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Question Paper Code : 31354

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Third Semester

Electronics and Communication Engineering

EC 2204/EC 35/EC 1202 A/080290015/10144 EC 305 — SIGNALS AND SYSTEMS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the mathematical and graphical representation of continuous time and discrete time unit impulse function.
2. What are the conditions for a system to be LTI system?
3. State Dirichlet's conditions.
4. Give the equation for trigonometric Fourier series.
5. What are the three elementary operations in block diagram representation of continuous time system?
6. Check whether the causal system with transfer function $H(s)=\frac{1}{s-2}$ is stable.
7. What is aliasing?
8. Define unilateral and bilateral Z transform.
9. Define convolution sum with its equation.
10. Check whether the system with system function $H(z)=\frac{1}{1-\frac{1}{2}z^{-1}}+\frac{1}{1-2z^{-1}}$ with ROC $|Z|<½$ is causal and stable.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine whether the signal $x(t)=\sin 20\pi t+\sin 5\pi t$ is periodic and if it is periodic find the fundamental period. (5)

(ii) Define energy and power signals. Find whether the signal $x(n)=\left(\frac{1}{2}\right)^n u(n)$ is energy or power signal and calculate their energy or power. (5)

(iii) Discuss various forms of real and complex exponential signals with graphical representation. (6)

Or

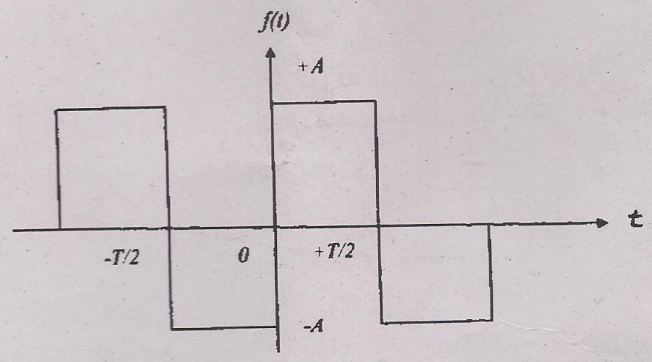
(b) Determine whether the discrete time system $y(n)=x(n)\cos(\omega n)$ is

(i) Memoryless (ii) Stable

(iii) Causal (iv) Linear

(v) Time invariant. (16)

12. (a) (i) Find the exponential Fourier series of the waveform. (10)



(ii) Find the Fourier transform of the signal $x(t)=e^{-a|t|}$. (6)

Or

(b) (i) Find the Laplace transform of the signal $f(t)=e^{-at}\sin\omega t$. (8)

(ii) Find the inverse Fourier transform of the rectangular spectrum given by $X(j\omega)=\begin{cases}1, & -W<\omega<W\\ 0, & |\omega|>W\end{cases}$. (8)

13. (a) (i) Define convolution integral and derive its equation. (8)

(ii) A stable LTI system is characterized by the differential equation

$$\frac{d^2y(t)}{dt^2}+4\frac{dy(t)}{dt}+3y(t)=\frac{dx(t)}{dt}+2x(t)$$

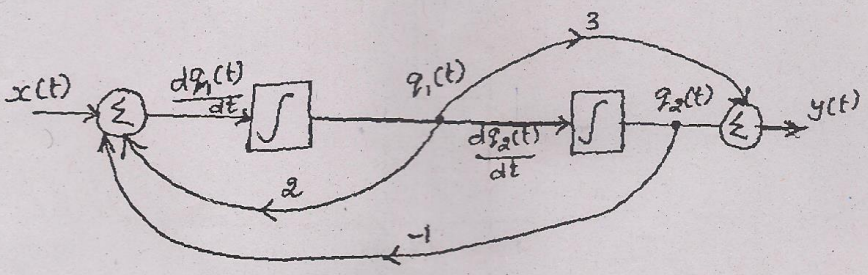
Find the frequency response and impulse response using Fourier transform. (8)

Or

(b) (i) Draw direct form, cascade form and parallel form of a system with system function.

$$H(s)=\frac{1}{(s+1)(s+2)}.$$ (8)

(ii) Determine the state variable description corresponding to the block diagram given below. (8)



14. (a) (i) Determine the discrete time Fourier transform of $x(n)=a^{|n|}$, $|a|<1$. (8)

(ii) Find the z transform and ROC of the sequence $x(n)=r^n\cos(n\theta)u(n)$. (8)

Or

(b) (i) State and prove the following properties of z transform

(1) Linearity

(2) Time shifting

(3) Differentiation

(4) Correlation. (8)

(ii) Find the inverse z-transform of the function

$$X(z)=\frac{1+z^{-1}}{\left(1-\frac{2}{3}z^{-1}\right)^2} \text{ ROC } |z|>\frac{2}{3}.$$ (8)

15. (a) (i) Compute convolution sum of the following sequences

$$x(n)=\begin{cases}1, & 0\le n\le 4\\ 0, & \textit{Otherwise}\end{cases} \text{ and}$$

$$h(n)=\begin{cases}\alpha^n, & 0\le n\le 6\\ 0, & \textit{Otherwise}\end{cases}. \qquad (10)$$

(ii) Draw direct form I and direct form II implementations of the system described by difference equation.

$$y(n)+\frac{1}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n)+x(n-1). \qquad (6)$$

Or

(b) (i) Determine the transfer function and the impulse response for the causal LTI system described by the difference equation using z transform.

$$y(n)-\frac{1}{4}y(n-1)-\frac{3}{8}y(n-2)=-x(n)+2x(n-1). \qquad (8)$$

(ii) Develop the state variable description for the discrete time system given below. (8)