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Question Paper Code: U3404

B.E./B.Tech. DEGREE EXAMINATION, MAY 2024

Third Semester

Electronics and Communication Engineering

21UEC304 – SIGNALS AND SYSTEMS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. A resistive-capacitive network is a _____ system. CO1- U
(a) causal & static (b) Non causal & static
(c) causal & dynamic (d) Non causal & dynamic
2. If $x(t)$ is odd, then its Fourier series coefficient must be CO1- U
(a) Real and odd (b) imaginary and odd (c) real and even (d) imaginary and even
3. CO3- App
If $F(s) = L[f(t)] = \frac{2(s+1)}{s^2 + 4s + 7}$ then the initial value of the signal is
(a) 0 (b) 2 (c) 1/2 (d) infinity
4. Let $(n) = (1/2)^n$, $(n) = x^2(n)$ and $Y(e^{j\omega})$ be the Fourier Transform of $y(n)$. CO4- App
Then $y(e^{j0})$ is
(a) 1/4 (b) 2 (c) 4 (d) 4/3
5. The ROC $X(z)$ cannot contain any CO1- U
(a) poles (b) zeros (c) poles or zeros (d) multiple poles

PART – B (5 x 3= 15 Marks)

6. State the relation between Impulse, step and ramp signals. CO1- U
7. State and prove the Parseval's theorem in Fourier series. CO1- U
8. State the initial and final value theorem of the Laplace transform. CO1- U
9. List the properties of convolution sum. Give the condition for the system to be casual with respect to impulse response. CO1- U

10. Derive the relationship between z-transform and Fourier transform.

CO1- U

PART – C (5 x 16= 80Marks)

11. (a) A mathematical expression for the discrete-time signal $x[n]$ is given CO2- App (16)

$$x(n) = \begin{cases} n, & 0 \leq n \leq 3 \\ 3, & n = 4 \\ 0, & \text{else} \end{cases}$$

Sketch and label each of the following signals.

(i) $x[n - 2]$; (ii) $x[2n]$; (iii) $x[-n]$; (iv) $x[-n + 2]$

Or

(b) Draw the wave forms represented by following step functions. CO2- App (16)

(i) $f_1(t) = 2u(t - 1)$ (ii) $f_2(t) = -2u(t - 2)$
(iii) $f(t) = f_1(t) + f_2(t)$ (iv) $f(t) = f_1(t) - f_2(t)$

12. (a) Obtain the trigonometric Fourier series for the half wave rectified Sine function of 't'. CO3-App (16)

Or

(b) Obtain the Fourier Transform of the signal $e^{-|t|}$ and plot its magnitude and phase spectrum. CO3- App (16)

13. (a) Realize the following LTI system in Direct form, cascade and parallel structure. Comment on the results obtained. CO6- Eva (16)

$$\frac{d^3 y(t)}{dt^3} + 4 \frac{d^2 y(t)}{dt^2} + 7 \frac{dy(t)}{dt} + 8y(t) = 5 \frac{d^2 x(t)}{dt^2} + 4 \frac{dx(t)}{dt} + 7x(t)$$

Or

(b) Obtain the convolution of the given two signals using the convolution property of the Laplace transform and evaluate the results also with the conventional method of convolution. CO5- Ana (16)

$$x(t) = e^{-3t} u(t) \quad \text{and} \quad y(t) = e^{-2t} u(t)$$

14. (a) Find the DTFT of the given signal $x(n) = a^{|n|}$ and plot magnitude and phase spectrum. CO4-Ana (16)

Or

(b) Find the convolution of the given two signals using the convolution property of DTFT. CO4- Ana (16)

$$x(n) = (1/2)^n u(n) \quad \text{and} \quad h(n) = (1/3)^n u(n)$$

15. (a) Realize the direct form I, direct form II, cascade and parallel structure for the given difference equation. Comment on the results obtained. CO6-Eva (16)

$$y(n) - 6y(n-1) + 6y(n-2) = x(n) + 3x(n-2)$$

Or

- (b) Consider an LTI system with impulse response CO5-Ana (16)

$$h[n] = \begin{cases} a^n & n \geq 0 \\ 0 & n < 0 \end{cases}$$

and input

$$x[n] = \begin{cases} 1 & 0 \leq n \leq N - 1 \\ 0 & \text{otherwise} \end{cases}$$

Determine the output $y[n]$ by explicitly evaluating the discrete convolution of $x[n]$ and $h[n]$

