3} e^{-4t}u(t)$. Determine Laplace transform for the signal $x(t)$. Plot pole zero and mark region of convergence. **(6)**

(OR)

b) i) Derive the Fourier Transform for the rectangular pulse $x(t)$ given in the below expression and plot the magnitude spectrum $X(j\omega)$. **(7)**

$$x(t) = \begin{cases} 1, & |t| < T_1 \\ 0, & T_1 < |t| < T/2 \end{cases}$$

ii) Determine Laplace transform for the signal $x(t) = e^{-a|t|}$ and mark the region of convergence in s plane. **(6)**

13. a) Let $x(t) = u(t-2) - u(t-5)$ and $h(t) = e^{-5t}$. Compute the convolution $y(t) = x(t) * h(t)$ and sketch the signal $y(t)$. **(13)**

(OR)

b) Consider an LTI system described by differential equation

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} + 2x(t).$$ Here $x(t)$ and $y(t)$ are the input and output of the system respectively.

i) Determine the transfer function $H(s)$ of the system, if the system is causal and stable. **(6)**

ii) Considering the system to be causal and stable, if the input is defined as $x(t) = e^{-3t}u(t)$, determine the response $y(t)$. **(7)**

14. a) i) Determine DTFT for the signal $x[n]$

$$x[n] = \begin{cases} 1, & |n| < N_1 \\ 0, & |n| > N_1 \end{cases}$$. Sketch its spectrum for $N_1 = 4$. **(8)**

ii) Consider a signal $x[n] = 5\left(\frac{1}{3}\right)^n u[n] - 3\left(\frac{1}{4}\right)^n u[n]$, determine its Z-transform $X[z]$ and mark its ROC. **(5)**

(OR)

b) i) Determine the Z-transform for the signal $x[n] = \left(\frac{1}{2}\right)^n \sin\left(\frac{\pi}{8}n\right) u[n]$ and mark its ROC. **(8)**

ii) Determine the Fourier transform for the signal $x[n] = u[n-3] - u[n-7]$. **(5)**

15. a) i) A Discrete time LTI system provides response $y[n] = 0.4^n u[n]$ for input $x[n] = 0.2^n u[n]$. Determine frequency response $H(e^{j\omega})$ of the system. **(7)**

ii) Consider second order LTI system described by $H(z) = \dfrac{1}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}$.

Determine the impulse response if the system is causal. **(6)**

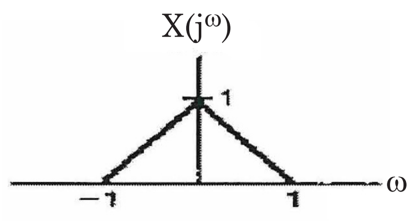
(OR)

b) Determine and plot the convolution of $x[n]$ and $h[n]$ defined by

$x[n] = \left(\frac{1}{3}\right)^{n-1} u[n-1]$ and $h[n] = u[n+3]$. **(13)**

PART – C **(1×15=15 Marks)**

16. a) Consider a signal x(t) with $X(j^{\omega})$ shown in Figure Let p(t) = sin(t).sin(2t). Determine the Fourier transform for the signal y(t) generated by the product of x(t) and p(t) given by y(t) = x(t).p(t). Sketch the spectrum $Y(j^{\omega})$. **(15)**



(OR)

b) Given x[n] has Fourier transform $x(e^{j\omega n})$. Express Fourier transform for the following signals

i) $x_1[n] = x[2 - n] + x[-2 - n]$ **(5)**

ii) $x_2[n] = (n - 1)^2\, x[n]$. **(10)**