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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)

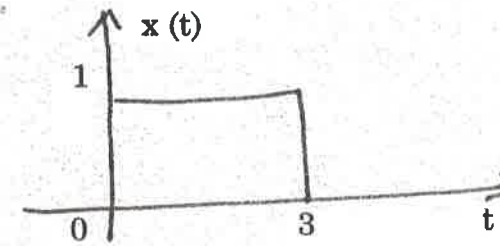
Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART - A (10×2=20 Marks)

1. Represent the following signal in terms of the unit step function.



- What is a random signal ? Give an example.
- Find the Fourier series representation of the signal $x(t) = \cos \frac{2\pi}{3} t$.
- Give Parseval's relation for continuous time Fourier transform.
- Given the input $x(t) = u(t)$ and $h(t) = \delta(t - 1)$. Find the response $y(t)$.
- Given $X(s) = \frac{3}{s+2}$, ROC : $\text{Re}\{s\} > -2$. Find $x(t)$.
- 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)