**Code No.ES303EC**

**METHODIST COLLEGE OF ENGINEERING & TECHNOLOGY (An Autonomous Institution)**

**B.E. (ECE) III-Semester (AICTE) (Regular) Examination, Feb -2023**

**Subject: PROBABILITY THEORY AND STOCHASTIC PROCESS**

**Time: 3 hours Max.Marks:60**

**Note: Missing data, if any, maybe suitably assumed.**

**PART-A**

**Answer All the questions.**

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| **Q.No.** | **Questions** | **Marks** | **CO** | **BTL** |
| **1. a** | **State the fundamental axioms of Probability?** | **2** | **1** | **1** |
| **b** | **List the properties of distribution function?** | **2** | **1** | **1** |
| **c** | **The cumulative distribution function of a random variable X is Fx(x)=(1-e-ax). Find the probability density function of X?** | **2** | **2** | **3** |
| **d** | **What is uniform random variable distribution and density functions?** | **2** | **2** | **1** |
| **e** | **State central limit theorem?** | **2** | **3** | **1** |
| **f** | **Prove that if two random variables are independent, then their covariance is zero.** | **2** | **3** | **2** |
| **g** | **Define mean ergodic process and correlation ergodic process?** | **2** | **4** | **1** |
| **h** | **What are the conditions for wide sense stationary random process?** | **2** | **4** | **1** |
| **i** | **Briefly explain white noise and colored noise?** | **2** | **5** | **2** |
| **j** | **The autocorrelation function of a random process is Rxx(τ)=a.e-b|τ| . Find its power spectral density?** | **2** | **5** | **3** |

**PTO**

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**PART-B**

**Answer Any Five questions**.

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| **Q.No.** |  | **Questions** | **Marks** | **CO** | **BTL** |
| **2.** | **a** | **State and prove the theorem of total probability?** | **4** | **1** | **2** |
| **b** | **Manufacturer X produces personal computers (PCs) at two different locations in the world. Fifteen percent of PCs produced at location A are delivered defective to a retail outlet, while 5 percent of PCs produced at location B are delivered defective to the same retail store. If the manufacturing plant at A produces 1,00,000 PCs per year and plant at B produces 1,50,000 PCs per year. Find the probability of purchasing a defective PC?** | **4** | **1** | **3** |
| **3.** | **a** | **Prove that the mean and variance of a Poisson distributed random variable X with parameter λ is same.** | **5** | **2** | **3** |
| **b** | **The diameter on an electric cable, say X is assumed to be a continuous random variable with pdf fx(x)=6x(1-x) for 0≤X≤1.**  **Check whether it is a valid pdf or not?** | **3** | **2** | **3** |
| **4.** | **a** | **Define joint density function fxy(x,y). Obtain the expressions to get the marginal density functions of X and Y using the joint density function.** | **4** | **3** | **2** |
| **b** | **Find the covariance and correlation coefficient of two random variables X and Y if E[X] = 2, E[Y] = 3, E[XY] = 10, E[X2] = 9 and E[Y2 ] = 16** | **4** | **3** | **3** |
| **5.** | **a** | **Consider a random process x(t)=a.sin(wot+θ) where θ is a uniform random variable in the interval (0,2π).Find the mean of this random process?** | **4** | **4** | **3** |
| **b** | **Find the autocorrelation function of the above random process x(t)? and check whether it is wide sense stationary or not** | **4** | **4** | **3** |
| **6.** |  | **Show that power density spectrum and the time average of the autocorrelation function forms a Fourier Transform pair.** | **8** | **5** | **2** |
|  |  |  |  |  |
| **7.** | **a** | **State and prove Bayes Theorem.** | **4** | **1** | **2** |
| **b** | **Find the characteristic function of a uniformly distributed random variable X over the interval [-1, 1 ]** | **4** | **2** | **3** |
| **8.** | **a** | **Define joint probability density function and list its properties?** | **4** | **3** | **2** |
| **b** | **Explain about first order, second order and Nth order stationary stochastic process.** | **4** | **4** | **2** |
| **9.** | **a** | **Define cross power spectral density of the random process X(t) and Y(t) and mention its properties.** | **4** | **5** | **2** |
| **b** | **An unbiased coin is tossed 4 times. If X denotes the number of heads from the distribution of X by writing down all possible outcomes, calculate the variance of the random variable X?** | **4** | **2** | **3** |

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