Roll No. ....

3037

B. Tech. 3rd Semester (ECE)
Examination – February, 2022

SIGNALS AND SYSTEMS

Paper : PCC-ECE-209-G

Time : Three hours]   *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Q. No. 1 is *compulsory*. Attempt *five* questions in all taking *one* question from each Unit.

1. (a) Define unit impulse function.   2.5

     (b) Check $x(n) = \cos(n/6 - \pi)$ is periodic or nonperiodic.   2.5

     (c) Explain in brief the region of convergence.   2.5

     (d) Explain the condition for the existence of fourier transform.   2.5

     (e) Explain the relationship between z transform and fourier transform.   2.5

     (f) Explain in brief the applications of z transform.   2.5

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UNIT– I

2. Define signal. Explain in detail the classification of signals with examples.   15

3. (a) Prove that sine wave $x(t) = A \sin wt$ is a periodic signal.   8

   (b) Write short notes on :   7

      (i) Linear and non linear system.

      (ii) Invertible and non invertible system

UNIT– II

4. Explain and prove the properties of fourier transform.   15

5. (a) Discuss the finite impulse response system and infinite impulse response system.   8

   (b) Explain in detail the cascade and parallel connection of LTI systems with examples.   7

UNIT– III

6. (a) Evaluate the Laplace transform of $x(t) = e^{at} u(t)$. Plot the ROC.   8

   (b) Explain the application of laplace transform to the LTI systems.   7

7. (a) Determine IZT of the following system given as : 8

$$X(Z) = \frac{z(z^2 - 4z + 5)}{(z-1)(z-2)(z-3)}$$

(b) Explain and prove the properties of z transform.(any *four*). 7

UNIT– IV

8. Explain in detail the following :

(a) State space representation of continuous time LTI systems. 8

(b) Multiple input and multiple output system. 7

9. A system is described by the differential equation : 15

$$\frac{d^3y}{dt^3}(t) + 6\frac{d^2y}{dt^2}(t) + 11\frac{dy}{dt}(t) + 10y(t) = 8x(t)$$

Where $y(t)$ is the output and $x(t)$ is the input to the system. Obtain state space representation of the system.

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Paper : PCC-ECE-209-G

Time : Three Hours]   [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Explain the following : $2.5 \times 6 = 15$

   (a) Explain the condition for existence of Fourier Transform.

   (b) Check $x(t) = e^{-at}$ is periodic or Aperiodic.

   (c) Differentiate the CTFT and DTFT.
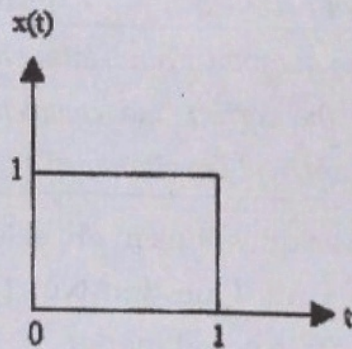
   (d) Discuss in brief the application of Z- Transform.

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(e) Explain the relationship between step, ramp and delta functions.

(f) Determine the relationship between Z- transform and DTFT.

UNIT – I

2. Describe signal and its classification with example.   15

3. (a) A continuous time signal x(t) is shown in figure. Sketch and label each of following signal :   8

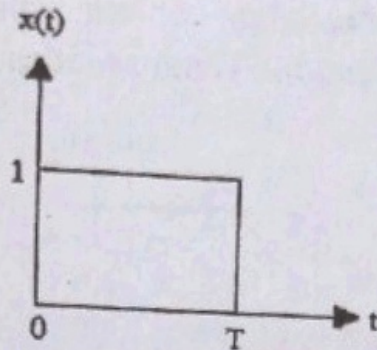   (i) $x(t-2)$

    (ii) $-1x(t+3)$

    (iii) $2x(-2t+6)$

(b) Check whether the following systems are linear or non linear :   7

    (i) $y(t) = t.x(t)$

    (ii) $y(t) = x^2(t)$

UNIT – II

4. Explain the various properties of discrete-time Fourier Transform.   15

5. (a) Determine the Fourier transform of a given rectangular pulse. 10

x(t)

(b) Define the Commutative, Distributive and Associative property of LTI system. 5

UNIT – III

6. Explain the various properties of Z-Transform. 15

7. (a) Determine the Laplace transform and ROC for the given signal $x(t) = 3e^{-2t}u(t) - 2e^{-t}u(-t)$. 8

(b) Determine the Z-transform of $x(n) = \cos \omega_0 n$ for $n \geq 0$. 7

UNIT – IV

8. The system is described by the second order differential equal. 15

$$\ddot{y}(t) + a_1 \dot{y}(t) + a_2 y(t) = br(t)$$

Obtain :
(i) State variable mode
(ii) State transition matrix
(iii) Transfer function of the system

9. (a) Analyze the different methods to obtain the state model. **10**

(b) Define the state of the system. Explain state variable model. What are its advantages ? **5**

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