(i) Printed Pages : 6 Roll No. ....

(ii) Questions : 9 **Sub. Code :** | 1 | 0 | 4 | 3 | 7 |

Exam. Code : | 5 | 0 | 0 | 2 |

Bachelor of Arts (FYUP) 2nd Semester

(2056)

STATISTICS

Paper : Probability Theory

(Common with B.Sc. 2nd Sem. FYUP)

Time Allowed : 3 Hours] **[Maximum Marks : 60**

Note :– Attempt **five** questions in all, including Question No. **1** which is compulsory and selecting **one** question from each unit. Use of electronic calculator with four basic mathematical operations and up to one memory is allowed.

(Compulsory Question)

1. Answer the following:

   (i) Define independent events with example.

   (ii) If two unbiased dice are thrown, find the probability that the sum of numbers on the dice is 8.

   (iii) Define the multiplication theorem for two events.

   (iv) Differentiate between discrete and continuous random variable.

(v) If X be a random variable has the following probability distribution:

X	1	2	3	4
p(x)	k	2k	3k	2k

Find the value of constant 'k'.

(vi) Define the probability generation function of a random variable X. 6×2

UNIT–I

2. Define the following:

(i) Random experiment and Sample Space with examples

(ii) Mutually-Exclusive Events with examples

(iii) Mathematical or Classical probability

(iv) Axiomatic Definition of Probability. 4×3

3. (a) If the letters in the word 'REGULATIONS' are randomly arranged, what is the probability that there are exactly four letters between R and E?

(b) For any two events A and B show that:

(i) $P(\overline{A} \cap B) = P(B) - P(A \cap B)$, and

(ii) $P(A \cap \overline{B}) = P(A) - P(A \cap B)$ 6,6

UNIT–II

4. (a) State and prove Conditional Probability theorem for two events.

   (b) From a sales force of 150 persons, one will be selected to attend a special sales meeting. If 52 of them are unmarried, 72 are college graduates, and 3/4 of the 52 that are unmarried are college graduates, find the probability that the sales person selected at random will be neither single nor a college graduate. 6,6

5. (a) In a city, the probabilities are given as follows:

   (i) The probability of selecting either a female or an educated is 7/10;

   (ii) The probability of selecting a female who is educated is 4/10;

   (iii) The probability of selecting educated first and then a female is 2/3.

   Determine the probabilities of selecting: (a) a non-educated, (b) a female, and (c) an educated given that a female is selected first.

   (b) In 2015, there are three candidates for the principal position, namely, Dr. Ram, Mr. Krishan, and Mr. Mohan, with the ratio of the probability of being appointed as the principal in 2015 as 4:2:3, respectively. Also, the probability that Dr. Ram would introduce co-education if appointed as the principal is 0.3, and the chances for Mr. Krishan and Mr. Mohan are 0.5 and 0.8, respectively.

(i) Find the probability that co-education will be introduced in the college in 2016.

(ii) Find the probability that Dr. Ram will be appointed as the principal if the co-education policy is implemented in 2016. 6,6

UNIT–III

6. (a) Define distribution function and write its properties.

(b) If X be a random variable having the following function

$$f(x)=\begin{cases}\dfrac{x^2}{3} & ; \ -1<x<2 \\ 0 & ; \ \text{otherwise}\end{cases}$$

(i) Verify it is probability function or not?

(ii) Find $P(0 < x < 1)$, and

(iii) Find F(x) i.e., the cdf.

(c) If X be the random variable has the following probability distribution:

X	1	2	3	4	5	6
p(x)	1/10	2/10	2/10	3/10	1/10	1/10

Find : (i) $P(X < 4)$, (ii) $P(2 \le X \le 5)$, (iii) The distribution function of X i.e., F(x) 4,4,4

7. (a) A two dimensional random variable (X, Y) have a bivariate distribution given by:

$$P(X = x, Y = y) = \frac{x^2 + y}{32};\ x = 0,1,2,3 \text{ and } y = 0,1.$$

Find:

(i) the marginal distributions of X and Y and

(ii) Conditional distribution of X given $Y = 1$.

(b) Define the following:

(i) Joint density function of two dimensional random variables (X, Y),

(ii) Marginal density functions of X and Y, and

(iii) Conditional probability density functions. 6,6

UNIT–IV

8. (a) Define mathematical expectation and write its properties.

(b) Let X be a random variable with the following probability distribution:

x	–3	6	9
P(X = x)	1/6	1/2	1/3

Find E(X) and $E(X^2)$. Also, using the property of expectation and variance, evaluate E(2X + 3) & Var(2X + 3). 6,6

9. (a) Define Moment generating function (MGF) and write its properties.

(b) Let X be a discrete random variable having the following probability mass function:

$p(x) = q^x p; x = 0, 1, 2, ...,\infty$ and $p + q = 1$.

Find the MGF of X.

(c) Write the properties of characteristic function. 5,3,4