

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATIONS-2022

B. Tech. -III Semester (EC/EM)

COURSE CODE (CREDITS): **18B11MA314** (4)

MAX. MARKS: 15

COURSE NAME: **Probability Theory and Random Processes**

COURSE INSTRUCTORS: Dr. Saurabh Srivastava

MAX. TIME: 1 Hour

Note: All questions are compulsory. Marks are indicated against each question in square brackets. Use of scientific calculator is allowed.

Q1. Police plan to enforce speed limits by using radar traps at 4 different locations within the city limits. The radar traps at each of these locations L1, L2, L3, L4 are operated for 28%, 27%, 25% and 20% of the time. If a person who is speeding on his way to work has probabilities of 0.2, 0.1, 0.5 and 0.2 respectively of passing through these locations, what is the probability that he will be fined (for over speed)? **[2](CO-1)**

Q2. A lot of 100 semiconductor chips contain 20 that are defective. Two chips are selected at random, without replacement, from the lot.

(a) What is the probability that the first one selected is defective?

(b) What is the probability that the second one selected is defective given that the first one was defective?

(c) What is the probability that both are defective? **[1+1+1](CO-1)**

Q3. A shipment of 8 similar microcomputers to a retail outlet contains 3 that are defective. If a school makes a random purchase of 2 of these computers, find the probability distribution for the number of defectives. Also find mean and variance of the random variable.

[1+1+1](CO-2)

Q4. A manufacturer has been using two different manufacturing processes to make computer memory chips. Let (X, Y) be a bivariate random variable, where X denotes the time to failure of chips made by process A and Y denotes the time to failure of chips made by process B. Assuming that the joint probability density function of (X, Y) is:

$$f_{XY}(x, y) = \begin{cases} abe^{-(ax+by)}, & x > 0, y > 0 \\ 0, & \text{otherwise} \end{cases}$$

, where $a = 10^{-4}$ and $b = 1.2(10^{-4})$, determine $P(X > Y)$.

[4](CO-2)

[P.T.O.]

Q5. A binary source generates digits 1 and 0 randomly with probabilities 0.6 and 0.4, respectively.

- (a) What is the probability that two 1s and three 0s will occur in a five-digit sequence?
- (b) What is the probability that at least three 1s will occur in a five-digit sequence?

[3](CO-3)

17 Examinations September 2021