Printed Page:- 06 **Subject Code:- AEC0303**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B. Tech

SEM: IV - THEORY EXAMINATION (2023 - 2024)

Subject: Signal, System and Network

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. The discrete-time equation $y(n + 1) + 0.5\, n\, y(n) = 0.5\, x(n+1)$ is Not attributable to a (CO1) 1

(a) memoryless system

(b) time-varying system

(c) linear system

(d) causal system

1-b. A continuous-time system is governed by the equation $3y^3(t) + 2\, y^2(t) + y(t) = x^2(t) + x(t)$, $y(t)$ and $x(t)$ respectively are output and input The system is (CO1) 1

(a) linear and dynamic

(b) linear and non-dynamic

(c) non-linear and dynamic

(d) non-linear and non-dynamic

1-c. Which property allows us to describe the output of an LTI system as a convolution of the input and the system's impulse response? (CO2) 1

(a) Homogeneity

(b) Linearity

(c) Additivity

(d) Time-invariance

1-d. Fourier transform of a rectangular pulse is (CO2) 1

(a) another rectangular pulse
(b) triangular pulse
(c) sinc function
(d) impulse function

1-e. The inverse Laplace transform of $F(s) = \frac{s+2}{(s+2)^2 + 1}$ (CO3) 1

(a) $e^{-t} \cos 2t$
(b) $e^{-t} \sin 2t$
(c) $e^{-2t} \cos 2t$
(d) $e^{-2t} \sin 2t$

1-f. The region of convergence (ROC) of a Laplace transform is: (CO3) 1

(a) The set of values of s for which the transform converges
(b) The set of values of t for which the transform converges
(c) The interval where the transform is continuous
(d) The interval where the transform is discontinuous

1-g. For an ideal step down (n :1) transformer, which one of the following is the C parameter? (CO4) 1

(a) n
(b) 0
(c) 3n
(d) 1/n

1-h. In ABCD parameters, 'A' represents: (CO4) 1

(a) Transmission loss
(b) Transmission gain
(c) Reflection coefficient at port 1
(d) Reflection coefficient at port 2

1-i. For real roots of s_k, all the quotients of s in $s^2+\omega_k^2$ of the polynomial P (s) are _____ (CO5) 1

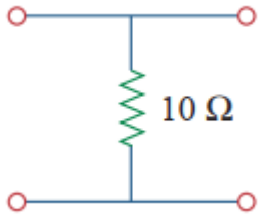
(a) negative
(b) non-negative
(c) positive
(d) non-positive

1-j. Consider the impedance function Z(s)=3(s+2)(s+4)/(s+1)(s+3). Find the value of R_2 after realizing by first Foster method. (CO5) 1

(a) 1
(b) 1/2
(c) 1/4
(d) 1/8

2. Attempt all parts:-

2.a.	A system is define by y(t) = 5x(t) +6 whrer x(t) is input and y(t) is output of the system. Find the system is linear or not. (CO1)	2
2.b.	Determine whether the system is causal and stable. Justify your answers. (CO2) $h(t) = e^{-4t} u(t - 2)$	2
2.c.	Derive the relation between current and voltage for inductor and capacitor? (CO3)	2
2.d.	For the single-element two-port network in Fig. Y13 is: (CO4)	2

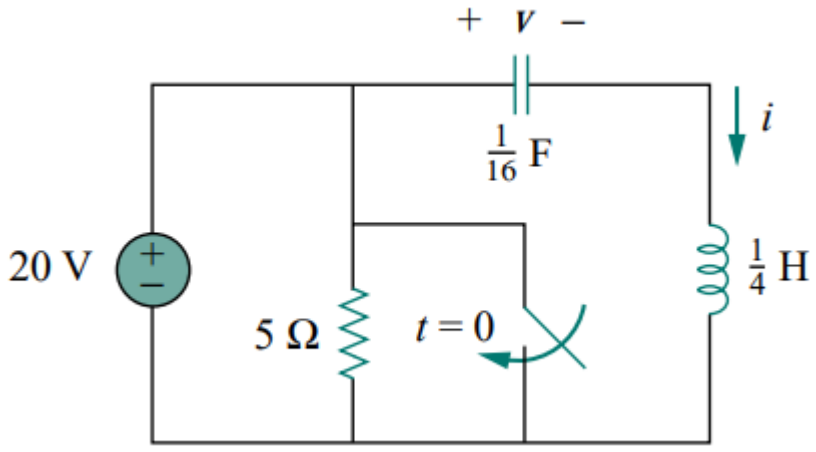


2.e.	Consider the impedance function Z(s)=3(s+2)(s+4)/(s+1)(s+3). Find the value of R_∞ after realizing by first Foster method. (CO5)	2

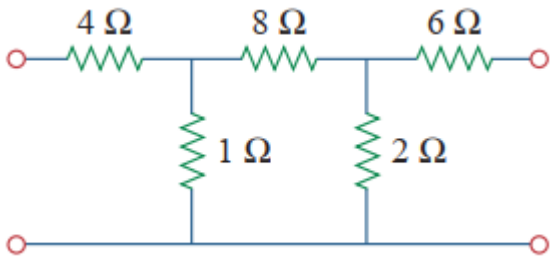
SECTION-B 30

3. Answer any five of the following:-

3-a.	Determine whether the following discrete time systems are stable or not? (CO1) (i) y(n) = x(n) + x(n-1) + y(n-1) (ii) $y(n) = r^n x(n)$; r>1	6
3-b.	Find x(t) = 4 + cos(4 πt) + 3sin(4t) is periodic or not, if periodic find its time period (CO1)	6
3-c.	Show that the convolution of a signal x(t) with a unit impulse function results in the signal x(t) itself. (CO2)	6
3-d.	Find the convolution of the two continuous time signals $f(t) = \exp(-t^2)$ and $g(t) = 3t^2$, for all t (CO2)	6
3.e.	Calculate v(t) for t > 0 in the circuit in Fig. (CO3)	6



3.f.	Find the transmission parameters for the circuit in Fig (CO4)	6



3.g. Find given polynomial is Hurwitz or not. (CO5) 6

$s^4+ s^3+3s^2+8s+24$

SECTION-C 50

4. Answer any one of the following:-

4-a. Find the even and odd component of (CO1) 10

1. $x_1(t) = e^{-2t}\cos(t)$

2. $x_2(t) = \begin{cases} Ae^{-\alpha t}, & t > 0 \\ 0, & t < 0 \end{cases}$

4-b. Find and draw the even and odd part of (CO1) 10

1. $u(t)$
2. $r(t)$
3. $\sin(w_o t)u(t)$
4. $\cos(w_o t)u(t)$

5. Answer any one of the following:-

5-a. Compute the convolution y(n) = conv(x(n), h(n)) of the following pairs of signals: 10

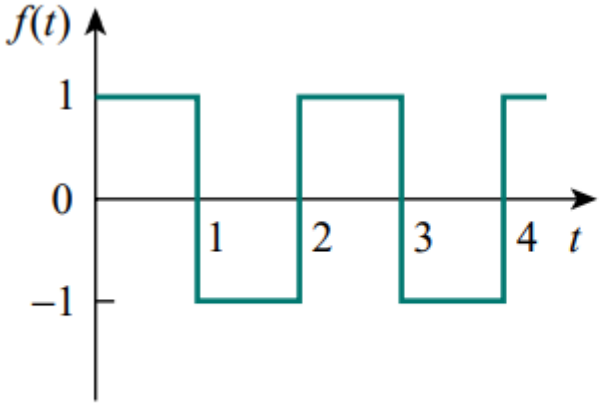
x(n) = n u(n) and h(n) = a^{-n} u(n -1), where a < 1 (CO2)

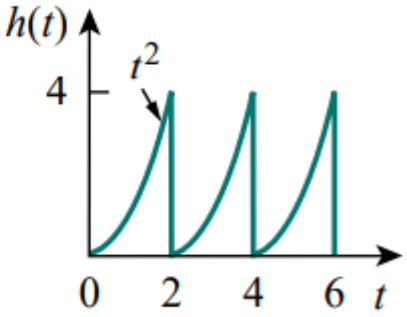
5-b. Determine and sketch the magnitude and phase response of the LTI causal system described by the difference equation (CO2) 10

$$\frac{dy(t)}{dt} + y(t) = \frac{dx(t)}{dt} - x(t)$$

6. Answer any one of the following:-

6-a. Determine the Laplace transforms of the periodic functions in Figure (CO3) 10





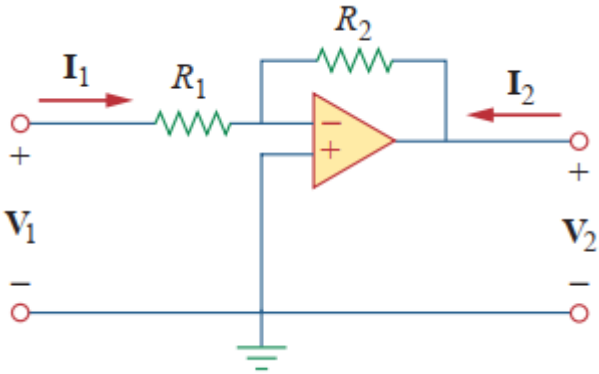
(a) (b)

6-b. Solve the following integrodifferential equation using the Laplace transform method: (CO3) 10

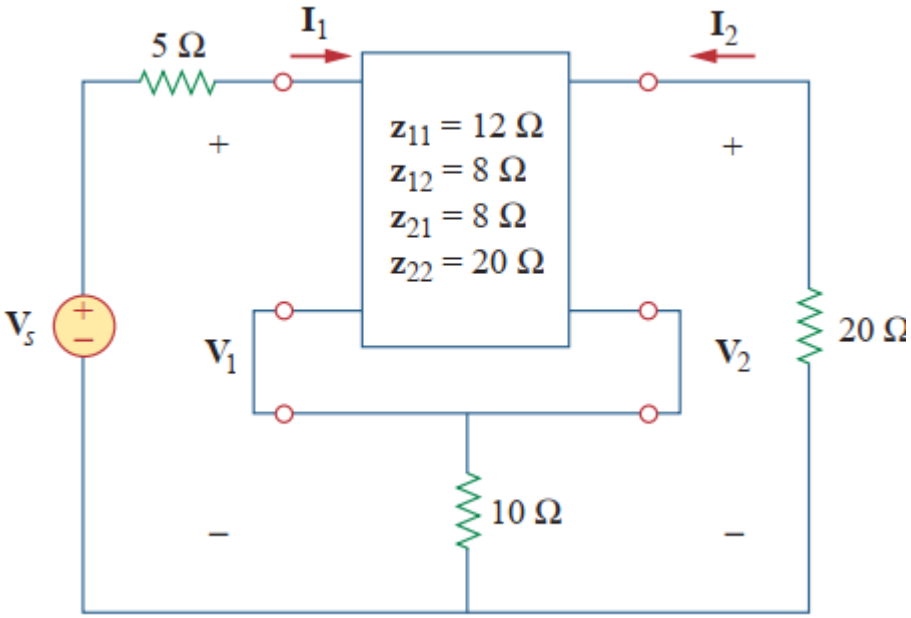
$$\frac{dy(t)}{dt} + 9\int_0^t y(\tau)\,d\tau = \cos 2t, \qquad y(0) = 1$$

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

7-a. Find the z parameters of the op amp circuit in Fig. Show that the circuit has no y parameters. (CO4) 10



7-b. Evaluate V_2 / V_5 in the circuit in Fig (CO4) 10



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

8-a. Realize the network using Cauer's first and second form. 10
$Z(s)=(s^2+6s+8)/(s^2+3s)$. (CO5)

8-b. Realize the network using Foster's first and second form. 10
$Z(s)=5(s+1)(s+4)/(s+3)(s+5)$. (CO5)