Printed Page:-06 Subject Code:- BEC0303

Roll. No:

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 time period for any signal x(t)=2cost+3cos 2t is given by _____. (CO1,K3) 1

(a) 1

(b) 2

(c) 2π

(d) Not periodic

1-b. _____signals are having finite and non zero Energy.(CO1,K1) 1

(a) Power Signal

(b) Energy Signal

(c) Non-Periodic Signal

(d) none of the above

1-c. Fourier series of any periodic signal x(t) can only be obtained if (CO2,K1) 1

(a) $\int_0^T |x(t)|dt < \infty$

(b) finite number of discontinuities within finite time interval T

(c) both of the above are true

(d) infinite number of discontinuities

1-d. Which of the following is correct? A system can be completely described by a transfer function if it is (CO2,K1) 1

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(a) non-linear and continuous
(b) Linear and time invariant
(c) linear and time-varying
(d) non-linear and time-invariant

1-e. The Laplace transform of the signal x(t) = dδ(t)/dt. (CO3,K3) 1

(a) 1
(b) s
(c) 1/s
(d) 2/s

1-f. Time domain function of s / $(a^2 + s^2)$ is given by (CO3,K3) 1

(a) Cos(at)
(b) Sin(at)
(c) Cos(at)Sin(at)
(d) Sin(t)

1-g. With respect to transmission parameters, which one of the following is correct? (CO4,K1) 1

(a) A and B are dimensionless
(b) B and C are dimensionless
(c) A and D are dimensionless
(d) B and D are dimensionless

1-h. In two-port networks the parameter g21 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 R_2 after realizing by first Foster method. (CO5,K3) 1

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

1-j. If the ratio of the polynomial P (s) and its derivative gives a continued fraction expansion with _____ coefficients, then the polynomial P (s) is Hurwitz. (CO5,K2) 1

(a) all negative
(b) all positive
(c) positive or negative
(d) positive and negative

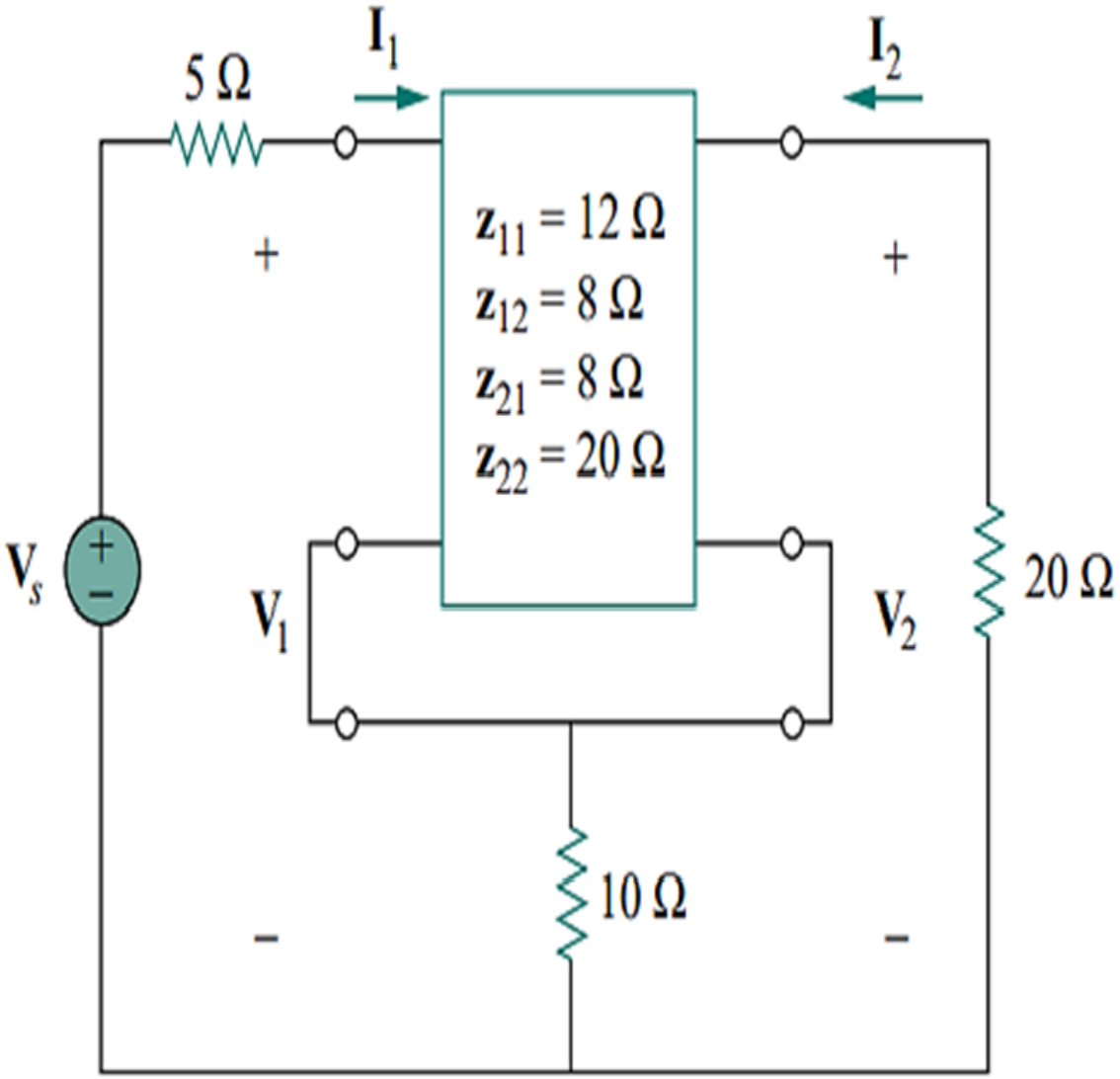
2. Attempt all parts:-

2.a.	Define following terms: (CO1,K1) (a) Unit ramp (b) Unit step (c) Unit impulse	2
2.b.	Determine whether the system is causal and stable. Justify your answers. (CO2,K2) h(t) = e-6l t l	2
2.c.	What is the use of laplace transform? (CO3,K1)	2
2.d.	Define the symmetricity conditions for two port network. (CO4,K1)	2
2.e.	Write down the properties of Hurwitz function also explain it with an example and prove it whether it is Hurwitz or not. (CO5,K1)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Draw the graph of u(t+2) – u (t-2) +r(t-3) . (CO1,K2)	6
3-b.	Check whether the given continuous time systems is *y(t) = t x(t).* (CO1,K1) (i) static or dynamic (ii) Linear or Non-linear (iii) Causal or non-causal	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.	*Solve the following differential equation: (CO3,K3)* *y'' (t)+ 5 y' (t)+ 6y(t) = 0* *Let y(0) = 1 and y'(0) = 2.*	6
3.f.	Evaluate V_2/V_s in the circuit in Figure (CO4,K3)	6



3.g. Check whether the following function is positive real function or not (CO5,K3) 6

$$Z(s) = \frac{(s+2)(s+4)}{(s+1)(s+3)}$$

SECTION-C 50

4. Answer any one of the following:-

4-a. Plot the graph for following signals (CO1,K3) 10

(i) x(t) = u(t + 1/2)+ (t+3)

(ii)Discrete signal x(n) =u(-n-1)

(iii) $y(t)=e^{-2t}u(t)$

(iv) $z(t)=e^{4t}u(t)$

(v) m(t)=u(-t+4)

4-b. Find and draw the even and odd part of (CO1,K3) 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:-

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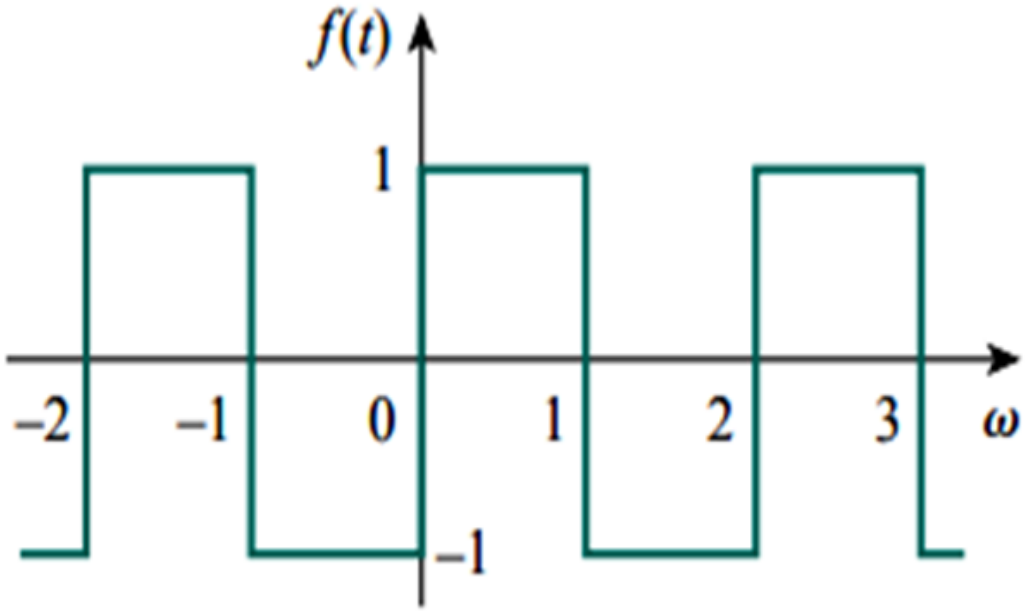
5-a. Find the Fourier series of the square wave in Figure. Also plot the amplitude and phase spectra.(CO2,K3) 10



5-b. Find the inverse Fourier Transform of (CO2,K2) 10
(i) $\delta(w)$
ii)$\delta(w-w_o)$

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

6-a. Calculate the Laplace transform of time domain signal (CO3,K3) 10
(i) $y(t)=u(t-2)*\delta(t-2)$
(ii) $u(t+2)$

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. Two identical two-port networks having transmission matrix are cascaded. Derive the overall Transmission Parameter $T_{overall}$ for this cascade network. 10
Two port network with transmission matrices: (CO4,K2)
$T1 = \begin{bmatrix} 1 & 2 \\ 0.1 & 4 \end{bmatrix}$ and $T2 = \begin{bmatrix} 2 & 4 \\ 0.5 & 3 \end{bmatrix}$ are connected in cascade. Calculate overall Transmission Parameter for this cascade network.

7-b. Explain the conversion of z-parameter in terms of y, h and T parameters.(CO4,K1) 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 sufficient conditions for positive real function with suitable example.(CO5,K1) 10

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