

FACULTY OF INFORMATICS**B.E. 2/4 (IT) II – Semester (Suppl.) Examination, January 2016****Subject: Probability and Random Process****Time: 3 Hours****Max.Marks: 75****Note: Answer all questions from Part A. Answer any five questions from Part B.****PART – A (25 Marks)**

- 1 Define Axiomatic definition of probability. 2
- 2 A biased coin is tossed till a head appears for the first time. What is the probability that the number of required tossed is odd. 3
- 3 A box B_1 contains 10 white and 5 red balls, and box B_2 contains 20 white and 20 red balls. A ball is drawn from each box. What is the probability that the ball from B_1 will be white and the ball from B_2 red? 3
- 4 Draw the graphs of c.d.f. and p.d.f. for the random experiment of the throwing a fair die. 3
- 5 What is the memory less property of exponential distribution? 3
- 6 A fair die is rolled 10 times. We shall determine the probability that “ f_1 ” shows three times and “even” shows six times. 3
- 7 State the properties of cross correlation. 2
- 8 Show that $|R_{xy}(\tau)| \leq \frac{1}{2} [R_{xx}(0) + R_{yy}(0)]$. 2
- 9 Define White Noise. 2
- 10 Define Filter. 2

PART – B (5x10 = 50 Marks)

- 11 a) A box contains m white balls and n black balls. Balls are drawn at random one at a time without replacement. Find the probability of encountering a white ball by the k^{th} draw. 5
- b) A box contains white and black balls. When two balls are drawn without replacement. Supposed the probability that both are white is $1/3$. Find the smallest number of balls in the box. 5
- 12 a) Suppose box 1 contains a white balls and b black balls, and box 2 contains c white balls and d black balls. One ball of unknown color is transferred from the first box into the second one and then a ball is drawn from the latter. What is the probability that it will be a white ball? 5
- b) We have four boxes. Box 1 contains 2000 components of which 5 % are defective. Box 2 contains 500 components of which 40 % are defective. Box 3 and 4 contain 1000 each with 10% defective. We select at random one of the boxes and we remove at random a single component. What is the probability that the selected component is defective? 5

- 13 a) Over a period of 12 hours, 180 calls are made at random. What is the probability that in a four-hour interval the number of calls is between 50 and 70? 4
- b) An insurance company has policies to 100,000 people for a premium of \$500 person. In the event of causality, the probability of which is assumed to be 0.001, the company pays \$200,000 causality. What is the probability that (i) the company will suffer a loss? (ii) The company will make a profit of at least \$25 million? 6
- 14 a) Suppose that the voltage V is a random variable given by $V = i(R + r_0)$. Where $i = 0.01$ A and $r_0 = 1000$. If the resistance R is random variable uniform between 900 and 1100 , then V is uniform between 19 and 21volts. 5
- b) The random variables X and Y are jointly normal with
 $\sigma_x^2 = 10$ $\sigma_y^2 = 0$ $\sigma_x^2 = 4$ $\sigma_y^2 = 1$ $\rho_{xy} = 0.5$
 Find the joint density of random variables $Z = X + Y$; $W = X - Y$ 5
- 15 Given $f_{xy}(x, y) = \begin{cases} k & 0 < x < y < 1 \\ 0; & \text{otherwise} \end{cases}$
 Determine $f_{x|y}(x|y)$ and $f_{y|x}(y|x)$ 10
- 16 a) Given a random variable S with density $f(\check{S})$ and a random variable $\{$ uniform in the interval $(-f, f)$ and independent of S , then prove that the process
 $X(t) = a \cos(\check{S}t + \{)$ is wss process. 5
- b) The process $X(t)$ is WSS and normal with $E\{X(t)\} = 0$ and $R(\dagger) = 4e^{-2|\dagger|}$.
 Find
 $E\{[X(t+1) - X(t-1)]^2\}$ 5
- 17 a) If $\{N(t)\}$ is a band limited white noise such that

$$S_{NN}(\check{S}) = \frac{N_0}{2} \text{ for } |\check{S}| < \check{S}_B$$

$$0, \text{ elsewhere}$$

 find the autocorrelation of $\{N(t)\}$ 5
- b) The impulse response of a low pass filter is $r e^{-r\dagger} U(t)$; where $r = \frac{1}{RC}$. If a zero mean, white Gaussian process $\{N(t)\}$ is input into this filter. Find the mean square value and autocorrelation function of the output. 5