Printed Page:- 05 **Subject Code:- AEC0303**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - CARRY OVER THEORY EXAMINATION - AUGUST 2023

Subject: Signals, Systems and Networks

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION A **20**

1. Attempt all parts:-

1-a. Which of the following is the correct statement? (CO1) 1

The system characterized by the equation y(t) = ax(t) + b is

(a) linear for any value of b

(b) linear if b > 0

(c) linear if b < 0

(d) linear if b = 0

1-b. The average power of an energy signal is _____(CO1) 1

(a) 0

(b) 1

(c) infinite

(d) none of these

1-c. The length of two discrete time sequence $x_1(n)$ and $x_2(n)$ are 5 and 7, respectively. What is the maximum length of a sequence $x_1(n)$ convolution with $x_2(n)$ (CO2) 1

(a) 5

(b) 6

(c) 7

(d) 11

1-d. The output signal in an LTI system with known input and known _____. 1

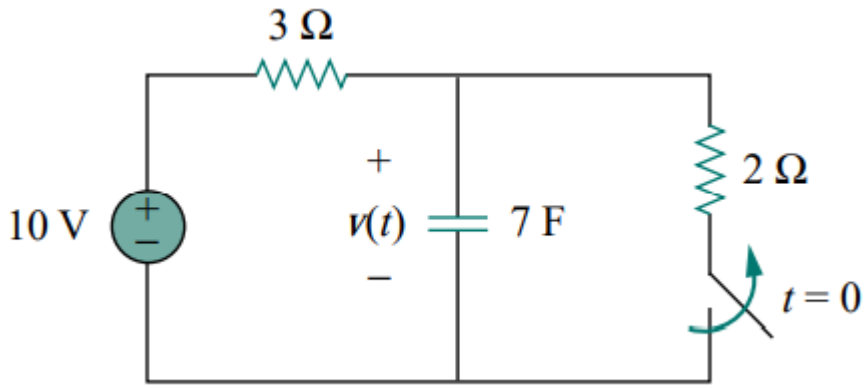
(a) impulse response can always be determined.

(b) impulse response cannot always be determined.

(c) impulse response can and cannot be determined.

(d) None of these

1-e. In the circuit of Figure v(∞) is: (CO2) 1



(a) 10 V

(b) 7 V

(c) 4 V

(d) 0 V

1-f. Laplace transform if sin(at)u(t) is_____?. (CO3) 1

(a) s/a^2+s^2

(b) a/a^2+s^2

(c) s^2/a^2+s^2

(d) a^2/a^2+s^2

1-g. Two-port networks are connected in series. The combination is to be represented as a single two-port network. The parameters of this network are obtained by the addition of the individual: (CO4) 1

(a) Z - parameters

(b) Y - parameters

(c) ABCD - parameters

(d) h - parameters

1-h. For an ideal step down (10 :5) transformer, which one of the following is the A 1

parameter? (CO4)

(a) 2

(b) 0

(c) 5n

(d) 0.5

1-i. The driving point impedance of an LC network is given by $Z(s)=(2s^5+12s^3+16s)/(s^4+4s^2+3)$. By taking the continued fraction expansion using first Cauer form, find the value of C_2. (CO5) 1

(a) 1

(b) 1/2

(c) 1/3

(d) 1/4

1-j. Consider the impedance function $Z(s)=(s^2+6s+8)/(s^2+3s)$. Find the value of R_1 after performing the first Cauer form. (CO5) 1

(a) 1

(b) 2

(c) 3

(d) 4

2. Attempt all parts:-

2.a. Consider a continuous-time system with input x(t) and output y(t) related by y(t) = x(sin(t)). (CO1) 2

Find whether the system is (i) causal or non-causal (ii) Time Variant or Time Invariant

2.b. Find the Fourier transform of $x(t) = \cos(\omega_0 t)\, u(t)$. (CO2) 2

2.c. Write the Properties of Laplace Transforms. (CO3) 2

2.d. Explain the immittance in two port network. (CO4) 2

2.e. Define Hurwitz polynomial and positive real function (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. Find the even and odd component of x[n] = u[n] - u[n-6] (CO1) 6

3-b. Explain Energy and Power signal in detail with an example.(CO1) 6

3-c. State and prove the linear and Shifting property of FT . (CO2) 6

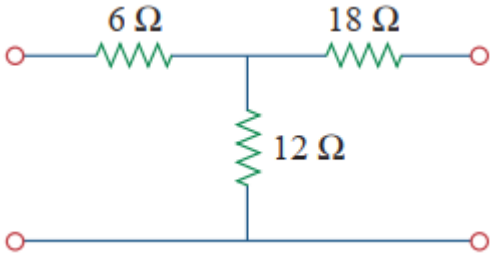
3-d. Determine and sketch the convolution of the following two signals: (CO2) 6

x(t) = u(t) and h(t) = δ(t)

3.e. Determine the inverse Laplace transform of the following function. (CO3) 6

$$\frac{s^2+1}{(s+3)(s^2+4s+5)}$$

3.f. Obtain the ABCD parameters for the T network shown in Fig. (CO4) 6



3.g. Consider the impedance function $Y(s)=(s^2+4s+3)/(3s^2+18s+24)$. Find the value of C_2 after realizing by second Foster method.(CO5) 6

SECTION C **50**

4. Answer any one of the following:-

4-a. Determine whether the following continuous time systems are causal or non-causal and Linear or Non-Linear. (CO1) 10

(i) y(t) = x(t) cos(t+1)

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

(iii) y(t) = x(-t)

4-b. Define Signals and its Classification with properties. (CO1) 10

5. Answer any one of the following:-

5-a. If $g(t) = e^{-at}\,u(t)$. Find the Fourier Transform of g(t). (CO2) 10

5-b. A causal and stable LTI system S has the frequency response 10

$$H(\omega) = \frac{4 + j\omega}{6 - \omega^2 + 5j\omega}$$ (CO2)

(a) Determine a differential equation relating the input x(t) and output y(t) of S.

(b) Determine the impulse response h(t) of S.

6. Answer any one of the following:-

6-a. Define Impulse response.A system is formed by cascading two systems as shown in Figure. Given that the impulse response of the systems are (CO3) 10

$$h_1(t) = 3e^{-t}\,u(t),$$

$$h_2(t) = e^{-4t}\,u(t)$$

(a) Obtain the impulse response of the overall system.

(b) Check if the overall system is stable.

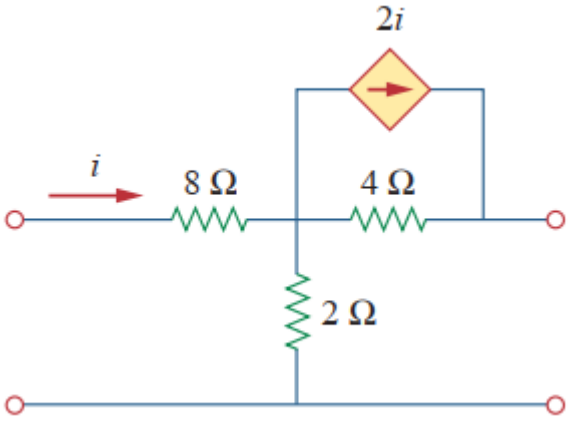
6-b. Find the Laplace transform of the following functions. (CO3) 10

i) f (t) =$\cos^2$ (3t)

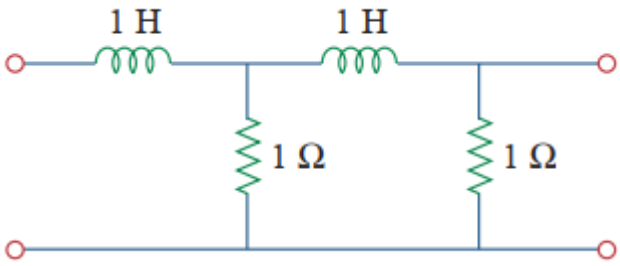
ii) f(t)= t^2 u(t)

7. Answer any <u>one</u> of the following:-

7-a. Determine the h parameters for the two-port shown in Fig. (CO4) 10



7-b. For the ladder network in Fig, determine the h parameters in the s domain. (CO4) 10



8. Answer any <u>one</u> of the following:-

8-a. Synthesize first and second Foster form of LC network for the impedance (CO5) 10

$$Z(s) = \frac{(s^2+1^2)(s^2+3^2)}{(s^2)(s^2+2^2)}$$

8-b. Realize the network using Cauer's first and second form. (CO5) 10

Z(s)=3(s+2)(s+4)/(s+1)(s+3).