SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code : SIGNALS AND SYSTEMS(18EC403) **Course & Branch**: B.Tech - ECE

Year & Sem: II B.Tech & I Sem **Regulation:** R18

UNIT –I

INTRODUCTION TO SIGNALS AND SYSTEMS

SHORT ANSWER QUESTIONS (2 MARKS)

1.Define a Signal. What is the relation between impulse, step, ramp and parabolic signals? [02M]
2.How are the signals are classified? [2M]
3. Define Unit impulse and Unit step Signals. [2M]
4.Distinguish between periodic and non-periodic signals [2M]
5. Distinguish causal and anti-causal signals. [2M]
6. Define Linear and Non-Linear System [2M]
7. Define time-variant and time-invariant systems. [2M]
8.How are systems classified? [2M]
9.Define stable and unstable systems. [2M]
10.Define causal and non-causal systems. [2M]

LONG ANSWER QUESTIONS (10 MARKS)

1.Define various elementary signals in continuous time and discrete time and indicate them Graphically? [10M]
2.What are the basic operations on signals? Illustrate with an example. [10M]
3.Explain the classification of signals in both continuous time and discrete time with suitable examples. [10M]
4.(a) Find which of the signals are causal or non-causal. [5M]
(i) $x(t)= e^{2t}u(t-1)$ (ii) $x(t)=3\ \text{sinc}\ 2t$ (iii) $x(n)=u(n+4)-u(n-2)$ (iv) $x(t)=u(-n)$
(b) Sketch the following signals [5M]
(i) $2u(t+2)- 2u(t-3)$ (ii) $u(t+4)\ u(-t+4)$ (iii) $r(t)-r(t-1)-r(t-3)-r(t-4)$ (iv) $\pi(t-2)$
5.Find whether the following signals are periodic or not? If periodic determine the fundamental Period
(a) $\sin 12\pi t$ (b)$3\sin 200\pi t+4\cos 100t$ (c) $\sin 10\pi t+\cos 20\pi t$
(d)$\sin(10t+1)- 2\cos(5t-2)$ (e) $e^{j4\pi t}$ [10M]
6.(a) Find the even and odd components of the following signals [5M]
(i) $x(t)= e^{j2t}$ (ii) $x(t) =(1+t^2+t^3)\cos^2 10t$ (iii) $x(n)=\{-3,1,\underset{\uparrow}{2}, -4,2\}$ (iv) $x(n)=\{5,4,\underset{\uparrow}{3},2,1\}$
(b)Determine whether the following signals are energy signals or power signals. Calculate their energy or power? [5M]
(i)$x(t)= 8\cos 4t\cos 6t$ (ii) $\sin^2 \omega_0 t$ (iii) $x(t)= e^{j[3t+(\pi/2)]}$ (iv) $x(n)=(1/2)^n u(n)$
7.Define a system. How are systems classified? Define each one of them. [10M]
8.Check whether the following system is [10M]
(a) static or dynamic (b) linear or non- linear
(c) causal or non- causal (d) Time invariant or time variant
(i)$d^3y(t)/dt^3+2d^2y(t)/dt^2+4\ dy(t)/dt+3y^2(t)=x(t+1)$

(ii)$d^2y(t)/dt^2+2y(t)\ dy(t)/dt+3ty(t)=x(t)$

9. Check whether the following system is [10M]

(a) static or dynamic (b) linear or non- linear

(c) causal or non- causal (d) Time invariant or time variant

(i)$y(n) = \log_{10} |x(n)|$ (ii) $y(n)=x^2(n)+1/x^2(n-1)$ (iii) $y(t)=at^2\ x(t)+bt\ x(t-4)$

10.(a) Check whether the following systems are causal or not? [5M]

(i)$y(t)=x^2(t)+x(t-4)$ (ii) $y(t)=x(t/2)$ (iii)$y(n)=x(2n)$

(b) Find whether the following systems are stable or not [5M]

(i) $y(t)= (t+5)\ u(t)$ (ii) $y(t) =(2+e^{-3t})\ u(t)$ (iii) $h(n)=a^n$ for $0<n<11$

UNIT –II

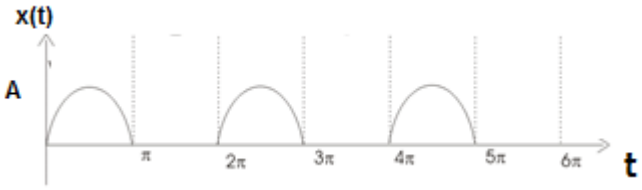
FOURIER SERIES AND FOURIER TRANSFORM

SHORT ANSWER QUESTIONS

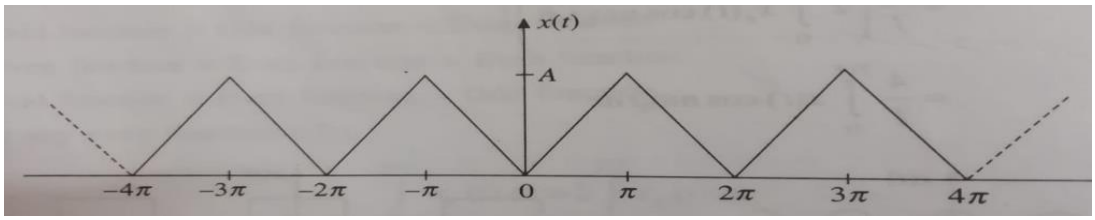
1.What is Fourier Series. [2M]
2.Waht are the three important classes of Fourier series methods available. [2M]
3.What are the Dirichlet's conditions? State them. [2M]
4.What is the Relationship between exponential Fourier series and trigonometric Fourier series coefficients? [2M]
5.How do you obtain Cosine Fourier series from exponential Fourier series? [2M]
6. Differentiate the Fourier series and Fourier transform. [2M]
7.what is Fourier transform? [2M]
8. Define Linearity Property of Fourier transform [2M]
9.What are the Merits of Fourier Transform? [2M]
10. Define Fourier transform and Inverse Fourier transform of discrete time signal. [2M]

LONG ANSWER QUESTIONS

1.Find the Fourier series expansion of the half wave rectified sine wave shown in figure. [10M]



2.State and Prove any Five Properties of the Fourier Series. [10M]
3. Derive the expressions for the trigonometric Fourier series coefficients. [10M]
4.Explain about exponential Fourier series and derive the Fourier series coefficient [10M]
5.(a) Obtain the trigonometric series for the waveform shown in figure [5M]



(b) Derive the expression for Fourier transform from Fourier series. [5M]
6.(a) Find the Fourier transform of the following [5M]
(i) sgn(t) (ii) sin $\omega_0 t$ (iii)cos $\omega_0 t$ (iv) 1(Constant Amplitude)
(b). Find the Fourier transform of the following [5M]
(i) impulse function (ii) $x(t)=e^{-at}u(t)$ (iii) $x(t)=e^{j\omega o^t}$ (iv) x(t)=u(t)
7.State and Prove the properties of Continuous time Fourier transform? [10M]
8.(a) Find the Fourier transform of the following signals [8M]
(i) $x(t)=e^{-3t}u(t)$ (ii) $x(t)=te^{-at}u(t)$ (iii) $x(t)=e^{-t}\sin 5t\,u(t)$ (iv) $x(t) = e^{-t}\cos 5t\,u(t)$
(b) Find the Fourier transform of (i)sin $\omega_0 t$ (ii) cos $\omega_0 t$ [2M]
9.Find the inverse Fourier transform of the following signals [10M]
(i) $X(\omega)=4(j\omega)+6/(j\omega)^2+6(j\omega)+8$ (ii) $X(\omega)=1+3(j\omega)/(j\omega+3)^2$ (iii) $X(\omega)=e^{-2\omega}u(w)$
10.(a) State and prove any three properties of the DTFT. [5M]
(b) Find the Fourier Transform of the Signal (i) Triangular Pulse (ii) $e^{-a|t|}$ [5M]

UNIT –III

SIGNAL TRANSMISSION THROUGH LINEAR SYSTESMS

SHORT ANSWER QUESTIONS

1.What are the properties of LTI systems? [2M]
2.Define transfer function of a system? [2M]
3.Define impulse response of a system.? [2M]
4.what is a filter? How are filters classified? [2M]
5.What is the Relation between unit step and impulse response? [2M]
6.Define sampling and sampling period? [2M]
7.State Sampling theorem [2M]
8.what is Nyquist rate and Nyquist interval? [2M]
9.What is anti-aliasing filter? [2M]
10.State Sampling theorem? [2M]

LONG ANSWER QUESTIONS

1.(a) Explain the Filter characteristics of linear systems explain with neat diagrams [5M]
(b) Define the following (i)Impulse Response (ii)Step Response (iii) Response of the System [5M]
2.(a) Derive the transfer function and impulse response of an LTI system. [5M]
(b) Define Linear time variant, Linear time-invariant, step response of the system. [5M]
3.Discuss the properties of linear time invariant systems. [10M]
4.(a) Consider a stable LTI System characterized by the differential equation $dy(t)/dt+2y(t)=x(t)$, Find its impulse response. [5M]
(b) Find the Nyquist Rate and Nyquist Interval of the following signals. [5M]
(i)$x(t)=1+\cos 2000\pi t + \sin 4000\pi t$ (ii) $x(t)=10 \sin 40\pi t \cos 300\pi t$
5.(a) Let the system function of an LTI system be $1/(j\omega+2)$. What is the output of the system for an input $(0.8)^t u(t)$? [5M]
(b) Consider a causal LTI system with frequency response $H(\omega)=1/4+j\omega$, for a input x(t), the system is observed to produce the output $y(t)=e^{-2t}u(t)- e^{-4t}u(t)$. find the input x(t).[5M]

7. Consider a stable LTI system that is characterized by the differential equation [10M]
$d^2y(t)/dt^2+4dy(t)/dt+3y(t)= dx(t)/dt+2x(t)$ find the response for an input $x(t)=e^{-t} u(t)$.
8.Find the Nyquist rate and Nyquist interval for the following signals [10M]
(i) $x(t)=1+\cos 2000\pi t +\sin 4000\pi t$ (ii) $10 \sin 40\pi t \cos 300\pi t$
(iii)$x(t)=\text{sinc}(100\pi t) + 3\,\text{sinc}^2(60\pi t)$ (iv) $x(t)= 2\,\text{sinc}(100\pi t)$
9.State and prove the sampling theorem for the band-limited signals with the help of graphical representation. [10M]
10.(a) Discuss about Effects of the under sampling. [5M]
(b) A system produces an output of $y(t)= e^{-3t} u(t)$ for an input of $x(t)= e^{-5t} u(t)$. Determine the impulse response and frequency response of the system. [5M]

UNIT –IV

CONVOLUTION AND CORRELATION OF SIGNALS

SHORT ANSWER QUESTIONS

1.What is convolution? State the shift property of convolution. [2M]
2.State Time convolution and Frequency convolution theorem [2M]
3.What is correlation and types of correlation? [2M]
4.What are the properties of cross correlation for energy signals? [2M]
5. What are the properties of auto correlation for power signals? [2M]
6.What is the relation between convolution and correlation? [2M]
7.What are the Properties of ESD? [2M]
8. differentiate ESD and PSD? [2M]
9.State Parseval's energy theorem? [2M]
10. State Parseval's power theorem? [2M]

LONG ANSWER QUESTIONS

1.(a) Write the properties of convolution. [5M]
(b) Find the convolution of the following signal $x_1(t)= e^{-2t}\,u(t)$, $x_2(t)=e^{-4t}\,u(t)$ [5M]
2.(a) State and prove the time convolution theorem with Fourier transforms. [5M]
(b) State and prove the frequency convolution theorem with Fourier transforms. [5M]
3.(a) Derive the relation between convolution and correlation. [5M]
(b). Write the properties of cross correlation for energy signals [5M]
4.(a) State and prove the Parseval's theorem for energy signals. [5M]
(b) State and prove the Parseval's theorem for power signals. [5M]
5.(a) Derive and Define the properties of Energy Spectral Density. [5M]
(b) Derive and Define the properties of Power Spectral Density [5M]
6.(a) Show that R(r) and ESD form Fourier transform pair. [5M]
(b) Show that R(r) and PSD form Fourier transform pair. [5M]
7.(a) Verify Parseval's theorem for the energy signal $x(t)=e^{-4t}\,u(t)$. [5M]
(b) Determine the autocorrelation function and energy spectral density of $x(t)=e^{-at}\,u(t)$. [5M]
8.(a) Find the autocorrelation of the signal $x(t)= a \sin(\omega_0 t +\theta)$. [5M]
(b) Distinguish the ESD and PSD. [5M]
9.(a) Explain the detection of periodic signals in the presence of noise by auto correlation. [5M]
(b) Explain the detection of periodic signals in the presence of noise by cross correlation [5M]
Explain the extraction of noise by Filtering.
10.Exaplain the extraction of a signal from noise by filtering. [10M]

UNIT –V

LAPLACE TRANSFORMS AND Z-TRANSFORMS

SHORT ANSWER QUESTIONS

1.What is the region of convergence (ROC)? [2M]
2.What is the relation between Laplace transform and Fourier transform? [2M]
3.State initial value theorem and final value theorem of Laplace transform. [2M]
4.What are the properties of ROC? [2M]
5. What is the Laplace Transform of Parabolic Function.? [2M]
6.What is the relation between Discrete-time Fourier transform and Z-transform? [2M]
7.What is the Z-transform of unit step signal? [2M]
8.Find Z-transform and ROC of $x(n)=(1/2)^n u(n-2)$ [2M]
9.State the Convolution Property of Z-transform [2M]
10. Discuss the comparison of Laplace and Z-Transform. [2M]

LONG ANSWER QUESTIONS

1.State and prove the any five Properties Laplace Transform [10M]
2.(a) Find the Laplace transform of the signal $x(t)= e^{-at} u(t) - e^{-bt} u(-t)$ and also find its ROC [5M]
(b) Find the Laplace transform and region for the following signals [5M]
(i)$x(t)=e-5t\ u(t-1)$ (ii)$x(t)=e^{2t} \sin 2t$ for $t \leq 0$ (iii) $x(t)=t\ e^{-2|t|}$
3.Find the Laplace transform of the following signals using properties of Laplace transform [10M]
(i) $x(t)=t\ e^{-t} u(t)$ (ii) $x(t)=t\ e^{-2t} \sin 2t\ u(t)$ (iii)$x(t)= \sin at/t$ (iv) $x(t)=1-e^t/t$
3.Find the inverse Laplace transform of the following [10M]
(a)$X(s) = 1/ s(s+1)(s+2)(s+3)$ (b) $X(s)= (3s^2+22s+27)/(s^2+3s+2)(s^2+2s+5)$
(c) $X(s)=s/(s+3)(s^2+4s+5)$
4.(a) Find the convolution of the sequences: [5M]
(b) Discuss about the Properties of the ROC of Laplace transform
5.(a)
(b).
6.Find the inverse z-transform of: [5M]
$X(z)=3z^{-1}/(1-z^{-1})(1-2z^{-1})$
(a)If ROC; $|z|>2$ (b) If ROC ; $|z|<1$ (c) If ROC ; $1<|z|<2$
7.(a) Find the inverse Z-transform of X(z) given $X(z) = 1/(1-az^{-1})$, ROC; $z|>|a|$ [5M]
(b) Find the convolution of the sequences: [5M]
$x_1(n)=(1/2)^n u(n)$ and $(1/3)^{n-2}u(n)$
8.(a) State and prove initial and final value theorems of Z-transform? [5M]
(b) Using the Properties of Z-transform. Find the Z-transform of following signals
(i) $x(n)=u(-n)$ (ii) $x(n)=2^n u(n-2)$ (iii) $2(3)^n u(-n)$
10.(a) Prove that the final value of x(n) for $X(z) = z^2/(z-1)(z-0.2)$ is 1.25 and its final value is unity?
(b). Find the inverse Z-transform of $X(z)= z^{-1}/(3-4z^{-1}+z^{-2})$, ROC: $|z|>1$

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