Printed Page:- Subject Code:- AEC0303

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B,Tech.

SEM: III - THEORY EXAMINATION (2022 - 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. The discrete time system described by $y(n) = x(n^2)$ is (CO1) 1

(a) non-causal, linear and time-varying

(b) causal, linear and time-varying

(c) non-causal, non- linear and time-varying

(d) causal, non-linear and time-varying

1-b. A system defined by $y[n] = \sum_{k=-\infty}^{n} x[k]$ is example of (CO1) 1

(a) invertible system

(b) memoryless system

(c) non-invertible system

(d) averaging system

1-c. A discrete LTI system is non-causal if its impulse response is (CO2) 1

(a) $a^n u(n-2)$

(b) $a^{n-2} u(n)$

(c) $a^{n+2}u(n)$

(d) $a^n u(n+2)$

1-d. The inverse Fourier transform of $\delta(f)$ is (CO2) 1

(a) u(t)

(b) 1

(c) $\delta(t)$

(d) e xp(i2∏t)

1-e. Find f (t) where (CO3) 1

$F(s) = e^{-2s}/(s+1)$,

(a) $e^{-2(t-1)}u(t-1)$

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

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

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

1-f. The Laplace transform of the signal x(t) = $d\delta(t)/dt$. (CO3) 1

(a) 1

(b) s

(c) 1/s

(d) 2/s

1-g. For the given information Z11 = 3, Z12 = 1, Z21 = 2, Z22 = 1. Find the value of Y12. (CO4) 1

(a) 1

(b) -1

(c) 2

(d) -2

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

(a) n

(b) 0

(c) 2n

(d) 1/n

1-i. 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) 1

(a) all negative

(b) all positive

(c) positive or negative

(d) positive and negative

1-j. The driving point impedance of a one-port reactive network is given by $Z(s)=5(s^2+4)(s^2+25)/s(s^2+16)$. 1

After taking the partial fractions, what is the value of H from Z (s)? (CO5)

(a) 3

(b) 4

(c) 5

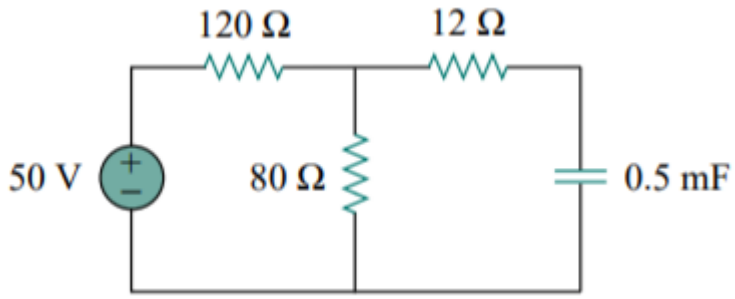
(d) 6

2. Attempt all parts:-

2.a. A system is define by $dy(t)/dt + 5y(t) = x(t)$ whrer x(t) is input and y(t) is output of the system. Find the system is linear or not. (CO1) 2

2.b. Explain Time shifting and Time scaling properties of Fourier Transform. (CO2) 2

2.c. Find the time constant for the RC circuit in Figure.(CO3) 2



2.d. Explain the shunt - shunt interconnection method of two port network. (CO4) 2

2.e. Check whether the polynomial $F(S) = S^4 + S^3 + 2S^2 + 3S + 2$ is Hurwitz polynomial or not. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Check whether the discrete time systems described by following equations are causal or non-causal. (CO1) 6

(i) $y(n) = x(n) + x(n-1)$

(ii) $y(n) = x(n) + x(n+1)$

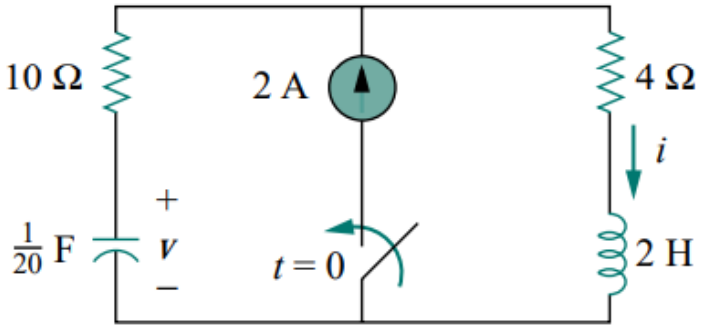
(iii) $y(n) = x(2n)$

3-b. Draw the graph of $u(t+2) – u(4t-2) + r(2t-6)$ CO1 6

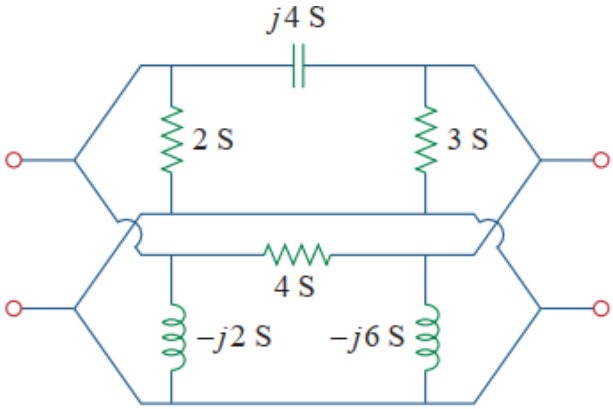
3-c. Consider a LTI system with frequency response $H(\omega) = \frac{1}{3 + j\omega}$. For a particular input x(t), this system is observed to produce the output $y(t) = e^{-3t} u(t) - e^{-4t} u(t)$. (CO2) 6

3-d. Find the convolution of the two continuous time signals (CO2) 6
$f(t) = 3\cos(2t)$, for all t and $g(t) = e^{-|t|}$

3.e. Determine v and i for t > 0 in the circuit of Figure. (CO3) 6



3.f. Find the y parameters of the two-port in Fig. (CO4) 6



3.g. Check the positive realness of the following functions. (CO5) 6

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

SECTION C 50

4. Answer any one of the following:-

4-a. Draw x(t) and the differentiation of x(t), where x(t) is (CO1) 10

$$x(t) = -u(t+1) + r(t+1) - r(t-1) - u(t-1)$$

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

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

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

5. Answer any one of the following:-

5-a. Find the Fourier transform G(w) of the signal g(t) = $\frac{1}{\pi t}$ (CO2) 10

5-b. Consider a stable LTI system characterized by the difference equation (CO2) 10

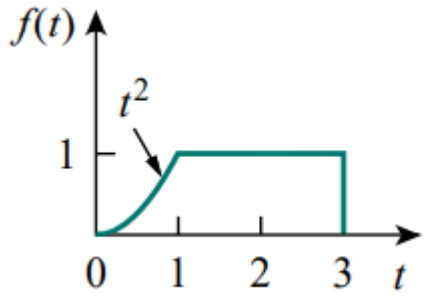
$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + 3x(t)$$

(a) Find the frequency response H(ω) and the impulse response h(t) of the system.

(b) What is the response of this system if the output x(t) = e^{-t} u(t)?

6. Answer any one of the following:-

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



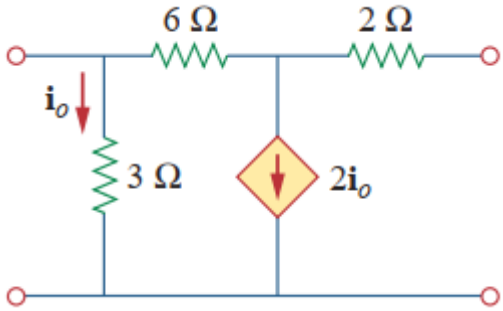
6-b. Solve the following equation by means of the Laplace transform (CO3) 10

y'' + 5y' + 6y = cos 2t

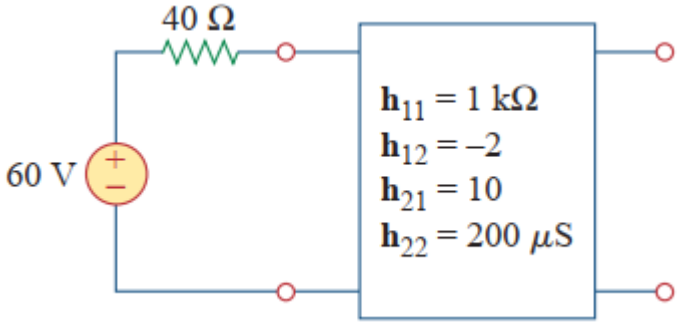
Let *y(0) = 1, y' (0) = 4*

7. Answer any one of the following:-

7-a. Obtain the ABCD parameters for the circuit in Fig. (CO4) 10



7-b. Determine the Thevenin equivalent at the output port of the circuit in Fig. (CO4) 10



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

8-a. Find the second Foster form and the first Cauer form of the network whose driving point admittance is (CO5) 10

$$Y(s) = \frac{3(s+2)(s+5)}{s(s+3)}$$

8-b. Find the first and second Foster forms of the function (CO5) 10

$$Z(s) = \frac{10^9 s^3 + 16 \times 10^{21} s}{s^4 + 37 \times 10^{12} s^2 + 36 \times 10^2 s}$$