Code No.: EC305ES | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–I–Semester End Examinations (Regular) - February- 2023
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) Discuss joint and conditional probabilities. [2M]
   b) What is the condition for a function to be a random variable? [2M]
   c) Define conditional density function. [2M]
   d) State central limit theorem. [2M]
   e) Show that $Sxx(\omega) = Sxx(-\omega)$. [2M]
   f) Define cross-covariance function. [2M]
   g) What is power spectrum density? [2M]
   h) Define cross correlation function of two variables. [2M]
   i) Define noise and write an example. [2M]
   j) What is Shannon Hartley-law? [2M]

PART-B **(50 Marks)**

2. In a single through of two dice, what is the probability of obtaining a sum of at least 10? [10M]

OR

3. Discuss in detail about the conditional probability with example. [10M]

4. If the pdf of a random variable is given by [10M]
   $f(x) = k(1- x^2)$; for $0 < x < 1$
   $= 0$ elsewhere:
   Find the value of k and the probability that it will take a value
   i) Between 0.1and 0.2 i.e $(0.1<X<0.2)$
   ii) Greater than 0.5 i.e $(X>0.5)$

OR

5. The density function of a random variable X is [10M]
   $f_x(x) = \begin{cases} 5e^{-5x}, 0 \le x \le \infty \\ 0 \text{ elsewhere} \end{cases}$
   Find: (i) E[X]. (ii) $E[(X-1)^2]$.

6. Explain the significance of auto correlation and write its properties. [10M]

OR

7. Explain about first order, second order, wide-sense and strict-sense stationery processes. [10M]

8. List the properties of cross power spectral density function. [10M]

OR

9. For two jointly stationary random processes, the cross-correlation function is $R_{XY}|\tau| = 2e^{-2\tau}\, u(t)$. Find the two cross-spectral density functions. [10M]

10.a) Explain the concept of noise sources. [10M]

b) Explain the following

i. Entropy ii. Information rate iii. Channel capacity iv. Mutual information.

OR

11. Derive the expression for [10M]

i. Noise Temperature.

ii. Noise equivalent bandwidth.

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