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Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U3404

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

Third Semester

Electronics and Communication Engineering

21UEC304 – Signals and Systems

(Regulations 2019)

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. If F(s) = L[f(t)] = $\frac{2(s+1)}{s^2+4s+7}$ then the initial value of the signal is CO3- App

   (a) 0 (b) 2 (c) 1/2 (d) infinity

4. Let $(n) = (1/2)^{n}(n)$, $(n) = x^2(n)$ $and Y(e^{j\omega})$ be the Fourier Transform of $y(n)$. Then $y(e^{j0})$ is CO4- App

   (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)

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

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) f1(t) = 2 u(t -1) (ii) f2(t) = -2u(t-2)

(iii) f(t) = f1(t) + f2(t) (iv) f(t) = f1(t) - f2(t)

12. (a) Obtain the trigonometric Fourier series for the half wave rectified Sine function of 't'. CO3-App (8)

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. CO5- Ana (16)

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

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)

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

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)

$x(n) = (1/2)^n u(n)$ and $h(n) = (1/3)^n u(n)$

15. (a) Realize the direct form I, direct form II, cascade and parallel structure for the given difference equation. Comment on the results obtained. CO5- Ana (16)

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

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

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

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