Code: 20A04301T **R20**

B.Tech II Year I Semester (R20) Supplementary Examinations August/September 2023

SIGNALS & SYSEMS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define Correlation of two signals. 2M

(b) Is the discrete in time signal $\sin(31\pi n)$ is periodic or aperiodic. 2M

(c) When Aliasing Phenomenon is occurred and how it can be eliminated? 2M

(d) Write the Modulation property of Fourier Transform. 2M

(e) Given impulse reponse of a system $h(t) = e^{-2t}u(t)$, check whether the system is stable or not. 2M

(f) Find the ROC of $h(t) = e^{-2t}u(t)$ + $e^{t}u(t)$. 2M

(g) Define System Bandwidth. 2M

(h) Write the condition for a LTI system to be a distortion less System. 2M

(i) Find the Z-Transform of $h(n) = a^{-2n}u(n)$. 2M

(j) Find the Final value of $h(n) = \sin(31\pi n)\,u(n)$. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) Determine whether the following function is periodic or not. If so find the period. 5M
x(t) = 3sin200πt + 4cos100t.

(b) Define mean square error and derive the expression for evaluating mean square error. 5M

OR

3 (a) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$. 5M

(b) Explain the properties of unit impulse function. 5M

4 (a) State and prove Sampling Theorem for Low pass Signals. 5M

(b) Find the Fourier transform of signum function. 5M

OR

5 (a) What is the difference between Fourier series Analysis and Fourier Transforms? Explain with an example. 5M

(b) State and Prove Modulation property of Fourier Transform. 5M

6 (a) Determine the Laplace transform of 5M
$x(t) = e^{-at}\,u(t) + e^{-bt}\,u(t)$ and identify the ROC ,poles and zeros located in s-plane.

(b) Find the output response of the system described by a differential equation 5M
$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = x(t)$ when the input signal x(t) = cos(t). The initial conditions are $\frac{dy(0^+)}{dt} = 1$ $y(0^+) = 1$.

OR

7 (a) State and prove all the properties of Region of Convergence of Laplace Transform. 5M

(b) Find the inverse Laplace transform of $X(s) = \frac{s+2}{s^3+7s^2+15s+9}$. 5M

Contd. In Page 2

8 (a) Derive the relation between the bandwidth and rise time of a LTI system. 5M

(b) Given a signal $x(t) = e^{-2t}u(t)$; impulse response of LTI system. $h(t) = e^{-2t}u(t)$, find output $Y(\omega)$. 5M

OR

9 (a) What is Impulse Response? Show that the response of an LTI system is convolution integral of its impulse Response with input signal? 5M

(b) Define Energy and Power spectral densities and give their Physical significance. 5M

10 (a) Find the z-transform of $x(n) = a^n \sin(\omega n)\, u(n)$. 5M

(b) Find inverse Z-Transform of $X(Z) = (1 - z^{-1})/(z - 1/2)(z - 1/3)$; for ROC $|Z|$>1/2. 5M

OR

11 (a) Obtain the Z-transform of x(n) = $-a^n \mathrm{u}(-\mathrm{n} - 1)$ and find its ROC. 5M

(b) State and explain the following properties of Z-transform. 5M

(i) Convolution (ii) Time Shifting (iii) Time Reversal (iv) Frequency Shifting.

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Code: 20A04301T **R20**

B.Tech II Year I Semester (R20) Supplementary Examinations April/May 2024

SIGNALS & SYSTEMS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define Signal and System. 2M

(b) Find the time period of a signal, x(t) = 5 Cos(4t) + 4 Sin(5t). 2M

(c) Discuss any two symmetry properties of trigonometric Fourier series. 2M

(d) Obtain the FT of Cos(2t). 2M

(e) Discuss the concept “Existence of Laplace Transform”. 2M

(f) Obtan the transfer function of the continuous time LTI system governed by the differential equation: $\frac{d^2}{dt^2}y(t) + 4\frac{d}{dt}y(t) + 3y(t) = 2\frac{d}{dt}x(t) + 4x(t)$. Assume, zero initial conditions. 2M

(g) When the system is said to be physically realizable? Discuss all the related conditions. 2M

(h) Why the system, y(t) = T{x(t)} = 2 x(t) + 3 is linear time invariance? 2M

(i) Evaluate the system function in w-domain of a discrete system having LCCDE, $y(n) - \frac{1}{2}y(n-1) = x(n) + \frac{1}{2}x(n-1)$. 2M

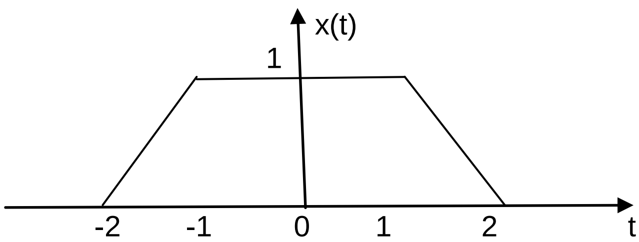
(j) Determine the z-domain of a unit step sequence, x(n) = -u(-n-2). 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) List the various operations used in continuous time signals and discuss any three with suitable examples. 5M

(b) Use graphical method to evaluate the integral $\int_{-\infty}^{\infty}\left|\frac{d^2}{dt^2}x(t)\right|dt$ for the signal given below, 5M



OR

3 (a) Explain the following with suitable examples: 5M

(i) Bounded and unbounded discrete signals,

(ii) Energy and Power discrete signals.

(b) Draw the graphical representation and sequence form of a discrete time signal x(n) = r(n+2) - r(n-3) - 5u(n-4) and also, Evaluate the summation $\sum_{n=0}^{\infty} x(n)$, where r(n) is unit ramp sequence. 5M

4 (a) How to represent a signal by using trigonometric Fourier Series? Explain. 5M

(b) Evaluate the coefficients of trigonometric Fourier series a_o, a_n and b_n, given x(t) over the interval (0, 2π) 5M

$$x(t) = \begin{cases} 1, & 0 < t < \pi \\ -1, & \pi < t < 2\pi \end{cases}$$

OR

Contd. in Page 2

5 (a) State and prove time differentiation property of Fourier Transform. 5M

(b) Apply the properties of Fourier Transform and obtain the frequency domain of (i) Unit step signal u(t) and (ii) Signum signal Sgn(t). 5M

6 (a) State and prove differentiation in s-domain property of Laplace Transform. 5M

(b) Evaluate the Laplace Transform of x(t), indicate poles, zeroes, and ROC in s-plane, given $x(t) = 3e^{-2t}u(t) - 2e^{-3t}u(t)$. 5M

OR

7 (a) Discuss the LTI system having rational system function H(s) for causality and stability with a suitable example. 5M

(b) Evaluate the causal signal x(t) from its s-domain representation 5M

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

8 (a) Compare continuous time systems with discrete time systems. 5M

(b) Examine the continuous time system for Linearity, Time Invariance and BIBO stability. 5M

$y(t) = T\{x(t)\} = \frac{d}{dt}x(t)$.

OR

9 (a) Explain ideal and practical characteristics of LPF, HPF, BPF and BSF. 5M

(b) Draw RC low pass filter circuit and obtain: 5M

(i) System Function $H(\omega)$,

(ii) Magnitude Response,

(iii) Band Width (BW).

10 (a) What is DTFT and IDTFT? State any 3 properties of DTFT. 5M

(b) Apply the properties of DTFT and find, 5M

(i) $X(e^{j\omega})$ at $\omega = 0$ (ii) $\int_{-\pi}^{\pi} X(e^{j\omega})\,d\omega$ (iii) $\int_{-\pi}^{\pi} \left| X(e^{j\omega}) \right|^2 d\omega$

Given $x(n) = \{1, 4, 3, 2, 5, 6, 7, 0, 9\}$ and DTFT[x(n)] = $X(e^{j\omega})$.

OR

11 (a) Define the z-transform of a right sided, left sided and both sided sequences. 5M

(b) Calculate the initial and final values of a causal sequence x(n) from the z-domain 5M

$$X(z) = \frac{z(z+1)(z+2)}{(z-1)(z-1/2)(z-1/4)(z-1/8)}.$$

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