Code No: **20EC3T02** **R20**

II B. TECH I SEMESTER REGULAR EXAMINATIONS, FEB - 2022
SIGNALS AND SYSTEMS
(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 Hours **Max. Marks: 70**

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$. [7M]

   b) Obtain the Exponential Fourier series coefficients for $x(t) = A \sin \omega_0 t$. [7M]

(OR)

2. a) Given $x(t) = (t+2)/6$, $-2 \leq t \leq 4$. Then Sketch (i) x (t) (ii) x (t+1) (iii) x (2t) (iv) x(t/2). [7M]

   b) Find the complex Exponential Fourier series coefficient of the signal $x(t)=\sin(3\pi t)+2\cos(4\pi t)$. [7M]

UNIT-II

3. a) Find the inverse Fourier transform of $X(\omega) = 1/ (a + j\omega)^2$. [6M]

   b) A signal $g(t) = \text{Cos}(200\pi t) + 2\text{Cos}(280\pi t)$ is sampled at a sampling frequency of 300Hz. If the sampled signal is transmitted through an ideal LPF with cut-off frequency of 250Hz. What frequency component will present in the output? [6M]

(OR)

4. a) Find the Fourier transform of u(t). [8M]

   b) Determine the Nyquist sampling rate and Nyquist sampling interval for the signal $x(t) = \text{sinc}^2 (200\pi t)$. [6M]

UNIT-III

5. a) Prove that the ideal low pass Filter is not physically realizable. [7M]

   b) Prove that the correlation and convolution functions are identical for even signals. [7M]

(OR)

6. a) Determine the output of an LTI system whose input and unit sample response are given as follows: $x(t) = e^{-2t} u(t)$, $h(t) = e^{-3t} u(t)$. [7M]

   b) State and prove the properties of Cross correlation function. [7M]

UNIT-IV

7. a) Explain the Time convolution and Scaling properties of Laplace transform. [7M]

   b) Find the inverse Laplace transform of $x(s) = 2s / (s+1)^2 (s+2)$; $Re(s) < -2$. [7M]

(OR)

8. a) Find the inverse Laplace transform of $X(s) = \frac{5s+13}{s(s^2+4s+13)}$, $Re(s) > 0$. [7M]
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b) The output y(t) of a continuous-time LTI system is found to be $2e^{-3t}$ u(t) when the input x(t) is u(t), then find the impulse response h(t) of the system. [7M]

UNIT-V

9. a) Prove the Z-differentiation property of Z-transform. Explain the concept of ROC in Z- transform. [7M]

b) Using Z-transforms find $x_1(n) * x_2(n)$ if $x_1(n) = u(n)$ and $x_2(n) = (1/2)^n u(n)$. [7M]

(OR)

10. a) Find the Z-transform of the discrete signal $x[n] = [2(3^n) - 4(3^n)]\,u[n]$. [8M]

b) Give the relationship between z-transform, Fourier transform and Laplace Transform. [6M]

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