



B.Tech II Year I Semester Supplementary Examinations, July 2022
Signals and Stochastic Process

ECE

Maximum Marks: 70

Date: 27.07.2022

Duration: 3 hours

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 Write about unit step function and unit impulse function.
- 2 Define signal bandwidth and system bandwidth
- 3 What is half wave symmetry? What is its effect?
- 4 State the conditions for the existence of Fourier Transform.
- 5 Find laplace transform of $e^{-at}u(t)$.
- 6 Find z- transform and ROC of $x[n] = -a^n u(-n-1)$.
- 7 Give an example of a deterministic random process.
- 8 Write short notes on Gaussian random process.
- 9 Write the expression for power spectral density.
- 10 The output of a filter is given by $Y(t) = X(t+T) + X(t-T)$, where $X(t)$ is a WSS process, power spectral density $S_{xx}(w)$, and T is a constant. Find the power spectrum of $Y(t)$.

Part-B

Answer All the following questions.

(10M X 5=50Marks)

- 11 a) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$.
b) show that $x(t)=2, y(t)=1-2t$ are orthogonal over the interval $[0,1]$. [7+3]
OR
- 12 Write in detail about Ideal filters. [10]
- 13 Expand following function $f(t)$ by trigonometric Fourier series over the interval $(0,1)$. In this interval $f(t)$ is expressed as $f(t) = At$. [10]
OR
- 14 (a) Find the Fourier Transform of signum function
(b) State and prove time reversal, time shifting and time scaling properties of Fourier Transform. [4+6]
- 15 (a) Prove that $x(t) = e^{-at}u(t)$ and $x(t) = -e^{-at}u(-t)$ have the same $X(S)$ and differ only in ROC. Also plot the ROC.
(b) State and prove time shifting property and shifting in S-domain property. [5+5]
OR
- 16 (a) State and prove initial value and final value theorems of Z-Transform.
(b) Find the inverse Z-Transform of $X(Z) = \frac{Z}{(Z-1)(Z-1/2)}$. [5+5]
- 17 (a) Explain briefly about Gaussian and Poisson Random Process.

(b) Show that the random process $X(t) = A\cos(\omega_0 t + \theta)$ is wide-sense stationary if it is assumed that A and ω_0 are constants and θ is a uniformly density random variable over the interval $(0, 2\pi)$. [4+6]

OR

18 (a) Define autocorrelation function of a random process. Write its properties and prove any two of them.

(b) Explain the concept of time average and ergodicity. Write the conditions for a random process to be ergodic in mean and autocorrelation. [5+5]

19 Explain about cross power spectrum density and its properties with proofs. [10]

OR

20 Derive the relationship between cross-power spectrum and cross correlation function. [10]