

Code No.: EC305ES

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CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS

II-B.TECH-I-Semester End Examinations (Regular) - January- 2022
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(ECE)

[Time: 3 Hours]

[Max. Marks: 70]

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 20 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A

(20 Marks)

1. a) Explain Probability density and distribution function. [2M]
- b) Define various types of Transformation of Random Variables. [2M]
- c) If $E[X]=2$, $E[Y]=3$, $E[XY]=10$, $E[X^2]=9$, and $E[Y^2]=16$ then find Covariance of X & Y , if X and Y are independent Random variables. [2M]
- d) Define conditional distribution function. [2M]
- e) Define Wide Sense Stationary Random Processes. [2M]
- f) Give the statement of Ergodic Theorem. [2M]
- g) Formulate Power Spectrum Density. [2M]
- h) Show that $S_{xx}(\omega) = S_{xx}(-\omega)$. [2M]
- i) Write short notes on White Noise. [2M]
- j) Explain Effective Noise Temperature. [2M]

PART-B

(50 Marks)

2. a) Define set, sample space and probability. [5M]
 - b) Five men out of 100 and 25 women out of 100 are colour blind. A colour blind person is chosen at random. Find the probability that the person is a male? Assume that probability of choosing male and female are equal. [5M]
- OR
3. a) Discuss the Mutually exclusive events with an example. [5M]
 - b) An urn contains 10 white and 12 red chips. Two chips are drawn at random without looking at their colours, and then two chips are discarded. What is the probability that a third chip drawn is red? [5M]
4. Verify that Uniform density is a valid density function. [10M]
- OR
5. a) Summarize the properties of a moment generating function. [5M]
 - b) A random variable X has a pdf [5M]
- $$f_x(x) = \begin{cases} \frac{1}{2} \cos x & -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0 & \text{Elsewhere} \end{cases}$$
- Find the mean value of the random variable X . [5M]

6. a) Explain how Random Processes are classified with neat sketches. [5M]
b) A Random Process $X(t) = A\cos(\omega_0 t) + B\sin(\omega_0 t)$ where ω_0 is a constant and A,B are uncorrelated zero mean random variables with same variances. Check whether $X(t)$ is WSS or not? [5M]

OR

7. a) Define Autocorrelation function of a random process. Write its properties and prove any two of them. [5M]
b) Explain the concept of time average and Ergodicity. Write the conditions for a random process to be ergodic in mean and autocorrelation. [5M]
8. a) The Autocorrelation function of a random process $R_{XX}(\tau) = 4 \cos(\omega_0 \tau)$, where ω_0 is a constant. Obtain its power spectral density. [5M]
b) Obtain the average power in the Random Process $X(t) = A\cos(\omega_0 t + \theta)$ where A, ω_0 are real constants and θ is a random variable uniformly distributed in the range $(0, 2\pi)$. [5M]

OR

9. a) Derive the expression for the Cross Spectral Density of the input Random Process $X(t)$ and the output Random Process $Y(t)$ of an LTI system in terms of its Transfer function. [5M]
b) Write the properties of power spectral density. [5M]
10. Define and explain Noise Figure, Thermal Noise and Entropy. [10M]
- OR
11. How to trade off between band width and SNR? Explain with example. [10M]
