Reg. No. :

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)

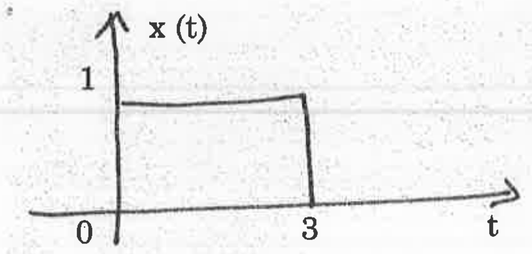
(Regulations 2013)

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)