ACE Engineering College
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**Question Paper Code:** EC305ES

**ACE-R20**

# Semester Supplementary Examination
## II B. Tech- I Semester- SEPTEMBER-2022
## PROBABILITY THEORY AND STOCHASTIC PROCESSESS
### (Electronics and Communication Engineering )

**Time: 3 Hours**

**Max. Marks: 70**

| **H. T. No** | | | | | | | | | | |
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*Answer any 5 Questions out of 8 Questions from the following*

**M=Marks**

| Q.No | Question | M |
|---|---|---|
| 1. a) | Give the classical definition of probability. Discuss joint probability and conditional probability with an example. | 6 |
| b) | Briefly explain the Gaussian density and distribution function with plots. Determine the probability of the event $\{X=7.3\}$, if Gaussian random variable having $a_X = 7$ and $\sigma_x = 0.5$. | 5 |
| c) | Compute the probability of the event "getting a queen card" from a deck of 52 cards. | 3 |
| 2. a) | Let X and Y be jointly continuous random variables with joint density function $f_{XY}(x,y) = xy\, e^{-\left(\frac{x^2+y^2}{2}\right)}$ for x>0, y>0; $= 0$, otherwise. (i) Check whether x and y are independent. (ii) Find P (x≤1, y≤1). | 7 |
| b) | Prove the following: $var(ax+by) = a^2 var(x) + b^2 var(y) + 2ab\, cov(x,y)$ | 7 |
| 3. a) | If X(t) is a stationary random process with density function $f(x) = 3x$, $0<x<2$; $=0$, otherwise. and auto correlation function: $R_{XX}(\tau) = 9 + (2/\tau)$, where X is a random variable. Find the mean and variance of the random variable. | 6 |
| b) | Explain about mean-ergodic process, Auto correlation and Cross correlation functions with its properties. | 8 |
| 4. a) | Define conditional distribution and density functions and list their properties. | 6 |

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|---|---|---|
| 4.b) | Random variables X and Y have the joint density:<br>$f_{XY}(x,y)= 1/24$ for $0 < x < 6$ & $0 < y < 4$<br>$=0$ , elsewhere<br><br>What is the expected value of the function $g(X,Y) = (XY)^2$ ? | 8 |
| 5. a) | How do you explain statistically independent events using Baye's rule? | 6 |
| b) | A random process is defined as $X(t) = A \sin(\omega t+\theta)$, where A is a constant and $\theta$ is a random variableuniformly distributed over $(-\pi,\pi)$, Check X(t) for stationarity. | 8 |
| 6. a) | Find auto correlation function of a random process whose power spectral density is given by $1/(25+\omega^2)$ ? | 6 |
| b) | A wide sense stationary random process X(t) is applied to the input of an LTI system whose impulse response is $5t\, e^{-2t}$. The mean of X(t) is 3. Find the mean output of the system. | 3 |
| c) | Briefly explain the concept of cross power density spectrum. | 5 |
| 7. a) | Show that a narrow band noise process can be expressed as in-phase and quadrature components of it. | 7 |
| b) | A mixer stage has a noise figure of 20dB and this is preceded by a amplifier that has a noise figure of 9dB and an available power gain 15dB. Calculate the overall noise figure referred to the input. | 7 |
| 8. a) | Find power spectrum of WSS noise process N(t) with autocorrelation function defined as below $R_{NN}(\tau)=Pe^{-3\|\tau\|}$ | 6 |
| b) | Find the cross-correlation function for a cross-power density spectrum given below $S_{XY}(\omega)= 8/(\alpha+j\omega)^3$ ? | 8 |