AQ – 2920

First Semester M. E. (ENTC) Full Time Examination

RANDOM PROCESS

Paper – 1 ENTC 2

P. Pages : 4

Time : Three Hours]   [Max. Marks : 80

Note : (1) Assume suitable data wherever necessary.
(2) Illustrate your answer wherever necessary with the help of neat sketches.
(3) Use pen of Blue/Black ink/refill only for writing the answer book.

1. (a) According to the world values survey. In India the most recent phase of the survey that Polled 77,882 people from 32 states estimates that 36.2% of the Indias population agree with the statement "Men should have more right to a job than women". The survey also estimates that 13.8% of people have an IIT Degree, and that 3.6% of people fit both criteria.
Answer for the following :—

 (i) Are agreeing with the statement "Men should have more right to a job than women" and having IIT degree Disjoint Events ?

 (ii) Draw a Venn diagram summarizing the variables and their associated proba-bilities.

 (iii) What is the probability that a random drawn person has a IIT Degree or Agree with the statement about "men should have more right to a job than women" ?

 (iv) What percent of the Indian population do not have a IIT degree and disagree with the statement ?

 (v) Does it apear that the event that someone agrees with the statement is independent of the event that they have IIT Degree ?

 (vi) What is the probability that at least 1 in 5 randomly selected people agree with the statement about "Men having more right to a job than women" ?   13

OR

2. (a) For the experiment of fair coin toss, take a discrete random variable X. map to any real number. Find and sketch Cumulative Distribution Function (CDF). Can you find and sketch a PDF for that ?   6

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(b) For a given random variable X, the Proba-bility Density Function is described bellow,

$$f_x(x) = \begin{cases} 2/3 & ; 1 \le x \le 5/2 \\ 0 & ; \text{otherwise} \end{cases}$$

Plot the given PDF and also find Cumulative Distribution Function and plot that. **7**

3. (a) According to a 2015 TCS Poll, allover India only 13% of employees are engaged at work. (psychologically committed to their jobs and likely to be making positive contribution to their organization).Among a random sample of 10 employees, what is the probability that 8 of them are engaged at work ? (Hint : Use Binomial Distribution). **7**

(b) An insurance Company has issued Policies to 100,000 people for a premium of Rs. 500/person. In the event of a casualty, the probability of which is assumed to be 0.001, the company pays Rs. 200,000/ casualty. What is the probability that (i) the company will suffer a Loss ? (ii) the company will make a profits of at least Rs 2.5 crore?
(Hint : Use Poison Distribution). **7**

OR

4. (a) Consider x is a random variable and y is a function of x. y = ax + b where a > 0 Find the Cumulative Distribution Function and Probability Density Function of a random variable y in terms of X. What will be its Jacobian transformation ? **7**

(b) Suppose $f_x(x)$ $2x/\pi^2$, $0 < x < \pi$, and y = sin (x). Determine $f_y(y)$. **7**

5. (a) For a multiple random variable i.e. x_1, x_2. Describe Joint CDF and also describe joint PDF. If these two random variables are independent then, what will be its conditional. Distribution and density function. **7**

(b) Let z = x – y. Determine Joint PDF $f_z(z)$. **6**

OR

6. (a) Consider a$^{n^4}$ jointly Gaussian Random vector. as
$x_1 \to \{-1.5, -1, 0, 1, 1.5\}$, $x_2 \to \{1, 2, 3, 4, 5\}$, $x_3 \to \{0, 2, 4, 6, 8\}$, $x_4 \to \{1, 3, 5, 7, 9\}$.
Find mean vector $\underline{m}$ and covarriance Matrix $\underline{\underline{M}}$ and Describe jointly Probability Density Function. **6**

(b) Let x and y be independent exponential random variables with common parameter λ. Define $u = x + y$, $v = x - y$ Find the joint and marginal P.D.F. of μ and v. 7

7. (a) Describe in detail, Meaning of stochastic process. What do you understand by sample function ? Explain with example Continuous Random Process and Discrete Random Process. 6

(b) Suppose that x(t) is a Poisson process as shown in fig bellow (fig. 7.b) such that $E\{x(9)\} = 6$. (i) find mean and the variance of x(8). (ii) find P $\{x(2) \leqslant 3\}$. (iii) Find $P\{x(4) \leqslant 5|x(2) \leqslant 3\}$
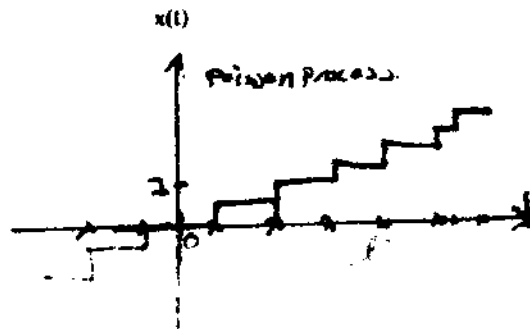

fig.7.(b) 7

OR

8. (a) What do you mean by Random walk ? Explain it with neat sketch and proper example. 6

(b) Suppose that x(t) is a normal Random process with $n(t) = 3$ $c(t_1, t_2) = 4e^{-0.2|t_1 - t_2|}$

(i) Find the probability that $x(5) \leqslant 2$.

(ii) Find the probability that $|x(8) - x(5)| \leqslant 1$. 7

9. (a) The process $x(t) = c^{at}$ is a family of exponentials depending on the random variable a. Express the mean $n(t)$. The Autocorrelation $R(t_1, t_2)$, and the first-order density $f(x, t)$ of x(t) interms of the density $f_a(a)$ of a. 7

(b) Express the Autocorrelation Function for a Complex valued random process. Also explain the condition for the two random process 'ec. x(t), y(t) are independent in terms of their correlations. 7

OR

10. (a) The Random variable C is uniform in the internal (O, T). Find $R_x(t_1, t_2)$ if (i) $x(t) = \mu(t - c)$, (ii) $x(t) = \delta(t - c)$.   7

   (b) Show that (i) x(t) is a complex WSS process, Then

$$E\{|x(t + \tau) - x(t)|^2\} = 2 \; \text{Re} \, [R(0) - R(\tau)].$$ 7

11. (a) Given a real process x(t) with Fourier Transform $x(w) = A(w) + jB(w)$, show that if the processes A(w) and B(w) satisfy $\{E(A^2(w)) = E(B^2(w)), E(A(w)B(w)) = 0\}$ and $E(A(w) = E(B(w)) = 0$, then x(t) is WSS.   7

   (b) Explain and proof at least two properties of PSD.   6

OR

12. (a) Find and express power spectral Density of Autocorrelation function $\phi(t)$, what will be the Average power ? Why does it called Power spectral Density ?   6

   (b) Draw and explain the PSD of white noise, Also find its correlation function and sketch that.   7

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