NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: III - THEORY EXAMINATION (2024 - 2025)
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.   The graph of discrete signal u(n-2) starts from (CO1,K3)   1

    (a)   n=2

    (b)   n=0

    (c)   n=-2

    (d)   none of the above

1-b.   The discrete-time equation $y(n + 1) + 0.5\ n\ y(n) = 0.5\ x(n+1)$ is Not attributable to a (CO1,K2)   1

    (a)   memoryless system

    (b)   time-varying system

    (c)   linear system

    (d)   causal system

1-c.   The Fourier series of a real, even periodic signal will contain only (CO2,K1)   1

    (a)   cosine terms

    (b)   sine terms

    (c)   even terms

    (d)   odd harmonics

1-d.   The Fourier Transform of a rectangular pulse is ... (CO2,K2)   1

    (a)   Triangular Pulse

    (b)   Rectangular Pulse

(c)   Sinc function

(d)   Impulse function

1-e.   The inverse Laplace transform of (CO3,K3)   1

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

(a) $e^{-t} \cos 2t$

(b) $e^{-t} \sin 2t$

(c) $e^{-2t} \cos 2t$

(d) $e^{-2t} \sin 2t$

1-f.   If F (s) = 1/(s + 2), then f (t) is (CO3,K2)   1

(a) $e^{2t} u(t)$

(b) $e^{-2t} u(t)$

(c) $u(t - 2)$

(d) $u(t + 2)$

1-g.   Two port network are connected in cascade. The combination is to be represented   1
as a single two-port network. The parameters of this network are abtained
by (CO4,K1)

(a)   Z - parameters

(b)   Y - parameters

(c)   ABCD - parameters

(d)   h - parameters

1-h.   In two-port networks the parameter g11 is called _____ (CO4,K1)   1

(a)   Short circuit input impedance

(b)   Short circuit current ratio

(c)   Open circuit voltage ratio

(d)   Open circuit input admittance

1-i.   Consider the impedance function Z(s)=3(s+2)(s+4)/(s+1)(s+3). Find the value of   1
R_1 after realizing by first Foster method.(CO5,K2)

(a)   9/2

(b)   2/9

(c)   9

(d)   1/9

1-j.   The denominator polynomial in a transfer function may not have any missing   1
terms between the highest and the lowest degree, unless? (CO5,K2)

(a)   all odd terms are missing

(b)   all even terms are missing

(c)   all even or odd terms are missing

(d)   all even and odd terms are missing

2. Attempt all parts:-

2.a.	Define energy and power signals. (CO1,K1)	2
2.b.	Determine whether the system is causal and stable. Justify your answers. (CO2,K3) $h(t) = e^{-6t} u(3 - t)$	2
2.c.	Give the relationship between laplace transform and Fourier transform. (CO3,K2)	2
2.d.	What are the condition for reciprocity of two port network? (CO4,K1)	2
2.e.	Check whether the polynomial $F(S) = S^4 + 2S^3 + 2 S^2 + 6S + 10$ is Hurwitz polynomial or not. (CO5,K3)	2

SECTION-B 30

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

3-a.	Draw the fallowing signal (CO1,K3) $x(t) = u(t) + r(t) - 2r(t-1) + r(t-2) - u(t-2)$	6
3-b.	Find out whether the following continuous time systems are time invariant or time variant. (CO1,K2) (i) $y(t) = \sin x(t)$ (ii) $y(t) = t\, x(t) + 3$ (iii) $y(t) = x(t) \cos(200\Pi t)$	6
3-c.	Describe the properties of Fourier transform.(CO2,K2)	6
3-d.	Find out the fourier transform and spectrum of following signals: (CO2,K2) (i) $x(t) = \cos\omega_0 t$ (ii) $x(t) = \sin\omega_0 t$	6
3.e.	Find the the initial and final values of the function whose Laplace transform is given as: (CO3,K2) $X(s) = (5s+50)/s(s+5)$	6
3.f.	Determine the z and y parameters for the as shown in Figure.(CO4,K3)	6
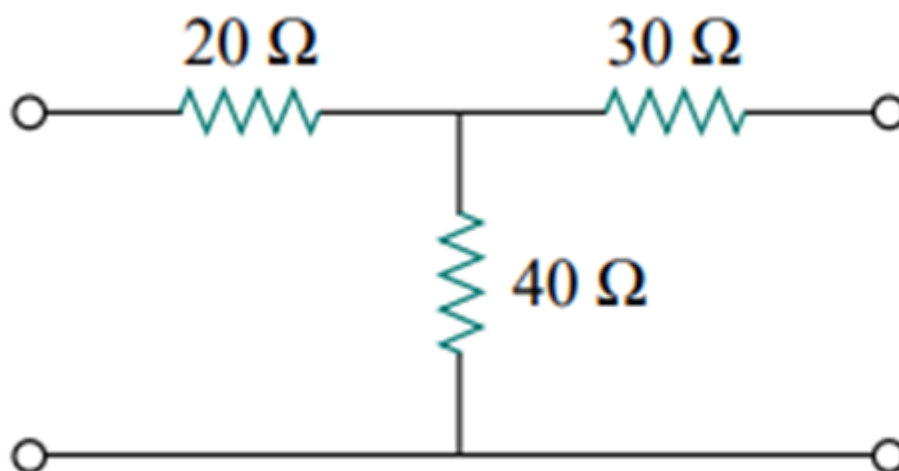
3.g.	Check Whether the following function is positive real function or not (CO5,K3) $Z(s) = \dfrac{(s+2)(s+4)}{(s+1)(s+3)}$	6

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

4-a.   Find the even and odd component of (CO1,K3)   10

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

2. $x_2(t) = \begin{cases} Ae^{-at}, & t > 0 \\ 0, & t < 0 \end{cases}$
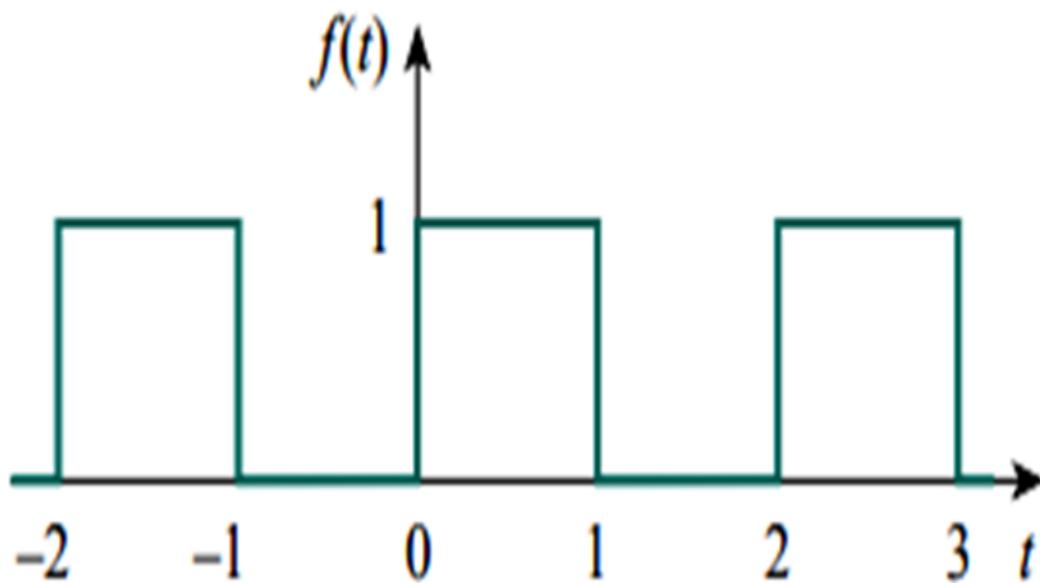
4-b.   Draw the graph of (CO1,K3)   10

$x[n] = (a)^n u[n]$

      1. when 0<a<1
      2. when -1<a<0

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

5-a.   Determine the Fourier series of the waveform shown in figure and also obtain the   10
amplitude and phase spectra.(CO2,K2)

5-b.   Obtain the Fourier transform of the signal e^{-at} u(t) and plot its magnitude and   10
phase spectrum.(CO2,K2)

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

6-a.   A continuous-time LTI system is initially relaxed and represented by the   10
equation (CO3,K2)
y''(t)+ 3 y'(t) + 2y(t) = 2x(t). Find response of the system to an input x(t) =
$4e^{-3t}$ u(t).

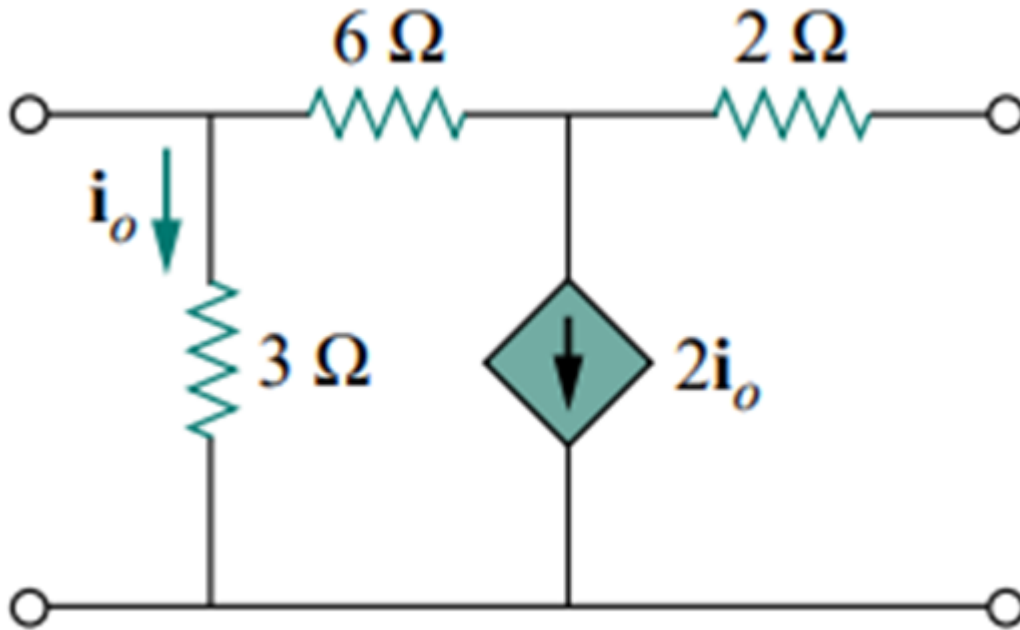6-b.   Obtain inverse Laplace transform of the following function: (CO3,K2)   10
      $X(s) = (3s+7)/(s^2-2s-3)$
for ROCs of (i) Re(s) > 3
          (ii) Re (s) < - 1

(iii) -1 < Re (s) < 3 .

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

7-a.   Explain the series-parallel interconnection of two port networks.(CO4,K2)   10

7-b.   Obtain the **y** parameters for the network shown in Figure: (CO4,K3)   10

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

8-a.   Find the first and second foster form of the function (CO5,K2)   10

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

8-b.   Explain the properties of positive real function. Also explain the necessary and   10
sufficient conditions for positive real function with suitable example.(CO5,K1)