Jaypee University of Information Technology, Waknaghat
Test-I Examination, February 2020
B.Tech (ECE/CSE/IT)

Course Title: Probability Theory and Random Processes Max. Marks: 15 marks
Course Code: 10B11MA411
Semester: IV   Max. Time: 1 hour

Note: Answer all the questions. ALL questions carry equal marks. Use of calculators is allowed. Describe random variables along with range where applicable.

1. A box contains 5 white balls and 3 black balls. The first ball is extracted and without returning it to the box a second ball is drawn. Determine the probability of winning: you win if you get a white ball on the second draw.   (3 Marks) [CO-1]

2. In 1989 there were three candidates for the position of principal - Mr. Chatterji, Mr. Ajay and Dr. Singh - whose chances of getting the appointment are in the proportion 4:2:3 respectively. The probability that Mr. Chatterji if selected would introduce co-education in the college is 0.3. The probabilities of Mr. Ajay and Dr. Singh doing the same are respectively 0.5 and 0.8. What is the probability that there was co-education in the college in 1990?   (3 Marks) [CO-1]

3. Consider the following density function of X: (3 Marks) [CO-2]

$$f(x) = \begin{cases} \frac{1}{2}(x-3) & , \quad 3 \le x \le 5 \\ 0 & , \quad \text{otherwise} \end{cases}$$

   (a) Find the *cumulative distribution function*.

   (b) Compute $\mathbb{P}(4 \le X \le 6)$ by using *distribution function*.

4. A sample of 3 items is selected at random from a box containing 20 items of which 4 are defective. Suppose X denotes number of defective items in the sample. (3 Marks) [CO-2]

   (a) Determine the probability distribution of X.

   (b) Find the expected number of defective items in the sample.

5. Consider the following density function of X: (3 Marks) [CO-2]

$$f(x) = \begin{cases} \frac{1}{3} & , \quad -1 < x < 2 \\ 0 & , \quad \text{elsewhere} \end{cases}$$

   (a) Determine the *moment generating function* of the random variable X.

   (b) Deduce the *mean value* of X.

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