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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time: 3 *Hours*] [*Max. Marks*: 80

Section A – (Marks: 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain classification and tabulation of data.
2. What is skewness?
3. Calculate mode for the following data:

C-I	0-10	10-20	20-30	30-40	40-50
Frequency	5	15	10	6	8

4. Define Sample Space with an example.
5. Define mathematical, statistical and axiomatic definitions of probability.
6. If two dice are thrown, find the probability of
   (i) equal number occurrence on two faces
   (ii) the sum of two faces are 8.
7. Define discrete and continuous random variables with an example.
8. Define:
   (i) Joint probability mass function
   (ii) Independence of two random variables
9. The diameter of an electric cable, say 'x', is assumed to be a continuous random variable with p.d.f.: $f(x) = 6x(1-x)\ 0 \le x \le 1$
   (i) Check that f(x) is p.d.f. and
   (ii) $P(0 \le x \le 0.5) = ?$
10. State addition and multiplication theorems of expectation.
11. Define characteristic function and probability generating function of a random variable 'x'.
12. Let 'x' be a random variable with following probability distribution. Find E(x) and $E(x^2)$ and V(x).

x	1	2	3	4	5
p/x	1/6	1/6	¼	½	½

10. State addition and multiplication theorems of expectations.

11. Define expected value of a r.v.X, when X is continuous. If $g(x)$ is a function of a r.v.X, then define expectation of $g(x)$.

12. Find the expectation of the number on a die when thrown.

Section B – (Marks : 4 × 12 = 48)

(Essay type Answer Questions)

Answer **all** *questions.*

13. (a) Explain various data collection methods. How to classify and tabulate the data?

Or

(b) Define Central and non-Central moments. Derive the relation between them.

14. (a) State and prove Bayes theorem, also write its applications.

Or

(b) For n events $A_1, A_2, ..., A_n$ prove that

(i) $P\left(\bigcap_{i=1}^{n} Ai\right) \geq \sum_{i=1}^{n} P(Ai) - (n-1)$

(ii) $P\left(\bigcup_{i=1}^{n} Ai\right) \leq \sum_{i=1}^{n} P(Ai)$

15. (a) Define a distribution function of a r.v.x. and write its properties. Prove any two properties.

Or

(b) Define conditional probability distribution functions of x/y and y/x. Prove that if x and y are independent then the joint probability mass function is equal to the product of two marginal functions.

16. (a) Define moment generating function of a r.v. x. How to obtain the moments using M.g.f.? Also state any two properties.

Or

(b) State and prove Chebychev's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (III Semester) Examination

STATISTICS

Paper III

(Statistical Methods and Theory of Estimation)

Time : 3 *Hours*] [*Max. Marks* : 80

Section A – (Marks: 8 × 4 = 32)

(*Short Answer Questions*)

Answer any eight questions.

1. Define the term correlation with an example.
2. Explain principle of least squares.
3. From the following data, obtain two regression equations.

X	6	2	10	4	8
Y	9	11	5	8	7

4. Calculate $R_{1.23}$ from the following data:

   $r_{12} = 0.9$ $r_{23} = 0.4$ and $r_{13} = 0.5$
5. Define an attribute with an example.
6. What do you mean by independent of attributes?
7. Explain:

   (a) Standard error of sample mean

   (b) Standard error of sample proportion.
8. Define Chi - square distribution and also write its applications.
9. Show that $\overline{X}$ is the consistent estimator of Parameter λ of Possion disribution.
10. State Neyman's factorization theorem. Also give its importance in the theory of estimation.
11. Explain the concept of Asymptotic properties of MLE.
12. Let $x_1, x_2 ..... x_n$ be a random sample from Binomial distribution B(n,p). Find a sufficient estimator for 'P'.

[P.T.O.

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FACULTY OF SCIENCE

B.Sc. (V Semester) Examination

STATISTICS

Paper V

(Applied Statistics - I)

Time: 3 Hours] *[Max. Marks: 80*

Section A – (Marks: 4 × 10 = 40)

Answer any **four** *questions*

1. Explain the merits and demerits of Random Sampling.
2. Explain subjective, probability and mixed sampling methods.
3. What is systematic sampling? How it is different from stratified random sampling.
4. Explain proportion allocation and optimum allocation.
5. Explain Graphical method of estimating the trend in Time Series data.
6. Explain ratio to trend method.
7. Define an 'Index Number'. Write its uses. Explain why this is called "Economic barometers"
8. Explain the concept of Base shifting, Splicing and deflating of an Index Number.

Section B – (Marks: 2 × 20 = 40)

Answer any **two** *questions*

9. What are the principle steps involved in a sample survey? Discuss them briefly.
10. In SRSWOR, prove that $Var(\bar{y}_n) = \frac{S^2}{n} \frac{N-n}{N}$.
11. Explain how you would fit a straight line trend to a given time series data. From the following sales data, find the estimate sales in 2007.

Year	2001	2002	2003	2004	2005
Sales	1	5	8	12	18

12. Explain the procedure for the construction of cost of living index number.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time : 3 Hours] [*Max. Marks* : 80

Section A – (Marks : 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain classification and tabulation of data.
2. Define moments and write types of moments.
3. The first four moments of a distribution about the value 3 are 4, 7, 2, and 5. Find the corresponding moments about the mean.
4. Define the following terms with an example.
   (i) Sample space.
   (ii) Independent and dependent events.
5. State Boole's inequality.
6. A bag contains 6 white, 4 green and 10 yellow balls. Two balls are drawn at random. Find the probability that both will be yellow.
7. Define discrete and continuous randam variables.
8. Explain Transformation of one-dimensional random variable.
9. A r.v. X has the following probability function.

X	0	1	2	3	4	5	6	7	8
P(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

   (a) Determine the value of 'a'.
   (b) Find $P(x < 3)$, $P(x \geq 3)$ $P(0 < x < 5)$.
10. Define mathematical expectation of a random variable.
11. Define characteristic function.

Section B– (Marks: 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13. (a) Explain various methods of data collection and editing.

Or

(b) Define central and non-central moments and derive the relation between th

14. (a) Prove that for 'n' events $A_1, A_2 \ldots\ldots A_n$

$$P\left(\bigcap_{i=1}^{n} Ai\right) \geq \sum_{i=1}^{n} P(Ai) - (n-1)$$

(b) State and prove Bayes' theorem. Also mentioin its merits.

15. (a) Define the following terms with an example:

(i) Probability mass function

(ii) Probability density function

(iii) Distribution function

(iv) Marginal and Conditional distribution.

Or

(b) The joint probability distribution of two random variables x and y is give

$$P(x=0, y=1) = \frac{1}{3},\ P(x=1,\ y=-1) = \frac{1}{3}\ \ and\ \ P(x=1,\ y=1) = \frac{1}{3}$$

Find (i) Marginal distributioin of x and y

(ii) Conditional probability distribution of x, given y = 1.

16. (a) Define moment generating function. Explain the procedure for obtainin moments using m.g.f . Also mention any two properties of m.g.f .

Or

(b) State and prove Chebyshev's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time : 3 *Hours*]

[*Max. Marks* : 80

Section A – (Marks : $8 \times 4 = 32$)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Define primary and secondary data.
2. Define mean deviation, standard deviation and coefficient of variation.
3. Calculate mean and standard deviation for the following data.

   10, 20, 30, 40, 50, 60, 70.
4. Define mutually exclusive and independent events.
5. Write the axioms of probability.
6. From a pack of playing cards, two cards are drawn at random. Find the probability that one is a King and the other is a Queen.
7. Define probability mass function and probability density function.
8. Define any **two** of the following terms:

   (i) Conditional distribution function.

   (ii) Independence of two random variables.

   (iii) Joint and marginal probability mass function.
9. Let X be a continuous random variable with p.d.f.

$$f(x) = \begin{cases} ax & ; \ 0 \le x \le 1 \\ a & ; \ 1 \le x \le 2 \\ -ax + 3a & ; \ 2 \le x \le 3 \\ O & : \ OW \end{cases}$$

10. Define mathematical expectation of a random variable X.

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FACULTY OF SCIENCE

B.Sc. (II Semester) Examination

STATISTICS

Paper II

(Probability Distribution)

(CBCS)

Time : 2 *Hours*] [*Max. Marks* : 80

Section A – (Marks: 4 × 10 = 40)

Answer any **four** *questions.*

1. Define Binomial distribution. Derive its mean and variance.
2. Explain lack of memory property of Geometric distribution.
3. Explain additive property of Poisson distribution.
4. Show that Poisson distribution as a limiting case of Binomial distribution.
5. Define gamma distribution. Derive mean and variance of gamma distribution.
6. Define normal distribution. State its chief characteristics.
7. State central limit theorem, mention its uses.
8. Explain the additive property of normal distribution.

Section B – (Marks: 2 × 20 = 40)

Answer any **two** *questions.*

9. Define Poisson distribution. Derive mean and variance of Poisson distribution, also show that its mean and variance are equal.
10. Derive the moment generating function of Negative Binomial distribution.
11. Define exponential distribution. Derive its mean and variance using m.g.f.
12. If 'X' is normally distributed with mean 25 and standard deviation 5 then find

    (i) $P(X \leq 15)$

    (ii) $P(X \geq 30)$

    (iii) $P(20 \leq X \leq 35)$

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FACULTY OF SCIENCE

B. Sc. (III Semester) Examination

BIO STATISTICS

(Skill Enhancement Course-2) (NEW)

Time : 2 *Hours*] [*Max. Marks* : 40

Section A – (Marks: $4 \times 4 = 16$)

(Short Answer Questions)

1. Attempt any **four** of the following:

(a) What is Histogram? Explain the construction procedure of Histogram.

(b) Compute the mean from the following data:

C.I.	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
f	5	10	25	30	20	10

(c) Define correlation with an example.

(d) Define the term probability and give one example for it.

(e) If a surgeon transplants a liver in 550 cases and succeds in 275 cases, calculate the probability of survival after transplant.

(f) Define null hypothesis and alternative hypothesis. Give one example for each.

Section B – (Marks: $2 \times 12 = 24$)

(Essay Type Questions)

Answer **all** *questions.*

2. (a) Explain the following with the related formula.

(i) Mean (ii) Median

(iii) Mode (iv) Standard deviation

(v) Standard error (vi) Coefficient of variation.

Or

(b) Calculate Karl-Pearson's coefficient of correlation for the following data:

x	8	10	15	11	12	9	13	14	10	9
y	45	55	70	80	65	70	90	90	76	67

3. (a) Explain Binomial, Poisson and Normal distributions. Also mention its applications.

Or

(b) In an experiment on breeding of flowers of a species: a researcher obtained 107 magenta flowers with a green stigma, 42 magenta flowers with a red stigma, 38 red flowers with a green stigma and 13 red flowers with a red stigma. According to Mendel's laws the theory predicts that these types should be obtained in the ratio of 9:3:3:1. Draw your conclusions based on the calculated Chi-square value. (Table value of Chi-square at 0.05 L.O.S. for 3 degrees of freedom = 7.81)

[P.T.O.

12. Compute the expected value of the random variable X whose density function given by

$$f(x) = \begin{cases} \frac{1}{x^2} & ; \ 1 < x < \infty \\ 0 & ; \ \text{elsewhere} \end{cases}$$

Section B – (Marks : 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13. (a) Explain various measures of Central tendencies with suitable examples.

Or

(b) Define skewness. Explain measures of skewness based on quartiles and moments.

14. (a) Define mathematical, statistical and axiomatic definition of probability and distinguish between mathematical and statistical definition of probability.

Or

(b) Define conditional probability. State and prove multiplication theorem of probability.

15. (a) Explain the following terms:

(i) Joint distribution function.

(ii) Marginal and conditional distribution functions.

(iii) Independence of two random variables.

Or

(b) Let 'x' be a continuous random variable with p.d.f. fx(x). Let y = g (x) be strictly monotonic function of x. Assume that g(x) is a differentiable and is continuous for all x. Prove that p.d.f. h(·) of the r.v. y is $h_r(y) = f_x^{(x)} \left| \frac{dx}{dy} \right|$ where x is expressed in terms of y, using the transformation y = g (x).

16. (a) State and prove addition and multiplication theorems of expectation.

Or

(b) Define moment generating function. How to obtain moments using moment generating function?.

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FACULTY OF SCIENCE

B.Sc. (V Semester) Examination

STATISTICS

Paper VI

(SQC & LPP)

Time : 3 *Hours*] [*Max. Marks* : 80

Section A – (Marks: 4 × 10 = 40)

Answer any **four** *questions.*

1. Explain chance causes and assignable causes of variations in the quality of a product.
2. Derive the control limits of d and C-chart.
3. Explain AQL and LTPD.
4. Explain acceptance sampling procedure of single sampling plan.
5. Explain the aim and scope of Operations Research.
6. Define artificial variable and also explain Charnes' Big-M method.
7. Discuss the concept of duality in LPP.
8. Write down the dual of the following L.P.P. and solve it.

   Maximize $z = 2x_1 + x_2$

   Subject to the constraints:

   $x_1 + 2x_2 \leq 10$

   $x_1 + x_2 \leq 6$

   $x_1 - x_2 \leq 2$

   $x_1 - 2x_2 \leq 1$

   and $x_1, x_2 \geq 0$.

Section B – (Marks: 2 × 20 = 40)

Answer any **two** *questions.*

9. (i) What is control chart? Explain the basic principles underlying the control charts.

   (ii) Explain in detail mean chart.

10. Obtain OC curve for double sampling plan.
11. Solve the following L.P.P. using simplex method

    Maximize $Z = 5x_1 + 4x_2$

    Subject to constraints

    $4x_1 + 5x_2 \leq 10$

    $3x_1 + 2x_2 \leq 9$

    $8x_1 + 3x_2 \leq 12$

    and $x_1 \geq 0, x_2 \geq 0$

12. Prove that the dual of the dual is primal L.P.P.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time : 3 *Hours*]

[*Max. Marks* : 80

Section A – (Marks : 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain method of frequency distribution for an ungrouped data.

2. Define Mean, Median and Mode. Also mention its merits.

3. The first four moments of a distribution about the value 4 of the variable are –1.5, 17, – 30 and 108. Find the moments about Mean, β_1 and β_2.

4. Define the following terms with an example:

   (i) Outcome and sample space

   (ii) Axioms of probability.

5. Define Conditional Probability. State Multiplication theorem.

6. Two dice are thrown at a time. Find the probability that occurrence of an :

   (i) Equal number on the face

   (ii) Sum greater than 8

   (iii) Sum neither 6 nor 7.

7. Define discrete and continuous random variables. Give an example for each.

8. Define Joint and Marginal Probability Mass functions of a bivariate random variable.

9. A random variable X has the following probability function:

Value of X, x	0	1	2	3	4	5	6	7
P (x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

   (i) Find K

   (ii) Evaluate P (X < 6), P (X ≥ 6).

[P.T.O.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability Distributions)

(CBCS)

Time : 2 Hours] [*Max. Marks* : 80

Section A – (Marks: 4 × 10 = 40)

Answer any **four** *questions*

1. Discuss the merits and demerits of various measures of central tendency.

2. The first four non-central moments of a distribution are 0, 4.5, 3.7, and 16.75. Compute Central moments, Pearson's coefficients.

3. Define Mathematical, Statistical and axiomatic definitions of probability with an example.

4. A bag contains 8 red and 5 white balls. Three balls are drawn at random. Find the probability that

   (a) all the three balls are white (b) One ball is red and two balls are white

5. Explain different types of random variables with examples.

6. A random variable X has the following probability function :

X :	– 4	– 3	0	3	5	6
P (x) :	0.5	K	0.4	2k	0.6	k

   Find the value of k and also find $P(X \leq 4)$ and $P(-4 \leq X \leq 6)$.

7. (a) If $X \geq 0$ then show that $E(X) \geq 0$ and (b) Show that $|E(X)| \leq E|X|$

8. State and prove addition and multiplication theorems of expectations.

Section B – (Marks: 2 × 20 = 40)

Answer any **two** *questions*

9. Explain skewness and kurtosis with diagrams. Which of these characters are essential for a good data.

10. What is Conditional Probability? State and prove multiplication theorem of probability.

11. Define Distribution function and prove its properties.

12. Define probability generating function of a random variable and derive the moments from it.

Section B– (Marks: 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13. (a) Explain various methods of data collection and editing.

Or

(b) Define central and non-central moments and derive the relation between them.

14. (a) Prove that for 'n' events $A_1, A_2 \ldots\ldots A_n$

$$P\left(\bigcap_{i=1}^{n} Ai\right) \geq \sum_{i=1}^{n} P(Ai) - (n-1)$$

(b) State and prove Bayes' theorem. Also mentioin its merits.

15. (a) Define the following terms with an example:

(i) Probability mass function

(ii) Probability density function

(iii) Distribution function

(iv) Marginal and Conditional distribution.

Or

(b) The joint probability distribution of two random variables x and y is given by:

$$P(x=0, y=1) = \frac{1}{3},\ P(x=1,\ y=-1) = \frac{1}{3}\ and\ P(x=1,\ y=1) = \frac{1}{3}$$

Find (i) Marginal distributioin of x and y

(ii) Conditional probability distribution of x, given y = 1.

16. (a) Define moment generating function. Explain the procedure for obtaining moments using m.g.f. Also mention any two properties of m.g.f.

Or

(b) State and prove Chebyshev's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time: 3 *Hours*] [*Max. Marks*: 80

Section A – (Marks: 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain classification and tabulation of data.
2. What is skewness?
3. Calculate mode for the following data:

C-I	0-10	10-20	20-30	30-40	40-50
Frequency	5	15	10	6	8

4. Define Sample Space with an example.
5. Define mathematical, statistical and axiomatic definitions of probability.
6. If two dice are thrown, find the probability of
   (i) equal number occurrence on two faces
   (ii) the sum of two faces are 8.
7. Define discrete and continuous random variables with an example.
8. Define:
   (i) Joint probability mass function
   (ii) Independence of two random variables
9. The diameter of an electric cable, say 'x', is assumed to be a continuous random variable with p.d.f.: $f(x) = 6x(1-x)\ 0 \leq x \leq 1$
   (i) Check that f(x) is p.d.f. and
   (ii) $P(0 \leq x \leq 0.5) = ?$
10. State addition and multiplication theorems of expectation.
11. Define characteristic function and probability generating function of a random variable 'x'.
12. Let 'x' be a random variable with following probability distribution. Find E(x) and $E(x^2)$ and V(x).

x	1	2	3	4	5
p/x	1/6	1/6	¼	½	½

Section B – (Marks: 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13\. (a) Explain:

(i) Bi - Variate data

(ii) Scattered diagram

Derive an expression for finding rank correlation coefficient.

Or

(b) (i) Derive the properties of regression coefficient.

(ii) If $8x - 10y + 66 = 0$ and $40x - 18y = 214$ are the two lines of regression then find the mean values of x and y.

14\. (a) (i) Show that for 'n' attributes $A_1, A_2, A_3, \ldots A_n$ $(A_1, A_2, A_3, \ldots A_n) \geq (A_1) + (A_2) + (A_3) + \ldots + (A_n) - (n-1)N$.

(ii) Check the consistency of the following data:

$N = 1100$ $(A) = 860$, $(B) = 510$, $(AB) = 50$.

Or

(b) Define Yule's coefficient of association and coefficient of colligation and derive the relation between them.

15\. (a) Explain the criterion of a good estimator.

Or

(b) Define t and F distributions and derive the relation between them.

16\. (a) Explain the method of maximum likelihood estimation. Find the MLE for the parameter 'θ' of exponential distribution.

Or

(b) What is interval estimation. Obtain confidence intervals for the parameters of μ and σ^2 of the normal distribution.

11. Define moment generating function and probability generating function.

12. Let 'X' be a random variable with the following probability distribution.

x	–3	6	3	
p(x)	$^1/_6$	$^1/_2$	$^1/_3$	

Find mean and variance of the distribution.

Section B – (Marks : 4 × 12 = 48)

(Essay type Answer Questions)

Answer **all** *questions.*

13. (a) Define Skewness and Kurtosis. Explain various measures of skewness.

Or

(b) Define Central and non-Central moments, also derive the relation between Central and non-Central moments.

14. (a) State and prove addition theorem of probability for 'n' events.

Or

(b) Define mathematical and statistical definition of probability also mention its merits and demerits.

15. (a) Define distribution function of a random variable X with a suitable example. State and prove any two properties of distribution function.

Or

(b) Let x be a continuous random variable with p.d.f. $f_X(x)$. Let y = g(x) be strictly monotonic (increasing or decreasing) function of x. Assume that g(x) is differentiable and is continuous for all x. Prove that p.d.f. h(·) of the r.v. y is

$h_r(y) = f_x(x)\left|\frac{dx}{dy}\right|$ where x is expressed in terms of y, using the transformation y = g (x).

16. (a) Define the characteristic function of a random variable x and state its properties. How to obtain the moments using characteristic function.

Or

(b) Explain the concept of inequalities, state and prove Cauchy-Schwartz's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time : 3 *Hours*]

[*Max. Marks* : 80

Section A – (Marks : 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain method of frequency distribution for an ungrouped data.
2. Define Mean, Median and Mode. Also mention its merits.
3. The first four moments of a distribution about the value 4 of the variable are –1.5, 17, – 30 and 108. Find the moments about Mean, β_1 and β_2.
4. Define the following terms with an example:
   (i) Outcome and sample space
   (ii) Axioms of probability.
5. Define Conditional Probability. State Multiplication theorem.
6. Two dice are thrown at a time. Find the probability that occurrence of an :
   (i) Equal number on the face
   (ii) Sum greater than 8
   (iii) Sum neither 6 nor 7.
7. Define discrete and continuous random variables. Give an example for each.
8. Define Joint and Marginal Probability Mass functions of a bivariate random variable.
9. A random variable X has the following probability function:

Value of X, x	0	1	2	3	4	5	6	7
P (x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

   (i) Find K
   (ii) Evaluate $P(X < 6), P(X \geq 6)$.

[P.T.O.

10. State addition and multiplication theorems of expectations.

11. Define expected value of a r.v.X, when X is continuous. If $g(x)$ is a function of a r.v.X, then define expectation of $g(x)$.

12. Find the expectation of the number on a die when thrown.

Section B – (Marks : 4 × 12 = 48)

(Essay type Answer Questions)

Answer **all** *questions.*

13. (a) Explain various data collection methods. How to classify and tabulate the data?

Or

(b) Define Central and non-Central moments. Derive the relation between them.

14. (a) State and prove Bayes theorem, also write its applications.

Or

(b) For n events $A_1, A_2, ..., A_n$ prove that

(i) $P\left(\bigcap_{i=1}^{n} Ai\right) \geq \sum_{i=1}^{n} P(Ai) - (n-1)$

(ii) $P\left(\bigcup_{i=1}^{n} Ai\right) \leq \sum_{i=1}^{n} P(Ai)$

15. (a) Define a distribution function of a r.v.x. and write its properties. Prove any two properties.

Or

(b) Define conditional probability distribution functions of x/y and y/x. Prove that if x and y are independent then the joint probability mass function is equal to the product of two marginal functions.

16. (a) Define moment generating function of a r.v. x. How to obtain the moments using M.g.f.? Also state any two properties.

Or

(b) State and prove Chebychev's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (II Semester) Examination

STATISTICS

Paper II

(Probability Distributions)

(Time : 3 Hours] *[Max. Marks : 80*

Section A – (Marks: 8 × 4 = 32)

(Short answer questions)

1. Answer any **eight** questions:
   - (a) Derive mgf of discrete uniform distribution.
   - (b) Write the pmf of Bernoulli distribution.
   - (c) Define hyper-geometric distribution.
   - (d) Derive characteristic function of geometric distribution.
   - (e) Derive moments upto fourth order of Poisson distribution.
   - (f) Write any two applications of negative binomial distribution.
   - (g) Derive probability generating function of Gamma distribution.
   - (h) Define Beta distribution of second kind.
   - (i) Write any four properties of normal distribution.
   - (j) Write any 2 real life applications of exponential distribution.
   - (k) Define strong law of large numbers.
   - (l) Derive Mean and Variance of Gamma distribution.

Section B – (Marks: 4 × 12 = 48)

(Essay type questions)

Answer **all** *questions.*

2. (a) Derive pmf of Binomial distribution with underlying assumptions.

   Or

   (b) Derive pmf of hyper-geometric distribution.

3. (a) Derive Poisson approximation to negative binomial distribution.

   Or

   (b) Derive reproductive property of geometric distribution.

4. (a) Derive normal distribution as a limiting case of binomial distribution.

   Or

   (b) Derive the inter-relation between Beta-I and Beta-II distributions.

5. (a) State and prove central limit theorem for i.i.d. random variables.

   Or

   (b) Define weak law of large numbers and write its applications.

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FACULTY OF SCIENCE

B.Sc. (IV Semester) Examination

STATISTICS

Paper IV

(Statistical Inference)

Time : 3 *Hours*] [*Max. Marks* : 80

Section A – (Marks : 8 × 4 = 32)

(*Short Answer Questions*)

Answer any **eight** *questions.*

1. Define the following terms with an example.
   (a) Null hypothesis
   (b) Alternative hypothesis.

2. Explain Randomized and Non-randomized test functions.

3. Let P be the probability that a coin will fall head in a single toss in order to test $H_0 : p = \frac{1}{2}$ against $H_1 : p = \frac{3}{4}$. The coin is tossed 5 times and H_0 is rejected if more than 3 heads are obtained. Find the probability of type-I error.

4. State Central Limit theorem.

5. Explain the test procedure for testing the significance for single mean.

6. A dice is thrown 9000 times and throw 3 or 4 observed 3240 times. Test whether the dice can be regarded as an unbiased one.

7. Explain Chi-square test for goodness of fit.

8. Define order statistics and write its distribution.

9. Prices of shares of a company of 10 days were found to be : 66, 65, 69, 70, 69, 71, 70, 63, 64, 68. Can it be concluded that the prices of shares on an average is 65?

10. What is run?

11. Explain the advantages of Mann-Whitney U test.

12. Test the randomness for the following:

    MMNMNMMNNN

[P.T.O.

Section B – (Marks : 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13. (a) Explain one tailed and two tailed tests.

Or

(b) State and prove Neyman-Pearson's fundamental lemma and give its utility.

14. (a) Explain the test procedure for testing the significance of the difference between two proportions.

Or

(b) Explain the test procedure for testing the significance of the difference between two Standard Deviations.

15. (a) Explain the procedure of testing the difference between Means of two independent samples.

Or

(b) What is a contingency table? Explain the test procedure for independence of two attributes.

16. (a) Explain advantages and disadvantages of non-parametric tests.

Or

(b) Explain Wilcoxon-signed-rank test for matched-paired samples.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time: 3 *Hours*] [*Max. Marks*: 80

Section A – (Marks: 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain classification and tabulation of data.
2. What is skewness?
3. Calculate mode for the following data:

C-I	0-10	10-20	20-30	30-40	40-50
Frequency	5	15	10	6	8

4. Define Sample Space with an example.
5. Define mathematical, statistical and axiomatic definitions of probability.
6. If two dice are thrown, find the probability of
   (i) equal number occurrence on two faces
   (ii) the sum of two faces are 8.
7. Define discrete and continuous random variables with an example.
8. Define:
   (i) Joint probability mass function
   (ii) Independence of two random variables
9. The diameter of an electric cable, say 'x', is assumed to be a continuous random variable with p.d.f.: $f(x) = 6x(1-x)\ 0 \leq x \leq 1$
   (i) Check that f(x) is p.d.f. and
   (ii) $P(0 \leq x \leq 0.5) = ?$
10. State addition and multiplication theorems of expectation.
11. Define characteristic function and probability generating function of a random variable 'x'.
12. Let 'x' be a random variable with following probability distribution. Find E(x) and $E(x^2)$ and V(x).

x	1	2	3	4	5
p/x	1/6	1/6	¼	½	½

Section B– (Marks: 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13. (a) Explain various methods of data collection and editing.

Or

(b) Define central and non-central moments and derive the relation between them.

14. (a) Prove that for 'n' events $A_1, A_2 ..... A_n$

$$P\left(\bigcap_{i=1}^{n} Ai\right) \geq \sum_{i=1}^{n} P(Ai) - (n-1)$$

(b) State and prove Bayes' theorem. Also mentioin its merits.

15. (a) Define the following terms with an example:

(i) Probability mass function

(ii) Probability density function

(iii) Distribution function

(iv) Marginal and Conditional distribution.

Or

(b) The joint probability distribution of two random variables x and y is given by:

$$P(x=0, y=1) = \frac{1}{3},\ P(x=1,\ y=-1) = \frac{1}{3}\ and\ P(x=1,\ y=1) = \frac{1}{3}$$

Find (i) Marginal distributioin of x and y

(ii) Conditional probability distribution of x, given y = 1.

16. (a) Define moment generating function. Explain the procedure for obtaining moments using m.g.f . Also mention any two properties of m.g.f .

Or

(b) State and prove Chebyshev's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (I Semester) Examination

STATISTICS

Paper I

(Descriptive Statistics and Probability)

Time: 3 *Hours*] [*Max. Marks*: 80

Section A – (Marks: 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain classification and tabulation of data.
2. What is skewness?
3. Calculate mode for the following data:

C-I	0-10	10-20	20-30	30-40	40-50
Frequency	5	15	10	6	8

4. Define Sample Space with an example.
5. Define mathematical, statistical and axiomatic definitions of probability.
6. If two dice are thrown, find the probability of
   (i) equal number occurrence on two faces
   (ii) the sum of two faces are 8.
7. Define discrete and continuous random variables with an example.
8. Define:
   (i) Joint probability mass function
   (ii) Independence of two random variables
9. The diameter of an electric cable, say 'x', is assumed to be a continuous random variable with p.d.f.: $f(x) = 6x(1-x)\ 0 \le x \le 1$
   (i) Check that f(x) is p.d.f. and
   (ii) $P(0 \le x \le 0.5) = ?$
10. State addition and multiplication theorems of expectation.
11. Define characteristic function and probability generating function of a random variable 'x'.
12. Let 'x' be a random variable with following probability distribution. Find E(x) and $E(x^2)$ and V(x).

x	1	2	3	4	5
p/x	1/6	1/6	¼	½	½

Section B– (Marks: 4 × 12 = 48)

(Essay Type Questions)

Answer **all** *questions.*

13. (a) Explain various methods of data collection and editing.

Or

(b) Define central and non-central moments and derive the relation between them.

14. (a) Prove that for 'n' events $A_1, A_2 \ldots\ldots A_n$

$$P\left(\bigcap_{i=1}^{n} Ai\right) \geq \sum_{i=1}^{n} P(Ai) - (n-1)$$

(b) State and prove Bayes' theorem. Also mentioin its merits.

15. (a) Define the following terms with an example:

(i) Probability mass function

(ii) Probability density function

(iii) Distribution function

(iv) Marginal and Conditional distribution.

Or

(b) The joint probability distribution of two random variables x and y is given by:

$$P(x=0, y=1) = \frac{1}{3},\ P(x=1,\ y=-1) = \frac{1}{3}\ and\ P(x=1,\ y=1) = \frac{1}{3}$$

Find (i) Marginal distributioin of x and y

(ii) Conditional probability distribution of x, given y = 1.

16. (a) Define moment generating function. Explain the procedure for obtaining moments using m.g.f . Also mention any two properties of m.g.f .

Or

(b) State and prove Chebyshev's inequality. Also write its applications.

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FACULTY OF SCIENCE

B.Sc. (III Semester) Examination

STATISTICS

Paper III

(Statistical Methods)

Time : 3 *Hours*] [*Max. Marks* : 80

Section A – (Marks: 8 × 4 = 32)

(Short Answer Questions)

Answer any **eight** *questions.*

1. Explain about scattered diagram.

2. Explain principle of least squares with an example.

3. Calculate coefficient of correlation between x and y for the following data:

X	7	10	12	9	8	6	5
Y	6	10	11	8	7	3	2

4. What is categorical data?

5. Discuss the conditions for consistency of data.

6. Examine the consistency of the following data:

N = 1100 (A) = 860 (B) = 510 (AB) = 50

7. Define the following terms with an example:

(i) Population (ii) Sample (iii) Parameter (iv) Statistic

8. Explain the properties and applications of Chi-square distribution.

9. If $X_1, X_2, \ldots\ldots X_n$ be a random sample drawn from normal population with mean μ and variance σ^2, then find the sampling distribution of Sample Mean.

10. State Neyman's factorization theorem.

11. Distinguish between point estimation and internal estimation.

12. $X_1, X_2, \ldots\ldots X_n$ is a random sample drawn from a normal population $N(\mu,1)$. Show that

$$t = \frac{1}{n}\sum_{i=1}^{n} X_i^2$$

is an unbiased estimator of μ^2+1.

[P.T.O.

Section B – (Marks: 4 × 12 = 48)

(Essay Type Questions)

*Answer **all** questions.*

13. (a) Define correlation and rank correlation coefficient and with the usual notations, prove that

$$P = 1 - \left[\frac{6\Sigma d^2}{n(n^2-1)}\right]$$

Or

(b) (i) Distinguish between correlation and regression.

(ii) Derive the regression lines x on y and y on x.

14. (a) Explain:

(i) Independence of attributes

(ii) Association and partial association of attributes.

Or

(b) Define Yule's coefficient of association and coefficient of colligation. Derive the relation between them.

15. (a) Define students 't' distribution and derive the constants of 't' distribution.

Or

(b) Define F distribution and derive the relation between F and χ^2.

16. (a) Define an estimator. Explain the properties of good estimators.

Or

(b) Define MLE and

Let $X_1, X_2, \ldots\ldots. X_n$ be a random sample from the exponential distribution with p.d.f.

$$f(x, \theta) = \theta e^{-\theta x}, 0 < x < \theta$$

$$= 0 \text{ elsewhere}$$

Obtain the maximum likelihood estimator for θ.

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