Reg. No. :

Question Paper Code : 30939

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third Semester

Electronics and Communication Engineering

EC 2204 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering)

(Regulation 2008)

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 the time scaling property of Laplace transform.

4. What is the Fourier transform of a DC signal of amplitude 1?

5. List the properties of convolution integral.

6. State the significance of impulse response.

7. Define DTFT and inverse DTFT.

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

9. List the advantages of the state variable representation of a system.

10. Find the system function for the given difference equation $y(n) = 0.5\, y(n-1) + x(n)$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the even and odd components of the signal $x(n) = \{1, 0, -1, 2, 3\}$. (8)

(ii) Find the fundamental period of the signal $x(t) = e^{j\frac{7\pi}{3}n}$. (8)

Or

(b) (i) Check the system $y(n) = \log_{10}|x(n)|$ is linear, time invariant, causal and static. (10)

(ii) Find the summation $\sum_{n=0}^{5} \delta(n+1)2^n$. (6)

12. (a) (i) Prove the scaling and time shifting properties of Laplace transform. (8)

(ii) Determine the Laplace transform of $x(t) = e^{-at} \cos \omega t \, u(t)$. (8)

Or

(b) (i) State and prove the Fourier transform of the following signal in terms of $X(j\omega); x(t-t_0), x(t)e^{j\omega t}$. (8)

(ii) Find the complex exponential Fourier series coefficient of the signal $x(t) = \sin 3\pi t + 2\cos 4\pi t$. (8)

13. (a) (i) Determine the impulse response $h(t)$ of the system given by the differential equation $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$ with all initial conditions to be zero. (8)

(ii) Obtain the direct form I realization of $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$. (8)

Or

(b) The system produces the output $y(t) = e^{-t}u(t)$ for an input $x(t) = e^{-2t}u(t)$. Determine

(i) frequency response

(ii) magnitude and phase of the response

(iii) the impulse response. (16)

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

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

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)

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