

Question Paper Code : 40953

14/05/18

Ans

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

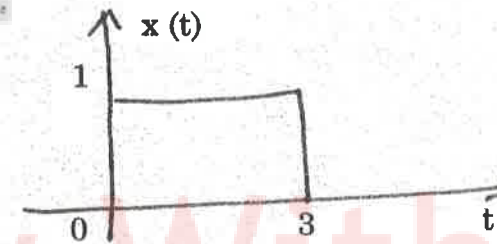
Maximum : 100 Marks

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  $h(t) = \delta(t - 1)$ . Find the response  $y(t)$ .
6. Given  $X(s) = \frac{3}{s+2}$ , ROC :  $\text{Re}\{s\} > -2$ . Find  $x(t)$ .
7. Find the Nyquist rate for the signal  $x(t) = 1 + \cos 10\pi t$ , 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

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

## 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

$$x[n] = a^n u[n] + b^n u[-n-1]. \text{ Considering the two conditions } a > b \text{ and } a < b.$$

(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)