Reg. No. :

Question Paper Code : 11324

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Third Semester

Electronics and Communication Engineering

EC 2204/147303/EC 35/EC 1202 A/10144 EC 305/080290015 — SIGNALS AND SYSTEMS

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine whether the following signal is energy or power signal. And calculate its energy or power :

$$x(t) = e^{-2t}\, u(t)$$

2. Check whether the following system is static (or) dynamic and also causal (or) non-causal :

$$y(n) = x(2n)$$

3. Give synthesis and analysis equations of continuous time Fourier transform.

4. Define the region of convergence of the Laplace transform.

5. List and draw the basic elements for the block diagram representation of the continuous time system.

6. Check the causality of the system with impulse response $h(t) = e^{-t}\, u(t)$.

7. Define DTFT and inverse DTFT.

8. State the convolution property of the z-transform.

9. Convolve the following two sequences :

$$x(n) = \{1, 1, 1, 1\}$$

$$h(n) = \{3, 2\}$$

10. A causal LTI system has impulse response $h(n)$, for which the z-transform is $H(z) = \dfrac{1+z^{-1}}{(1-0.5z^{-1})(1+0.25z^{-1})}$. Is the system stable? Explain.

PART B — (5 × 16 = 80 marks)

11. (a) (i) How are the signals classified? Explain. (8)

(ii) Determine whether the following signal is periodic. If periodic, determine the fundamental period : (4)

$$x(t) = 3\cos t + 4\cos\frac{t}{3}.$$

(iii) Give the equation and draw the waveforms of discrete time real and complex exponential signals. (4)

Or

(b) (i) Determine whether the following system is linear, time invariant, stable and invertible : (10)

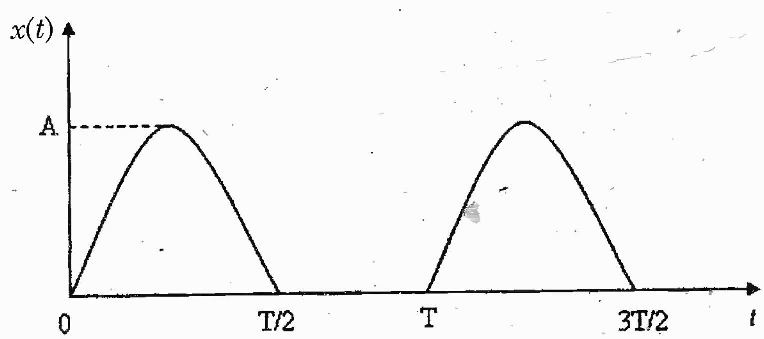
(1) $y(n) = x^2(n)$

(2) $y(n) = x(-n)$

(ii) Define LTI system. List the properties of LTI system and explain.(6)

12. (a) (i) State Dirichlet's conditions. Also state its importance. (4)

(ii) Obtain the trigonometric Fourier series for the half wave rectified sine wave given below. (12)



Or

(b) (i) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-2|t|}$. Also draw its amplitude and phase spectra. (8)

(ii) Obtain the inverse Laplace transform of the function $X(s) = \frac{1}{s^2 + 3s + 2}$, ROC : $-2 < \text{Re}\{s\} < -1$. (8)

13. (a) (i) What is impulse response? Show that the response of an LTI system is convolution integral of its impulse response with input signal? (6)

(ii) Obtain the convolution of the following two signals : (10)

$$x(t) = e^{2t} u(-t)$$
$$h(t) = u(t-3)$$

Or

(b) The input $x(t)$ and output $y(t)$ for a system satisfy the differential equation $\frac{d^2 y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$.

(i) Compute the transfer function and impulse response. (8)

(ii) Draw direct form, cascade form and parallel form representations. (8)

14. (a) (i) State and prove sampling theorem for low pass band limited signal and explain the process of reconstruction of the signal from its samples. (10)

(ii) State and prove any two properties of DTFT. (6)

Or

(b) (i) Find the z-transform of the sequence $x(n) = \cos(n\theta)\, u(n)$. (8)

(ii) Determine the inverse z-transform of the following expression using partial fraction expansion : (8)

$$X(z) = \frac{1}{\left(1 - \frac{1}{3}z^{-1}\right)\left(1 - \frac{1}{6}z^{-1}\right)}, \quad \text{ROC} : |z| > \frac{1}{3}.$$

15. (a) (i) Find the system function and the impulse response $h(n)$ for a system described by the following input-output relationship

$$y(n) = \frac{1}{3} y(n-1) + 3x(n).$$ (6)

(ii) A linear time-invariant system is characterized by the system function

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}.$$

Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions :

(1) The system is stable

(2) The system is causal

(3) The system is anti-causal. (10)

Or

(b) (i) Derive the necessary and sufficient condition for BIBO stability of an LSI system. (6)

(ii) Draw the direct form, cascade form and parallel form block diagrams of the following system function : (10)

$$H(z) = \frac{1}{\left(1 + \frac{1}{2} z^{-1}\right)\left(1 - \frac{1}{4} z^{-1}\right)}.$$