PERIYAR UNIVERSITY

Periyar Palkalai Nagar

Salem – 636 011

Degree of Bachelor of Science
OUTCOME BASED EDUCATION

Syllabus for
B.Sc. STATISTICS
(SEMESTER PATTERN)
(For Candidates admitted in the Colleges affiliated to Periyar University from 2021-2022 onwards)

CHOICE BASED CREDIT SYSTEM
OBE PATTERN REGULATIONS

(From 2021 – 2022 Onwards)

Scheme of Examination and Course Structure

(Semester-wise)

PERIYAR UNIVERSITY, SALEM – 11.

BACHELOR OF SCIENCE

BRANCH - STATISTICS

(The Revised Syllabus shall be Effective from the Academic Year 2021-2022 Onwards)

1. OBJECTIVES

Statistics is a science which deals with data arise from various phenomena. Statistics plays an important role in almost all the disciplines of sociological and Biological Sciences, Economics, Computer Science and Information Technology. The main objective of the course is to make students to learn the fundamental principles, the scope of Statistics, to understand the theoretical basis of various realms of Statistical methods and to train the students in the application of various analytical tools in solving the real life problems.

The objectives of the course are

- To impart the knowledge about the theoretical development of Statistics.
- To elucidate the use of various mathematical concepts which are required for the development of statistics.
- To emphasize the scope of using statistical tools in various disciplines.
- To provide knowledge about various dimensions of statistics like collection, classification of data, Descriptive statistics, sampling techniques and inferential statistics etc.
- To equip the students with effective applications of various statistical tools for solving many real life problems.
- To provide a platform for pursuing higher studies such as Post-graduate and Doctorate degrees.

Learning Outcomes

Upon the completion of the program, students would be

- Able to understand and apply the concepts of statistics and various statistical tools in different areas of its application and hence able to solve a wide range of problems associated with Statistics.

- Able to conduct statistical surveys and experimental studies and to demonstrate data analysis together with proper and effective interpretations.

- Able to handle statistical packages for practical utility and also able to develop new software programs in accordance with the requirements for solving a problem.

This syllabus is aimed at preparing the students to cope with the latest developments and compete with students from other universities and put them on the right track. Along with this students are equipped with skill enhancement courses like Research methodology, Statistical packages and R language.

CARRIER IN STATISTICS

After the completion of undergraduate course, students can pursue higher education in the field of statistics, professional courses and research level studies.

Postgraduates	Professional Courses	Statistical Software	Competitive Exams
M.Sc Statistics	M.B.A	STATA	UPSC
M.Stat	M.C.A	SPSS	SSC
M.Sc Data Science/Data Analytics	C.A	Minitab	I.A.S
M.Sc Operations Research	I.C.W.A	R	I.F.S
M.Sc Actuarial Science	F.R.M	SAS	I.S.S
M.Sc in Library and Information Science	C.F.A	SAP	SSS
M.Sc in Quantitative Economics	C.C.A	ERP	CSO
M.A Economics		Python	NSSO
M. Pharm		MATLAB	IAMR
P.G Diploma in Statistical Methods with Applications		MaxStat.	ICMR

JOB OPPURTUNITIES

Jobs opportunities in Statistics Field	Job opportunities in other fields
Statistician	Business Analyst
Statistics Investigator (TNPSC)	Chartered Accountant
Actuarial Analyst	Economist
Block Health Statistician (TNPSC)	Financial Manager
Data Scientist	Financial Trader
Data Analyst	Insurance Underwriter
Market Researcher	Machine Learning Engineer
Operational Researcher	Research Scientist (maths)
Bio-Statistician	Python Developers
Meteorologist	Assistant Director (DPES)
Statistics Subject Matter Expert	Senior Manager – Research
Statistics at Upthink Expert (Tutor)	Civil Service Fast Streamer
Young professional (Statistics) in MOSPI	Project Technical Officer
Agriculture Statistical Officer	Banking Sectors
Field Officer (Statistics)	Trainee Data Analyst

2. ELIGIBILITY CONDITION FOR ADMISSION

Candidates who seek admission to the Degree of Bachelor of Science in Statistics are required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereto by the Periyar University, with Statistics/ Mathematics/Business Mathematics as one of the subjects.

3. DURATION OF THE COURSE

a) Each academic year will be divided into two semesters. The first academic year will comprise the first and second semester, the second academic year - the third and fourth semester and the third academic year – the fifth and sixth semester.

b) The odd semesters consist of the duration from June to November of each year and the even semesters consist of the duration from December to April of each year. There won't be less than 90 working days for each semester.

4. COURSE OF STUDY

In the following subjects, the course of study will comprise instruction according to the syllabus and books, prescribed from time to time.

5. EXAMINATIONS

During semester examination for each theory examination three hours is allotted. For practical examination also three hours is allotted. It will be conducted at the end of each academic year. The candidate who has failed in any subject will be permitted to attend the arrear subject(s) along with the subsequent examination.

6. COURSE STRUCTURE UNDER OBE:

Branch II STATISTICS
(For the students admitted from the Academic year 2021-2022 onwards)

PART	PAPER CODE	COURSE	TITLE OF THE PAPER	HOURS	CREDIT	CIA	UE	TOTAL
SEMESTER – I								
I	21UFTA01	Language	Tamil – I	6	3	25	75	100
II	21UFEN01	Language	English – I	6	3	25	75	100
III	21UST01	Core Theory – I	Descriptive Statistics	6	5	25	75	100
		Allied I: Theory - I	Algebra and Calculus	5	5	25	75	100
		Allied Practical – I	Allied Mathematics - Practical *	2	-	-	-	-
	21USTP01	Core Practical – I	Major Practical – I *	3	-	-	-	-
IV		Add-on Course	Professional English	6	4	25	75	100
	21UVE01	Common	Value Education (Yoga)	2	2	25	75	100
	NO. OF COURESES – 6	**TOTAL**		36	22	-	-	600

* Examination at the End of Second Semester

PART	PAPER CODE	COURSE	TITLE OF THE PAPER	HOURS	CREDIT	CIA	UE	TOTAL
SEMESTER – II								
I	21UFTA02	Language	Tamil – II	6	3	25	75	100
II	21UFEN02	Language	English – II	4	3	25	75	100
II		NMSDC - I : Effective English	Language Proficiency for Employability	2	2	25	75	100
III	21UST02	Core Theory – II	Probability and Random Variables	6	5	25	75	100
		Allied I: Theory - II	Differential Equations and Laplace Transforms	5	5	25	75	100
		Allied Practical – I	Allied Mathematics - Practical	2	3	40	60	100
	21USTP01	Core Practical – I	Major Practical – I	3	3	40	60	100
IV		Add-on Course	Professional English	6	4	25	75	100
	21UES01	Common	Environmental Studies	2	-	25	75	100
	NO. OF COURESES – 8	**TOTAL**		38	28	-	-	800

PART	PAPER CODE	COURSE	TITLE OF THE PAPER	HOURS	CREDIT	CIA	UE	TOTAL
SEMESTER – III								
I	21UFTA03	Language	Tamil – III	6	3	25	75	100
II	21UFEN03	Language	English – III	6	3	25	75	100
III	21UST03	Core Theory – III	Distribution Theory	4	4	25	75	100
	21USTA15	Allied II: Theory - I	Applied Numerical Methods	4	5	25	75	100
	21USTAP04	Allied Practical II	Numerical Methods and Programming in C Practical	2	-	-	-	-
	21USTP02	Core Practical – II	Major Practical – II*	1	-	-	-	-
IV	21USTS01	SBEC – I	Regression Analysis	3	3	25	75	100
		NMEC – I		2	2	25	75	100
	Digital Skill for Employability - Microsoft Office Essentials			2	2	25	75	100
	NO. OF COURESES – 6	**TOTAL**		30	21	-	-	600

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			* Examination at the End of Fourth Semester					
			SEMESTER – IV					
I	21UFTA04	Language	Tamil – IV	6	3	25	75	100
II	21UFEN04	Language	English – IV	6	3	25	75	100
III	21UST04	Core Theory – IV	Sampling Techniques	5	5	25	75	100
	21USTA16	Allied II: Theory - II	Programming in C	5	5	25	75	100
	21USTAP04	Allied II : Practical II	Numerical Methods and Programming in C Practical	2	2	25	75	100
	21USTP02	Core Practical – II	Major Practical – II	2	3	25	75	100
IV	**SBEC**	**NMSDC - II : Office Fundamentals**	**Digital Skills for Employability**	**2**	**2**	**25**	**75**	**100**
		Internship Programme	-	-	-	-	-	-
		NMEC – II		2	2	25	75	100
NO. OF COURESES – 9			**TOTAL**	**30**	**25**	**-**	**-**	**800**
			SEMESTER – V					
III	**21UST05**	**Core Theory – V**	**Theory of Estimation**	**4**	**4**	**25**	**75**	**100**
	21UST06	**Core Theory – VI**	**Testing of Hypothesis**	**4**	**4**	**25**	**75**	**100**
	21UST07	Core Theory – VII	Statistical Quality Control	5	5	25	75	100
	21USTP03	Core Practical – III	Major Practical – III *	2	-	-	-	-
	21USTP04	Core Practical – IV	Major Practical – IV *	2	-	-	-	-
	21USTE01	Core Elective – I	Operations Research – I	4	4	25	75	100
	21USTE02	Core Elective – II	Stochastic Processes	4	4	25	75	100
IV	21USTS02	SBEC – II	Non-Parametric Test	3	3	25	75	100
IV		**NMSDC**	**Computational Intelligence for Employability – Fundamentals of Data Analytics with Tableau**	**2**	**2**	**25**	**75**	**100**
NO. OF COURESES – 6			**TOTAL**	**3 0**	**26**	**-**	**-**	**600**
			* Examination at the End of Sixth Semester					
			SEMESTER – VI					
III	21UST08	Core Theory – VIII	Design of Experiments	5	5	25	75	100
	21UST09	Core Theory – IX	Applied Statistics	5	5	25	75	100
	21USTE03	Core Elective – III	Operations Research – II	4	4	25	75	100
	21USTE04	Core Elective – IV	Actuarial Statistics	5	4	25	75	100
	Elective	**NMSDC - III : Project Based learning 3**	**Data Analytics with Advanced Tools for Employability**	**2**	**2**	**25**	**75**	**100**
	21USTP03	Core Practical – III	Major Practical – III	3	3	25	75	100
	21USTP04	Core Practical – IV	Major Practical – IV	3	3	25	75	100
IV	21USTS03	SBEC – III (or) SBEC – IV	Statistical Data Analysis Using EXCEL (or) Statistical Data Analysis Using R Programming	3	3	25	75	100
V	21UEX01	Common	*Extension Activities	-	-	-	-	-

NO. OF COURESES – 9	TOTAL	3 0	29	-	-	800
TOTAL NO. OF COURESES - 44	**GRAND TOTAL**	**192**	**151**	**-**	**-**	**4200**

TABLE SHOWING THE COURSES OFFERED WITH CREDITS UNDER VARIOUS PARTS
OBE Pattern With effect from the Academic Year 2021-22 onwards

Part	Course	Semester I			II			III			IV			V			VI			Total		
		N	H	C	N	H	C	N	H	C	N	H	C	N	H	C	N	H	C	N	H	C
I	Tamil	1	6	3	1	6	3	1	6	3	1	6	3	-	-	-	-	-	-	4	24	12
II	English	1	6	3	1	6	3	1	6	3	1	6	3	-	-	-	-	-	-	4	24	12
III	Core Theory	1	6	5	1	6	5	1	5	5	1	5	5	3	15	15	2	10	10	9	47	45
	Core Practical	-	3	-	1	3	3	-	2	-	1	2	3	-	4	-	2	6	6	4	20	12
	Core Elective	-	-	-	-	-	-	-	-	-	-	-	-	2	8	8	2	9	8	4	17	16
	NMSDC	-	-	-	-	-	-	-	-	-	1	2	2	-	-	-	1	2	2	2	4	4
	Allied Theory	1	5	5	1	5	5	1	4	5	1	5	5	-	-	-	-	-	-	4	19	20
	Allied Practical	-	2	-	1	2	3	-	2	-	1	2	2	-	-	-	-	-	-	2	8	5
IV	Add-on Course	1	6	4	1	6	4	-	-	-	-	-	-	-	-	-	-	-	-	2	12	8
	* Internship Programme	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	Value Education	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	2
	Environmental Studies	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-
	SBEC	-	-	-	-	-	-	1	3	3	-	-	-	1	3	3	1	3	3	3	9	9
	NMEC	-	-	-	-	-	-	1	2	2	1	2	2	-	-	-	-	-	-	2	4	4
V	** Extension Activities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-
	Total	7	36	22	8	36	26	6	30	21	8	30	25	6	30	26	9	30	29	44	192	149

N = NO. OF COURSES ; H = NO. OF HOURS/WEEK ; C = NO. OF CREDITS
** There is no University examination for this course

* INTERNSHIP PROGRAMME :

The Internship Programme provides practical experience and gives training to the students for the applications of Statistics. It also enhances the student's skills in problem solving. Internship requires students to spend a minimum of 15 days during 4th Semester vacation in any reputed organization and should get the certificate from the organization concerned for the participation of the Internship Programme. The Internship report has to be submitted along with the certificate issued by the company at the beginning of the 5th Semester. The student should undergo training with the help of a Guide/Supervisor.

The Internship result will be declared in the 5th Semester Mark sheet. The Internship Programme does not carry any credit or Marks. The Mark sheet will be showing the report of the Guide after the Viva-Voce Examination as Commended or Highly Commended.

7. QUESTION PAPER PATTERN AND EVALUTION FOR ALL COURSES

7.1. SCHEME OF EXAMINATIONS :

EXAMINATIONS	MARKS
CIA (Continuous Internal Assessment)	25 Marks
UE (University Examinations)	75 Marks
TOTAL	**100 Marks**

7.2. Evaluation of Continuous Internal Assessment (CIA):

S.NO	INTERNAL ASSESSMENT	DISTRIBUTION OF MARKS
1	Test	15 Marks
2	Assignments	5 Marks
3	Attendance	5 Marks
	TOTAL	**25 Marks**

7.3. Question Paper Pattern for Core /Allied/Elective/SBEC Papers (Theory):

Time: Three hours   **Maximum Marks: 75**

Part - A (15 x 1 = 15)
Answer ALL questions
(Three Questions from Each Unit)

Part - B (2 x 5 = 10)
Answer any TWO questions
(One Question from Each Unit)

Part - C (5 x 10 = 50)
Answer ALL questions
(One Question from Each Unit with Internal Choice)

7.4. Distribution of Marks for Core and Allied I Practical:

EXAMINATIONS	MARKS

CIA (Continuous Internal Assessment) Including Practical Record	40 Marks
UE (University Examinations)	60 Marks
TOTAL	**100 Marks**

7.5. Distribution of Marks for Allied II Practical:

University Examinations	Distribution of Marks	
	Written Practical	**Total Marks**
Algorithm / Flowchart	10 Marks	
Writing the Program in the Main Answer Book	20 Marks	60 Marks
Run the Program	20 Marks	
Display the Correct Output	10 Marks	
CIA (Including Practical Record)		40 Marks
Total		**100 Marks**

7.6. Evaluation of Continuous Internal Assessment (CIA) for Core and Allied Practical:

S.NO	INTERNAL ASSESSMENT	DISTRIBUTION OF MARKS
1	Record	25 Marks
2	Test	10 Marks
3	Attendance	5 Marks
	TOTAL	**40 Marks**

7.7. Question Paper Pattern for Core and Allied I - Practical:

Time: Three hours   **Maximum Marks: 60**

Part - A (3 x 20 = 60)
Answer Any THREE questions out of FIVE questions

(One question from each unit)

7.8. Question Paper Pattern for Allied II - Practical:

   Two questions are to be set with internal choice. All questions carry equal marks.
    Two questions are to be answered in 3 hours duration

| Time: Three hours | Maximum Marks: 60 |

Part - A (2 x 30 = 60)
Answer ALL questions

(Two questions either or choice)

8. (a) PASSING MINIMUM - Theory

The candidate shall be declared to have passed the examination if the candidate **secures not less than 40 marks** put together out of 100 **(CIA+EA). Minimum 40% should be secured (30 out of 75) in EA** of each theory paper.

(b) PASSING MINIMUM - Practical

The candidate shall be declared to have passed the examination if the candidate **secures not less than 40 marks** put together out of 100 **(CIA+EA). Minimum 40% should be secured (24 out of 60) in EA** of each Practical paper.

The CIA of each practical paper includes evaluation of record. However submission of record for the University Practical Examination is mandatory.

Examinations	Maximum Marks		
	CIA	UE	Total
Theory Paper	25	75	100
Practical Paper	40	60	100

9. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in the First Class.

All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtained 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for University Ranking.

1. **Passing Minimum** is 40% of the **ESE** and also 40% of the minimum of the paper/course.

2. **Minimum Credits to be Earned:**

   For THREE year Programme: Best 148 Credits

Part I and II   : Languages
Part III   : Major, Elective, Allied
Part IV   : Soft Skills
Part V   : Extension Activities

3. Marks and Grades:

The following table gives the marks, grade points, letter grades and classification to indicate the performance of the candidate.

Conversion of Marks to Grade Points and Letter Grade
(Performance in a Course/Paper)

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90 –100	9.0 - 10.0	O	Outstanding
80–89	8.0 - 8.9	D+	Excellent
75–79	7.5 - 7.9	D	Distinction
70–74	7.0 - 7.4	A+	Very Good
60–69	6.0 - 6.9	A	Good
50–59	5.0 - 5.9	B	Average
40–49	4.0 - 4.9	C	Satisfactory
00–39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

CALCULATION OF GPA AND CGPA

For a Semester :

$$GPA = \frac{\text{Sum of the Multiplication of Grade Points by the Credits of the Courses}}{\text{Sum of the Credits of the Courses in a Semster}}$$

$$\text{Grade Point Average (GPA)} = \frac{\sum_i C_i G_i}{\sum_i C_i}$$

For the entire Programme:

$$CGPA = \frac{\text{Sum of the Multiplication of Grade Points by the Credits of the Entire Programme}}{\text{Sum of the Credits of the Courses of the Entire Programme}}$$

C_i = Credits earned for course **'i'** in any semester

G_i = Grade Point obtained for course **'i'** in any semester.

n refers to the semester in which such courses were credited

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5-10.0	O+	First Class With Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class With Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	Third Class
4.0 and above but below 4.5	C	
0.0 and above but below 4.0	U	Re-appear

*The candidates who have passed in the first appearance and within the prescribed
Semester of the UG Programme (Major, Allied and Elective Courses Alone) are eligible.

10. MAXIMUM DURATION FOR THE COMPLETION OF THE UG PROGRAMME

The maximum duration for completion of the UG Programme will not exceed twelve semesters.

11. COMMENCEMENT OF THIS REGULATION

The OBE regulations shall take effect from the academic year 2021 – 2022 (i.e.) for the students who are admitted in the first year of the course during the academic year 2021 – 2022 and thereafter.

12. TRANSITARY PROVISION

Candidates who were admitted to the UG course of study prior to 2021-2022 will be permitted to appear for the examination under those regulations for a period of three years (i.e.) up to and inclusive of the examinations of April/May 2024. Thereafter they will be permitted to appear for the examination based on the regulations then in force.

LIST OF COURSES:

S.NO	COURSE	PAPER CODE	TITLE OF THE PAPER
1	CORE THEORY	21UST01	Descriptive Statistics
2		21UST02	Probability and Random Variables
3		21UST03	Distribution Theory
4		21UST04	Sampling Techniques
5		21UST05	Theory of Estimation
6		21UST06	Testing of Hypothesis
7		21UST07	Statistical Quality Control
8		21UST08	Design of Experiments
9		21UST09	Applied Statistics
10	NMSDC		Digital Skills for Employability
11			Data Analytics with Advanced Tools for Employability
12	CORE ELECTIVES	21USTE01	Operations Research – I
13		21USTE02	Stochastic Processes
14		21USTE03	Operations Research – II
15		21USTE04	Actuarial Statistics
16	CORE PRACTICALS	21USTP01	Major Practical I (Based on Core Theory 1 & 2)
17		21USTP02	Major Practical II (Based on Core Theory 3 & 4)
18		21USTP03	Major Practical III (Based on Core Theory 5, 6 & 8)
19		21USTP04	Major Practical IV (Based on Core Theory 7 & 9)
20	ALLIED THEORY		Algebra and Calculus
21			Differential Equations and Laplace Transforms
22		21USTA15	Applied Numerical Methods
23		21USTA16	Programming in C
24	ALLIED PRACTICALS		Allied Practical I: Mathematics Practical (Based on Allied I Theory papers 1 & 2)
25		21USTAP04	Allied Practical II: Numerical Methods and Programming in C - Practical (Based on Allied II Theory Papers 3 & 4)
26	SBEC	21USTS01	Regression Analysis
27		21USTS02	Non-Parametric Test

28		21USTS03	Statistical Data Analysis Using EXCEL (or)
		21USTS04	Statistical Data Analysis Using R
29			Add-on Course Professional English for Physical Sciences
30			Internship Programme
31	COMMON	21UVE01	Value Education
32		21UES01	Environmental Studies
33		21UEX01	Extension Activity

(For the candidates admitted from the Academic year 2021 –2022 onwards)

COURSE	B.Sc. STATISTICS
SEMESTER	I
CORE THEORY	I
PAPER CODE	**21UST01**
TITLE OF THE PAPER	**DESCRIPTIVE STATISTICS**
HOURS/WEEK	**6**
NO. OF CREDITS	**5**

Learning Objectives:

➢ To enable the students to understand the basic concepts of Statistics.

➢ To know the principle of samples, measurement of scales and methods of sampling.

➢ To distinguish between primary and secondary data.

➢ To familiarize students with pictorial representation of data.

➢ To understand the relation between two variables through correlation and regression**.**

Course Outcomes:

The students will be able to:

➢ Frame a questionnaire and collect primary and secondary data.

➢ Know the methods of data collection and classification of data.

➢ Estimate the measures of locations and dispersions.

➢ Understand the methods of skewness and kurtosis.

➢ Determine the correlation between the variables and to fit the regression lines.

UNIT – I   Collection and Presentation of Statistical Data

Nature, Scope and Limitations of Statistics – Data sources – Methods of collection of statistical data – Census – Sample Survey – Measurement of Scales – Nominal, Ordinal, Interval and Ratio scales – Classification and Tabulation – Formation of frequency distribution – Cumulative frequency distribution – Diagrammatic and Graphical representation of Data.

UNIT – II   Measures of Central Tendency and Dispersion

Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean for raw and grouped data – Properties – Quartiles, Deciles and Percentiles – Absolute and relative measures of Dispersion – Range – Quartile deviation – Mean deviation - Standard deviation – Coefficient of Variation – Lorenz Curve.

UNIT – III   Measures of Skewness, Kurtosis and Moments

Definition – Calculation of Karl Pearson's, Bowley's and Kelly's coefficient of Skewness – Moments **–** Raw and Central Moments – Relation between raw and central moments – Measures of Skewness and Kurtosis based on Moments.

UNIT – IV   Correlation

Definition of Correlation – Types of correlation – Methods of correlation – Scatter diagram – Karl Pearson's correlation coefficient – Spearman's rank correlation coefficient – Properties – Concurrent deviation method – Correlation coefficient for ungrouped and grouped bivariate data.

UNIT – V   Regression

Meaning of Regression – Regression lines – Regression coefficients – Regression coefficients for ungrouped and grouped bivariate data – Properties of regression coefficient – Finding the two regression equations of X on Y and Yon X and estimating the unknown values of X and Y.

Reference Books:

1. Gupta S. P (2002), Statistical Methods, Sultan Chand and Sons, New Delhi.
2. Gupta S. C and Kapoor V. K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
3. Goon A. M, Gupta M. K and Dasgupta B (2008), Fundamentals of Statistics, (Vol - I), World Press Ltd, Calcutta.
4. Bhat B. R, Srivenkataramana T and Madhava Rao K. S (1996), Statistics a Beginner's Text, (Vol – I), New Age International Publishers, New Delhi.
5. Hogg R. V and Craig A. T (2006), Introduction to Mathematical Statistics, MacMillan, London
6. Saxena H. C, Elementary Statistics, Sultan Chand and Sons, New Delhi.
7. Freund J. E (1981), Modern Elementary Statistics, PHI.
8. Sancheti D. C and V.K Kapoor, Statistics, Sultan Chand and Sons, New Delhi.
9. Agarwal B. L (1996), Basic Statistics (Third Edition), New Age International Publishers, New Delhi.
10. Sanjay Arora and Bansilal (2002), New Mathematical Statistics, Meerat Publications, New Delhi.

Web Links:

  ➢ https://www.tutorialspoint.com/statistics/data_collection.htm

  ➢ https://www.surveysystem.com/correlation.htm

  ➢ https://www.investopedia.com/terms/r/regression.asp

  ➢ https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression

  ➢ https://course-notes.org/statistics/sampling_theory

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	II
CORE THEORY	II
PAPER CODE	21UST02
TITLE OF THE PAPER	PROBABILITY AND RANDOM VARIABLES
HOURS/WEEK	6
NO. OF CREDITS	5

Learning Objectives:

➢ To introduce probability theory as the foundation for statistics and random variables.

➢ To learn the concepts of marginal and conditional distributions**.**

➢ To understand the method of analysing a bivariate distribution.

➢ To apply Chebychev's inequality in real life problems.

Course outcomes:

The students will be able to:

➢ Understand the basic concept of probability using classical, statistical and axiomatic approach.

➢ Gain knowledge about conditional probability and applications of Baye's Theorem.

➢ Comprehend the random variables and mathematical expectations.

➢ Understand and derive the moment generating function and characteristic function.

➢ Understand the properties and applications of various probability functions and weak law of Large Numbers.

UNIT – I   Probability

Concept of Random experiment – Trial, Sample point, Sample space, Event, Algebra of Events, Mutually exclusive events, Exhaustive events – Definition of Probability – Classical, Statistical and Axiomatic

approach – Properties of Probability – Theorems on Probability – Addition and Multiplication theorem of probabilities – Conditional probability – Baye's theorem - Simple Problems.

UNIT – II   Random Variables and Distribution Functions

Concept of Random variables – Discrete and Continuous random variables – Probability mass functions and Probability density functions – Distribution functions – Properties - Simple Problems.

UNIT – III   Bivariate Random Variables and Distribution Functions

Joint probability functions - Joint probability mass functions - Joint probability density functions – Marginal and conditional probability functions – Distribution functions of bivariate random variables and its properties – Marginal, Conditional distribution functions and density functions – Independence of Random variables – Properties of joint distribution functions.

UNIT – IV   Mathematical Expectation and Variance

Meaning and definitions of Expectation (discrete and continuous) – Properties – Moments – Variance – Properties – Conditional expectation and Conditional variance – Theorems on expectations – Chebychev's Inequality – Simple Problems.

UNIT – V   Moment Generating Function and Characteristic Function

Definition of Moment generating function – Properties and uses – Characteristic functions – Cumulants - Properties – Simple problems – Inversion theorem on Characteristic function (statement only) – Statement and Applications of Weak Law of Large Numbers.

Reference Books:

1. Gupta S. C and Kapoor V. K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
2. Kapur J.N and Saxena, H. C (1999), Mathematical Statistics –S. Chand and Company Ltd., New Delhi.
3. Feller, W. (2008), An Introduction to Probability Theory and its Applications, Volume I (Third Edition), John Wiley & Sons, New York.
4. Bhat B.R. (2014), Modern Probability Theory (Fourth Edition), New Age International Publishers, New Delhi.
5. Spiegel M.R. and Ray M (1980), Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.
6. Hogg R. V and Craig A. T (2006), Introduction to Mathematical Statistics, MacMillan, London.
7. Arora S. and B. Lal, New Mathematical Statistics, Satya Prakashan, 1989, New Delhi
8. Rohatgi V. K, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd.
9. Marek Fisz, (1961), Probability Theory and Mathematical Statistics, John Wiley & Sons, New York.

10. Mood, A. M Graybill, F. A Andboes, D. C, (1974) Introduction to Theory of Statistics, Tata McGraw Hill, New Delhi.

Web Links:

- https://seeing-theory.brown.edu/probability-distributions/index.html
- https://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/9557
- https://www.statisticssolutions.com/mathematical-expectation/
- http://itfeature.com/statistics/measure-of-dispersion/moments-in-statistics
- https://rmd.ac.in/dept/cse/notes/4/PQT/unit2.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	II
CORE PRACTICAL	I (Based on core theory paper I & II)
PAPER CODE	21USTP01
TITLE OF THE PAPER	MAJOR PRACTICAL – I
HOURS/WEEK	3
NO. OF CREDITS	3

Learning Objectives:

- To enable the students to gain practical knowledge about the concepts of statistics.
- To apply the measures of descriptive statistics and probability in real life situations.
- To provide practical knowledge in random variables, probability distributions, expectation, moment generating function and characteristic function.

Course Outcomes:

The Students will be able to:

- Analyse statistical data using measures of central tendency, dispersion and skewness.
- Interpret the Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient and understand their applications.
- Apply probability distributions and derive the marginal and conditional distributions of bivariate random variables.

UNIT – I   Presentation of Statistical Data

Construction of Univariate and Bivariate frequency distribution – Diagrammatic and Graphical representation of data - Ogive curves – Lorenz curve.

UNIT – II   Measures of Averages and Dispersion

Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric and Harmonic Mean - Absolute and Relative Measures of Dispersion – Coefficient of Variation.

UNIT – III   Skewness and Kurtosis

Karl Pearson's coefficient of Skewness – Bowley's coefficient of Skewness – Skewness and kurtosis based on Moments.

UNIT – IV   Correlation and Regression

Computation of Karl Pearson's correlation coefficient for ungrouped and grouped bivariate data – Spearman's Rank correlation coefficient – Regression coefficients and Regression equations.

UNIT – V   Probability Density and Distribution Functions

Bivariate distributions: Joint probability density and distribution functions, Marginal and Conditional probability density and distribution functions (discrete and continuous).

Note:

Question Paper Setting:

5 questions are to be set without omitting any unit. All questions carry equal marks.

Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	**60 Marks**
CIA (Including Practical Record)	**40 Marks**
Total	**100 Marks**

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	III
CORE THEORY	III
PAPER CODE	21UST03
TITLE OF THE PAPER	DISTRIBUTION THEORY
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

- ➢ To impart essential knowledge in discrete and continuous distributions.

- ➢ To learn the concepts of Binomial, Poisson and Normal distributions.

- ➢ To impart the knowledge about the basis of sampling distributions.

- ➢ To expose students to the concepts of gamma, rectangular, beta and exponential distributions.

- ➢ To enable the students to understand the properties and applications of discrete and continuous distributions

Course Outcomes:

The student will be able to:

- ➢ Understand the nature of the probability distributions such as Binomial, Poisson and Normal.

- ➢ Understand the sampling distributions t, χ^2 and F and their applications.

- ➢ Derive statistical distributions using the general theory of the random variables and generating functions.
- ➢ Derive sampling distributions and the relationship among them.

- ➢ Apply the knowledge of probability distributions and sampling distributions to real life situations.

UNIT – I   Discrete Distributions

Definitions of Bernoulli, Binomial, Negative Binomial, Uniform Distributions – Derivation of Moments, Moment generating function - Characteristic function - Recurrence relation for moments (Binomial) – Fitting of binomial distribution - Simple Problems.

UNIT – II   Discrete Distributions

Definitions of Poisson, Geometric, Hyper Geometric and Multinomial Distributions – Derivation of Moments - Moment generating function - Characteristic function and Recurrence relation for moments (Poisson) – Fitting of Poisson distribution - Simple Problems.

UNIT – III   Continuous Distributions

Normal distribution – Characteristics of Normal distribution – Derivation of Moments, Moment generating function - Characteristic function - Mean deviation about mean – Fitting of Normal distribution (area method and ordinate method) – Simple Problems.

UNIT – IV   Continuous Distributions

Concepts of Gamma and Rectangular Distributions, Beta Distribution of First and Second kind, Exponential Distribution - Derivation of Moments, Moment generating function - Simple Problems.

UNIT – V   Sampling Distributions

Concept of 't', 'χ^2' and 'F' distributions – Characteristics and Properties - Derivation of Moments, Moment generating function - Characteristic functions – Relationship between 't', 'χ^2' and 'F' distributions.

Reference Books:

1. Gupta S. C and Kapoor V. K, (2004), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

2. Rohatgi V.K, (1985), An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi.

3. Hogg R. V and Allen T. Craig (1998), Introduction to Mathematical Statistics, Mac Millan, London.

4. Mood A. M, Graybill F. A and Boes D. C (1974), Introduction to Theory of Statistics, Tata McGraw Hill, New Delhi.

5. Goon A. M Gupta M. D and Das Gupta B, (1993) Fundamentals of Statistics, (Vol. I) World press, Kolkata.

6. Bhuyan K. C (2010), Probability Distribution Theory and Statistical Inference, New Central Book agency private ltd, Reprint, 2015

7. Johnson N. L and Kotz S, Continuous Univariate Distributions, (Vol. I & II) John Wiley Publication, New York.

8. Bhat B. R (1984), Modern Probability Theory – An Introductory Text Book, Second Edition, John Wiley Publication, New York.

9. Hoel P G. (1971) Introduction to Mathematical Statistics, Wiley, New York.
10. Spiegel M.R. (1982) Theory and problems of Probability and Statistics, Schaum's outline series, McGraw Hill, New York.

Web Links:

➢ https://www.statisticshowto.datasciencecentral.com/

➢ https://online.stat.psu.edu/stat504/node/209/

➢ https://www.colorado.edu/amath/sites/default/files/attached-files/ch4.pdf

➢ https://www.cimt.org.uk/projects/mepres/alevel/stats_ch7.pdf

➢ https://www.investopedia.com/terms/c/chi-square-statistic.asp

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	III
ALLIED II: Theory	I
PAPER CODE	21USTA15
TITLE OF THE PAPER	APPLIED NUMERICAL METHODS
HOURS/WEEK	4
NO. OF CREDITS	5

Learning Objectives

➢ To enable the students to learn the concepts and numerical methods of solving algebraic and transcendental equations.

➢ To acquire knowledge about ordinary differential equations using different methods through the theory of finite differences.

➢ To enable the students to establish mathematical functions using numerical data and to learn interpolation with equal and unequal Intervals

➢ To provide the numerical methods for solving the numerical differentiation problems by using Newton's forward and backward difference formula.

➢ To impart the mathematical knowledge about numerical differentiation and integration.

Course Outcomes:

The students will be able to:

➢ Apply the Newton – Raphson iterative method and develop skills in numerical methods by using numerical analysis software.

➢ Implement various concepts of numerical analysis and statistics to solve real life problems.

- Gain sufficient knowledge in using interpolation techniques for finding roots of polynomial equations and evaluating integrals of functions.
- Develop the mathematical skills of the students in the areas of numerical methods and to write C programs for solving problems.
- Perform numerical integration using Trapezoidal and Simpson's rule.

UNIT – I   Solution of Algebraic and Transcendental Equation

Solution of Algebraic and Transcendental equations – Bisection, Regula- Falsi and Secant method – Newton – Raphson iterative method – Simple Problems .

UNIT – II   Finite Differences

Definition and Properties of Newton's forward difference operator – Newton's backward difference operator and Shift operator – Relations between them – n^{th} difference of Polynomials – Difference equations.

UNIT – III   Interpolation with Equal and Unequal Intervals

Newton – Gregory forward interpolation and backward interpolation formula for equal intervals – Lagrange formula for unequal intervals.

UNIT – IV   Numerical Differentiation

Numerical differentiation based on Newton's forward and backward difference formulae – Computation of second order derivatives numerically.

UNIT – V   Numerical Integration

Trepezoidal rule – Simpsons 1/3 and $3/8^{th}$ rules – Weddle's rule – Euler's summation formula - Numerical solution of ordinary differential equations – Taylor's series method – Euler method and Runge Kutta upto second order - Simple Problems.

Reference Books:

1. Kandasamy P, and Thilagavathi K, (2003) Calculus of Finite Differences and Numerical Analysis, Sultan Chand & Co, New Delhi.
2. Jain M. K, Iyengar S. R. K and Jain R. K, (1999) Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi.
3. Froberg C. E, (1979) Introduction to Numerical Analysis, (Second Edition), Addison Wesley Publishing Company.
4. Shankar Rao G, Numerical Analysis, New Age International Publishers, New Delhi.
5. Sastry S. S, (2010) Introductory Methods of Numerical Analysis, Prentice Hall.
6. Balasubramaniam P and Venkatraman M.K. (1972) Numerical Mathematics, Part I and II, Rochouse and Sons, New Delhi.
7. Rajaraman V, Computer Oriented Numerical Methods, Prentice Hall.

8. Hutchison, I. H. (2015), A Student Guide to Numerical Methods, Cambridge University Press, Cambridge.

9. Scarborough B, Numerical Mathematical Analysis, Oxford University Press.

10. Venkatraman M. K, Numerical Methods in Engineering and Science, National Publishing Company, India.

Web Links:

- http://www.math.iitb.ac.in/~baskar/book.pdf
- https://www.math.ust.hk/~machas/numerical-methods.pdf
- http://www.cse.iitm.ac.in/~vplab/downloads/opt/Applied%20Numerical%20Analysis.pdf
- http://www.ikiu.ac.ir/public-files/profiles/items/090ad_1410599906.pdf
- https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-2012/lecture-notes/

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	III
SBEC	I
PAPER CODE	21USTS01
TITLE OF THE PAPER	REGRESSION ANALYSIS
HOURS/WEEK	3
NO. OF CREDITS	3

Learning Objectives:

- To learn the concept of correlation, types and methods for measuring correlation coefficients.
- To make the students and to understand the relationships among simple, partial and multiple correlation coefficients.
- To understand the concept of principle of least squares for curve fitting and regression lines.
- To impart knowledge about fitting of power curve and exponential curve and related practical applications.
- Make the students to understand multiple regression coefficients and to fit regression in matrix terms

Course Outcomes:

The students will be able to:

- Understand the concept of partial and multiple correlation coefficients.
- Calculate regression coefficients and compute regression equations.
- Know the concept of least squares estimation in linear and non linear regression.

> Find multiple correlation coefficients and interpret analysis of multiple regression co-efficients.

> Gain knowledge about correlation and regression analysis and apply it in real life situations.

UNIT – I   Partial Correlation

Introduction - Concept of Correlation**,** Partial Correlation – Types and Methods of Correlation - Partial correlation coefficient – Zero order, First order and Second order Partial correlation coefficient – Partial correlation coefficient in case of three variables – Characteristics - Limitations – Significance of a partial correlation coefficient – Simple problems.

UNIT – II   Multiple Correlation

Meaning and definition – Coefficient of Multiple Correlation - Advantages and Limitations of Multiple Correlation Analysis - Relationships among simple, partial and multiple correlation coefficients – Simple Problems.

UNIT – III   Linear and Non Linear Regression

Concept of Regression - Simple Linear and Non Linear Regression - Least square estimation of regression coefficients and its Properties - Regression equation - Fitting a straight line by least squares - Curve fitting - Conversion of data into linear form - Fitting of Power Curve and Exponential Curve - Uses of Regression - Simple problems .

UNIT – IV   Multiple Linear Regression Analysis

Concept of Multiple Regression – Objectives of multiple regression analysis – Multiple regression coefficients – Multiple linear regression equation (three variables only) - Normal equations for the least square regression plans – Assumptions – Generalizations for more than three variables – Uses of Multiple Regression and Correlation Analysis – Coefficient of Multiple determination – Simple problems.

UNIT – V   Regression in Matrix Terms

Fitting a straight line in Matrix terms - Singularity Matrices – General linear regression when X'X is singular - Variances and Covariance of b_0 and b_1 from the matrix calculation.

Reference Books:

1. Gupta S. P, Statistical Methods, Sultan Chand & Sons Pvt Ltd., New Delhi.
2. Norman. R. Draper Harry Smith (1998), Applied Regression Analysis, John Wiley and Sons.
3. Gupta S. C and Kapoor V. K (2004), Fundamentals of Mathematics Statistics, Sultan Chand and Sons, New Delhi.
4. J. N Kapoor and H. C Sexana (1989), Mathematical Statistics, Sultan Chand and sons, New Delhi.
5. Draper N. R and Smith H (1981), Applied Regression Analysis, John Wiley & Sons.
6. Brook R. J and Arnold G. C (1985), Applied Regression Analysis and Experimental Design,

Marcel Dekker, Inc.

7. Plackeff. R.L. (1960), Principles of Regression Analysis, Oxford at the Clavendon press.

8. Anderson T. W, (1996), An Introduction to Multivariate Analysis, John Wiley, New York.

9. Seber G. A. F (1977), Linear Regression Analysis, John Wiley, New York.

10. John O. Rawlings, Sastry G. Pantula and David A. Dickey (2001) Applied Regression Analysis: A Research Tool (Springer Texts in Statistics).

Web Links:

➢ http://uregina.ca/~gingrich/regr.pdf

➢ https://www.researchgate.net/publication/300403700_Regression_Analysis

➢ http://www.ernestoamaral.com/docs/soci420-17fall/Lecture24.pdf

➢ https://www.globalspec.com/reference/69598/203279/chapter-11-curve-fitting-regression

➢ https://www.ms.uky.edu/~ma138/Spring20/Curve_fitting.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	IV
CORE THEORY	IV
PAPER CODE	21UST04
TITLE OF THE PAPER	SAMPLING TECHNIQUES
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

➢ To introduce the concept, methods and analysis of sampling techniques.

➢ To enable the students to understand and apply the sampling procedures to different situations.

➢ To learn the importance of Sampling and different methods of sampling techniques.

➢ To equip students with sampling techniques and enable them to conduct sample surveys.

➢ To collect the desired information from the universe in minimum time and estimate the higher degree of reliability.

Course Outcomes:

The student will be able to:

➢ Understand the importance of sampling and different methods of sampling techniques.

➢ Find sample estimates and their properties for simple random sampling and systematic sampling.

➢ Identify sample estimates for the method of stratification.

➢ Understand the principles of census and sample surveys and to become competent for conducting sample surveys.

➢ Compare the efficiency of various estimation strategies resulting from different sampling techniques.

UNIT – I   Sample Survey

Basic concept of Sample Survey - Census and Sample Survey - Population and Sample – Parameter and Statistic – Preparation of Questionnaire and Schedules – Principle steps in Sample Survey – Pilot survey – Sampling Distribution - Standard Error - Sampling and Non-sampling Errors – Advantages over Complete Enumeration – Limitations of sampling.

UNIT – II   Simple Random Sampling

Procedures of Selecting a Random sample – Simple Random Sampling with and without Replacement (Lottery method, Random number tables) – Estimation of Mean, Variance and Proportion of the Estimated Sample Mean – Determinations of Sample size – Confidence Limits – Simple Random Sampling for Attributes.

UNIT – III   Stratified Random Sampling

Meaning and Principles of Stratification – Advantages of Stratification – Estimation of Mean and Variance of the Estimated Sample Mean – Allocation of Sample Size in Different Strata – Equal Allocation, Neyman Allocation, Optimum Allocation and Proportional Allocation – Relative Precision of Stratified Random Sampling with Simple Random Sampling.

UNIT – IV   Systematic Random Sampling

Concept of Systematic Random Sampling – Selection Procedures, Advantages and Disadvantages, Estimation of Mean and Variance of the Estimated Sample Mean – Comparison of Simple Random Sampling and Stratified Random Sampling with Systematic Sampling.

UNIT – V   Cluster Sampling and Non - Probability Sampling

Cluster Sampling with Equal Sized Clusters – Estimation of Population Mean and Variance – Concepts of Convenience, Judgment, Quota and Snowball Sampling – Merits and Demerits – Applications.

Reference Books:

1. Cochran W. G (1985), Sampling Techniques, John Wiley & Sons, New Delhi.
2. Gupta S. C and Kapoor V. K, Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
3. Daroga Singh and Choudary F. S (1986), Theory and Analysis of Sample Survey Designs, New Age International Publishers, New Delhi.
4. Desraj (1976), Sampling Theory, Tata McGraw Hill, New York.(Reprint 1979).
5. Murthy M. N (1977), Sampling Theory and Statistical Methods, Statistical Publishing Society.

6. Sampath S (2001), Sampling Theory and Methods, Narosa Publishing House. New Delhi.

7. Sukhatame P. V and Sukhatame B. V (1997), Sampling Theory of Surveys with Applications (Third Edition), ISAS Publication.

8. Rajan K. Son, Practical Sampling Techniques, (Second Edition), CRC Publications, New York.

9. Goon, A. M, Gupta, M. K and Dasgupta, B. (2008).Fundamentals of Statistics, Volume - I, World Press Ltd, Calcutta.

10. Parimal Mukhopadhyay (1998), Theory and Methods of Survey Sampling, Prentice Hall of India, New Delhi.

Web Links:

➢ https://course-notes.org/statistics/sampling_theory

➢ http://www.statstutor.ac.uk/resources/uploaded/13samplingtechniques.pdf

➢ http://www.ph.ucla.edu/epi/rapidsurveys/RScourse/RSbook_ch3.pdf

➢ https://www.investopedia.com/terms/stratified_random_sampling.asp

➢ http://conflict.lshtm.ac.uk/page_35.htm

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	IV
ALLIED II : THEORY	II
PAPER CODE	21USTA16
TITLE OF THE PAPER	PROGRAMMING IN C
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

➢ To enable the students to understand the fundamentals and to develop programs in C.

➢ To impart essential knowledge in simple, control statements and functions.

➢ To acquire knowledge about the concepts of arrays, strings and array declaration.

➢ To learn and understand the basic concepts of structure initialization and arrays of structures.

➢ To enable the students to understand the basic structure of the C-PROGRAMMING, declaration and usage of variables through statistical computing and problem solving.

Course Outcomes:

The students will be able to:

➢ Understand basic data structures and to develop logics which will help them to create well-structured programs using C language.

➢ Know the concept of Pointers and Addresses, Pointers and Arrays in relation to Pointers and structures

- ➢ Gain knowledge in decision making using branching and looping.
- ➢ Describe C programs that use Pointers to access arrays, strings and functions.
- ➢ Develop the analytical as well as logical thinking which will help them to create programs and applications in C

UNIT – I   C-Fundamentals

Introduction to "C", Variables, Data Types - Declarations, Type Conversions, Increment and Decrement, Bitwise, Logical and Assignment Operators – Increment and Decrement, Conditional, Bitwise – Expression – Arithmetic Expression – Evaluation of Expressions – Type Conversion in Expression – Mathematical Function.

UNIT – II   Simple, Control Statements and Functions

Decision Making and Branching: Decision Making with – IF statement – Simple IF statement – IF… ELSE Statement – Switch Statement – ?: Operator – GOTO statement – Looping : WHILE statement – DO Statement – FOR statement – Jumps in Loop – Function, classification of functions – Defining and Declarations of Functions.

UNIT – III   Arrays and Pointers

Arrays and Strings – Array Declaration, Multi-dimensional Arrays Strings/Character Arrays, Array initialization – Pointers and Addresses, Pointers and Arrays-Pointer to function – Pointers and Structures.

UNIT – IV   Structures

Definition – Structure Initialization – Arrays of Structures – Structures and functions – pointers to Structure.

UNIT – V   File Processing

Files – Defining, Opening and Closing of a file - Input/output Operations on Files – Error handling during Input/output Operations – Random Access to files - Simple programs based on Statistics.

Reference Books:

1. Balagurusamy E, Programming in ANSI 'C', Tata McGraw Hill Publications.
2. Venugopal K. R and Prasad S. R, Mastering 'C', Tata McGraw Hill Publications.
3. Bryon S. Gottfried, Schaum's Outline Theory and Problems of Programming with 'C', International Editions.
4. Yaswant Kanetkar (1997), Let Us 'C', BPB Publications, New Delhi.
5. Bruce H. Hunter: Introduction to 'C', Wiley & Sons, Incorporated, John.
6. Herbert Schildt, Osborn, 'C' made simple, McGraw Hill Publications.
7. Brian W. Kernighan and Ritchie D (2002), 'C' Programming Language, Prentice Hall of India.
8. Gotfried B. S (1998), Programming in 'C', Schaum's Outline Series.

9. Yashwant Singh Kanetkar (1993), Exploring 'C', BPB Publications, New Delhi.

10. ReemaThareja, Programming in 'C', Oxford University Press.

Web Links:

- https://www.programiz.com/c-programming

- https://www.geeksforgeeks.org/c-language-set-1-introduction/

- http://www.skiet.org/downloads/cprogrammingquestion.pdf

- https://1234mathematics.files.wordpress.com/2013/02/cbnst-by-manish-goyal.pdf

- https://www.academia.edu/29344253/COMPUTER-BASED_NUMERICAL_and _STATISTICAL_ _TECHNIQUES

- http://www.sci.brooklyn.cuny.edu/~mate/nml/numanal.pdf

- https://repo.zenk-security.com/Programmation/O%20Reilly%20 %20Practical%20C%20 Programming,%203rd%20Edition.pdf

- https://www.indiastudychannel.com/resources/169841-C-Program-on-Statistical-Analysis.aspx

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	IV
CORE PRACTICAL	II (Based on Core Theory Paper III & IV)
PAPER CODE	21USTP02
TITLE OF THE PAPER	MAJOR PRACTICAL – II
HOURS/WEEK	2
NO. OF CREDITS	3

Learning Objectives:

- To enable the students to gain practical knowledge in Binomial, Poisson and Normal distributions.

- To acquire practical knowledge in solving simple random sampling stratified random sampling and systematic random sampling problems.

- To expose the practical applications of χ^2 statistic in real life problems.

Course Outcomes:

The Students will be able to:

- Use discrete and continuous probability distributions and find mean and variance for arriving decisions.

- Understand the nature and applications of sampling distributions such as t, χ^2 and F.

- Compare simple random sampling, stratified random sampling and systematic random sampling and estimate their mean and variance.

UNIT – I   Discrete Probability Distributions

Fitting of Binomial and Poisson distributions – Test for the Goodness of fit.

UNIT – II   Continuous Probability Distributions

Fitting of Normal distribution – Area method and Ordinate method – Test for the Goodness of fit.

UNIT – III   Simple random Sampling

Drawing Sample from the Population with and without Replacement – Estimation of Population Mean, Total Variance and its Standard Error.

Unit – IV   Stratified random Sampling

Estimation of Mean, Variance of the Population Means – Variance of the estimator of Mean under Proportional and Optimal allocations.

UNIT – V   Systematic random sampling

Estimation of Mean and Variance – Comparison of Simple Random Sampling, Stratified Random Sampling and Systematic Random Sampling.

Note:

Question Paper Setting:

   5 questions are to be set without omitting any unit. All questions carry equal marks.

   Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	**60 Marks**
CIA (Including Practical Record)	**40 Marks**
Total	**100 Marks**

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	IV
ALLIED II: PRACTICAL	II (Based on Allied Theory Paper III & IV)
PAPER CODE	21USTAP04
TITLE OF THE PAPER	ALLIED PRACTICAL – II: NUMERICAL METHODS AND PROGRAMMING IN - C
HOURS/WEEK	2
NO. OF CREDITS	2

Learning Objectives:

➢ To enable the students to understand and develop programs in C.

➢ To acquire practical knowledge in solving Algebraic and Transcendental Equation by using C Program.

➢ To impart the students to write the C program of the Newton's forward and backward interpolation.

➢ To enable the students to gain practical knowledge about numerical integration by Simpson's Rule in C Programming

Course Outcomes:

The students will be able to:

➢ Gain the practical application of programming in 'C'.

➢ Identify the numerical method through programming language.

- ➢ Understand the applications of Trapezoidal rule in C programming
- ➢ Have a clear understanding and apply Lagrange's interpolation method in C programming.
- ➢ Gain knowledge in C and developing programs for statistical problems.

Practical Exercise:

Write the C program for the following:

1. Generalized program for solving transcendental equation by Regula Falsi method.
2. Program of solving transcendental equation by Secant method.
3. Program of solving transcendental equation by general Newton Raphson method.
4. Program of solving transcendental equation by Bisection method.
5. Newton's forward difference method.
6. Newton's backward difference method.
7. Newton's forward interpolation.
8. Newton's backward interpolation.
9. Lagrange's interpolation.
10. Numerical integration by Trapezoidal Rule.
11. Numerical integration by Simpson's 1/3 Rule.
12. Numerical integration by Simpson's 3/8 Rule.

Practical Web Links:

- ➢ http://www.dailyfreecode.com/Tutorial_Simple_C_Programming-15/Numerical-Methods-265.aspx
- ➢ https://www.codewithc.com/numerical-methods-tutorial/
- ➢ https://www.codesansar.com/numerical-methods/
- ➢ https://nptel.ac.in/courses/122106033/
- ➢ https://www.codewithc.com/category/numerical-methods/numerical-methods-c/
- ➢ https://readthedocs.org/projects/numericalmethodstutorials/downloads/pdf/latest/
- ➢ https://numericalmethodstutorials.readthedocs.io/en/latest/
- ➢ https://www.sanfoundry.com/c-programming-examples-numerical-problems-algorithms/
- ➢ http://cprogrampracticals.blogspot.com/p/home-page.html
- ➢ https://www.includehelp.com/c-programming-examples-solved-c-programs.aspx

Note:

Two questions are to be set with internal choice. All questions carry equal marks.

Any 2 questions are to be answered in 3 hours duration.

University Examinations	Distribution of Marks		
	Written Practical	Total Marks	
Algorithm / Flowchart	10 Marks	60 Marks	
Writing the Program in the Main Answer Book	20 Marks		
Run the Program	20 Marks		
Display the Correct Output	10 Marks		
CIA (Including Practical Record)		40 Marks	
Total		100 Marks	

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	V
CORE THEORY	V
PAPER CODE	21UST05
TITLE OF THE PAPER	THEORY OF ESTIMATION
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

➢ To impart the knowledge about the estimators through various estimation methods.

➢ To enable the students to learn the concepts of point estimation and interval estimation, and their properties.

➢ To equip the students with the theoretical knowledge for estimating unknown parameters.

➢ To provide detailed idea of estimation and to study the various methods of finding an estimator.

➢ To expose the students to estimation theory in real-life applications.

Course Outcomes:

Students will be able to

➢ Understand the concept of point and interval estimation and to assess the characteristics of estimators.

➢ Gain sufficient knowledge in estimating the population parameters on the basis of sample statistics.

➢ Identify the best estimator for a parameter and to apply the methods of finding an estimator.

➢ Find the confidence intervals and limits for parameters of standard distributions.

➤ Obtain the estimators through various estimation methods and apply the theoretical concepts to real life applications.

UNIT – I   Point Estimation

Concept of Estimation theory – Basic definitions - Estimate and Estimator - Characteristics of Estimator – Unbiasedness – Consistency – Problems based on Binomial, Poisson and Normal distributions – Invariance property of Consistency – Sufficient conditions for Consistency.

UNIT – II   Point Estimation

Efficient Estimators – Most Efficient Estimator – Minimum Variance Unbiased Estimator (MVUE) – Sufficiency – Definition – Rao Blackwell Theorem – Crammer-Rao Inequality – Statement of Neymann Factorization Theorem – Invariance Property of Sufficient Estimator - Simple Problems.

UNIT – III   Methods of Estimation

Concept of Likelihood Function – Method of Maximum Likelihood Estimation – Properties of M.L.E - Simple Problems – Statement of Crammer Rao Theorem and Hazoor Bazar's Theorem.

UNIT – IV   Methods of Estimation

Methods of Minimum Variance – Methods of Moments and Methods of Least Squares - Simple Problems.

UNIT – V   Interval Estimation

Interval Estimators - Confidence Limits - Confidence Interval for Proportion(s), Mean(s), Variance(s) and variance ratio based on Normal, Chi-square, Student's - t and 'F' distributions - Simple Problems.

Reference Books:

1. Rohatgi, V.K. and Saleh, A. K. MD.E. (2001) An Introduction to Probability and Statistics, Wiley, India.
2. Lehmann, E.L., and Casella, G, (1998), Theory of Point Estimation, Second Edition, Springer Verlag, New York.(Reprint, 2008).
3. Hogg, R. V. Tanis, E and Zimmerman, D (2014) Probability and Statistical Inference, Pearson, New Delhi.
4. Mood A. M, Graybill F. A and Boes D. C (1974), Introduction to the Theory of Statistics, Third Edition, McGrow Hill International Edition.
5. Rao C. R (1973), Linear Statistical Inference and its Applications, Revised Edition, Wiley Eastern Ltd., New Delhi.
6. Spiegel M. R and Ray M (1980), Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.
7. Gupta S. C and Kapoor V. K (1982), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

8. Snedecor G. W and Cochran W. G, Statistical Methods, Oxford and IBH.

9. Rajagopalan M and Dhanavanthan P (2012), Statistical Inference, PHI Learning Private Limited, New Delhi.

10. Santhakumaran A (2004), Probability Models and their Parametric Estimation, K.P. Jam Publication, Chennai.

Web Links:

➢ https://www.univ-orleans.fr/deg/masters/ESA/CH/Chapter1_Estimation_Theory.pdf

➢ http://www.stat.columbia.edu/~liam/teaching/4107-fall05/notes3.pdf

➢ https://www.researchgate.net/publication/284156917_Introduction_to_Estimation_Theory_Lecture_Notes

➢ https://www.gs.washington.edu/academics/courses/akey/56008/lecture/lecture5.pdf

➢ https://www.britannica.com/science/interval-estimation

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	V
CORE THEORY	VI
PAPER CODE	21UST06
TITLE OF THE PAPER	TESTING OF HYPOTHESIS
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

➢ To enable the students to learn the concepts of hypothesis testing and to develop null and alternative hypothesis.

➢ To learn about hypotheses and derive test statistic based on large samples and small samples.

➢ To impart statistical knowledge about Type I and Type II errors.

➢ To introduce the concepts of parametric test and chi-square test.

➢ To know about the likelihood ratio test and the UMP test.

Course Outcomes:

The students will be able to:

➢ Understand the concepts of testing hypothesis and to develop null and alternative hypothesis.

➢ Get information about the population on the basis of a random sample taken from that population.

➢ Choose an appropriate test procedure under the test of significance.

➢ Understand the likelihood ratio test procedures and UMP test procedures.

➢ Test the equality of several means using LR test.

UNIT – I   **Statistical Hypothesis**

Concept of Hypothesis – Null and Alternative Hypothesis – Critical Region – Type I and Type II Errors – Level of Significance – Size and Power of the test – Most Powerful (MP) Test – UMP Test – Neymann – Pearson Fundamental Lemma - Simple Problems.

UNIT – II   **Likelihood Ratio (LR) Test**

Concept of LR test – Properties and Uses – Tests for the Mean and Variance of normal population – Tests for the Equality of Means and Variance of two normal populations.

UNIT – III   **Large Sample Tests**

Test of significance – Sampling distributions, Standard error – Large sample tests based on Mean, Proportion - Difference between Means, difference between Proportions and Standard deviation.

UNIT – IV   **Small Sample Tests**

Student's – t – test based on Mean, Difference of Two Means, Paired –t – test - Test for coefficient of correlation – F test for variance ratio.

UNIT – V   **Chi - square Test (χ^2)**

Conditions for the validity of χ^2-test – Applications of chi-square distribution – Test for independence of attributes – Yates Correction for 2x2 contingency table – Test for goodness of fit.

Reference Books:

1. Rohatgi V.K. and Saleh A. K, (2001). An Introduction to Probability and Statistics (Second Edition), John Wiley & Sons, New York. (Reprint, 2009).
2. Lehmann F. L (1986), Testing of Statistical Hypothesis (Student edition**).**
3. Hogg, R.V. and Craig, A.T. (1972) Introduction to Mathematical Statistics, Macmillan Publishing Co., Inc. New York.
4. Mood A.M Graybill F. A and Boes D. C (1974), Introduction to the Theory of Statistics, (Third Edition), McGraw Hill, New Delhi.
5. Rao C. R (1973), Linear Statistical Inference and its Applications, Revised Edition, Wiley Eastern Ltd., New Delhi.
6. Gupta S. C and Kapoor V. K (1982), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

7. Kale, B. K. (2005). A First Course in Parametric Inference (Second Edition), Narosa Publishing House, New Delhi. (Reprint, 2007).

8. Spiegel M. R and Ray M (198 0), Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.

9. Goon, A.M., Gupta, M. K., and Dasgupta, B. (1989).An Outline of Statistical Theory, Vol. II, World Press, Kolkata.

10. Rajagopalan M and Dhanavanthan P (2012), Statistical Inference. PHI Learning Pvt. Ltd., New Delhi.

Web Links:

➢ http://www.sci.utah.edu/~arpaiva/classes/UT_ece3530/hypothesis_testing.pdf

➢ https://stats.libretexts.org/Bookshelves/Introductory_Statistics/Book%3A_Introductory_Statistics_(Shafer_and_Zhang)/08%3A_Testing_Hypotheses/8.2%3A_Large_Sample_Tests_for_a_Population

➢ https://www.itl.nist.gov/div898/handbook/apr/section2/apr233.htm

➢ https://www.statisticshowto.datasciencecentral.com/parametric-and-non-parametric-data/

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	V
CORE THEORY	VII
PAPER CODE	21UST07
TITLE OF THE PAPER	STATISTICAL QUALITY CONTROL
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

➢ To enable the students to understand the concept of quality, process and product control using control chart techniques and sampling inspection plan.

➢ To have an idea about quality management, quality of conformance, quality movement and standardization of quality.

➢ To learn the principle of acceptance sampling, single, double and sequential sampling plan.

➢ To reduce the number of rejects and save the cost of material.

➢ To apply various sampling plans in industrial environment to study, analyze and control the quality of products.

Course Outcomes:

The student will be able to:

➢ To know about the basic of Statistical Quality Control and its tools.

- ➢ Evaluate the methods and processes of production and suggest further improvements in their functioning.
- ➢ Know about the practical applications of quality control techniques and apply them in industry.
- ➢ Describe principle of quality, specification limits, tolerance limits and concepts of SQC.
- ➢ Draw control charts for variables and attributes and interpret them.
- ➢ To monitor population through many stages of manufacturing.

Unit – I   Meaning and Concepts of SQC

Meaning and concepts of quality – Quality of design – Standardization for quality – Quality Movement – Quality Management – Quality of Conformance – Need for Statistical Quality Control Techniques in Industry – Causes of quality variations – Process control and Product control – Statistical basis for Control charts – Uses of Shewart's control charts.

Unit – II   Control Charts for Variable

Natural tolerance limits and specifications limits – 3σ limits – Warning limits – Variable control charts - $\bar{X}$,R and σ charts – Basis of sub grouping – Interpretation of $\bar{X}$ and R charts.

Unit – III   Control Charts for Attributes

Construction and analysis of p, np, c and u charts – Comparison of control charts for variable and attributes – Application of theory of runs in quality control.

Unit – IV   Acceptance Sampling for Attributes (Single Sampling Plan)

Fundamental Concepts of Acceptance Sampling by Attributes – Producer's and Consumer's risk – Concepts of AQL, LTPD, IQL and AOQL – Construction of OC, AOQ, ASN, ATI curves for Single Sampling Plan.

Unit – V   Acceptance Sampling for Attributes (Double Sampling Plan)

Double Sampling Plan for Attributes – Derivation and construction of OC, AOQ, ASN, ATI curves - Sequential Sampling – Sequential Probability Ratio Test (SPRT) – ASN function of Sequential Sampling Plan.

Reference Books:

1. Mahajan M (2002), Statistical Quality Control,(Third Edition), Dhanpat Rai and Co., New Delhi.
2. Gupta S. C and Kapoor V. K (2007), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
3. Duncan A. J (2006), Quality Control and Industrial Statistics, Irwin Illinois.
4. Grant E. L and Leavenworth R. S (2000), Statistical Quality Control, Tata McGraw-Hill, New Delhi.
5. Gupta R. C (1974), Statistical Quality Control, Khanna Publishing Co, New Delhi.
6. Montgomery D. C (2009). Introduction to Statistical Quality Control, Wiley India, New Delhi.
7. John T. Burr (2004), Elementary Statistical Quality Control, Marcel Dekker, New York.

8. Cowdon D. J (1960), Statistical Method in Quality Control, Asia Publishing House, Bombay.

9. Juran J. M and De Feo J. A (2010), Juran's Quality Control Handbook – The Complete Guide to Performance Excellence, (Sixth Edition), Tata McGraw-Hill, New Delhi.

10. Schilling E. G and Nuebauer D. V (2009), Acceptance Sampling in Quality Control (Second Edition), CRC Press, New York.

Web Links:

- http://www2.ing.unipi.it/lanzetta/stat/Chapter20.pdf
- http://endustri.eskisehir.edu.tr/ipoyraz/TKY302/icerik/text%20book_montgomery_6th%20edition.pdf
- https://www.itl.nist.gov/div898/handbook/pmc/section2/pmc21.htm
- https://www.oreilly.com/library/view/fundamentals-of-quality/9781118705148/c10.xhtml
- https://www.businessmanagementideas.com/production-2/control-charts-forvariablesand-attributes-quality-control/7044

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	V
CORE ELECTIVE	I
PAPER CODE	21USTE01
TITLE OF THE PAPER	OPERATIONS RESEARCH – I
HOURS/WEEK	4
NO. OF CREDITS	4

Learning Objectives:

- To introduce the concepts, models and problem solving techniques in optimization problems.
- To solve the linear programming problems using various methods.
- To implement operation research models for solving transportation and assignment problems.
- To learn and understand sequencing problems with n-jobs and m-machines.
- To acquire knowledge in application of queuing models in business for making decisions.

Course Outcomes:

Students will be able to

- Gain knowledge about various optimization techniques.
- Solve the problems related to business and industries by using linear programming techniques.
- Execute operations research techniques for finding the optimum solution in real life situations.

- ➢ Solve the sequencing , transportation and assignment problems
- ➢ Understand the characteristics of a queuing system.

UNIT – I   Introduction of OR and LPP

Origin – Nature of OR – Characteristics of OR – Models in OR – Phases of OR – Uses and Limitations of OR – Mathematical Formulation of LPP – Solution of LPP by Graphical Method.

UNIT – II   Linear Programming Problem

Solution of LPP by Simplex Method – Big-M method – Duality in LPP – Dual Simplex Method - Simple Problems.

UNIT – III   Transportation Problem

Transportation Problem – Formulation – Balanced, Unbalanced Transportation Problem – Initial Basic Feasible Solution – North West Corner Rule – Least Cost Method – Vogel's Approximation Method – Optimum solution – MODI method.

UNIT – IV   Assignment Problem and Sequencing Problem

Solution of Balanced and Unbalanced Assignment Problems – Sequencing Problem – Problems with n - jobs through two machines – n-jobs through three machines – Problems with n-jobs and m-machines.

UNIT – V   Queuing Theory

Basic concepts of queueing theory - Characteristics of a queueing model – classification of queueing models- Average waiting time, expected queue length - variance of queue length - Expression for probability of n customers in the system p(n) for the queueing models (M/M/1: ∞/FIFO) and (M/M/1: N/FIFO) - Simple problems.

Reference Books:

1. Kanti Swarup, Gupta P. K, Man Mohan (1980), Operations Research, Sultan Chand and sons, New Delhi.
2. Gupta, P.K., and Man Mohan. (1979). Operations Research: Linear Programming and Theory of Games, Third Edition, Sultan Chand and Sons, New Delhi.
3. Taha, H.A (2011). Operations Research: An Introduction, Ninth Edition, Prentice Hall Publishing Company.
4. Sharma J.K. (2013), Operations Research: Problems and Solutions, (Fifth Edition) Macmillan India Limited.

5. Gupta R. K (1985), Operations Research, Krishna Prakashan, Mandir Meerut.

6. Gupta, P. K and Hira D. S, (1986), Operations Research - An Introduction, Sultan Chand and Sons, New Delhi

7. Hillier, F.S., and Lieberman, G.J. (2005), Introduction to Operations Research, Ninth Edition, McGraw – Hill Publishing Company.

8. Nita H. Shah, Ravi M. Gor, Hardik Soni (2010), Operations Research, PHI Learning Private Limited, New Delhi.

9. Dr. B. S. Goel & Dr. S. K. Mittal, Operations Research, Pragathi Prakasam Publishers.

10. Sharma, S. D. (2010). Operations Research, KedarNath, Ram Nath and Co, Meerut.

Web Links:

➢ http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf

➢ http://www.uky.edu/~dsianita/300/online/LP.pdf

➢ http://web.tecnico.ulisboa.pt/mcasquilho/compute/_linpro/TaylorB_module_b.pdf

➢ https://link.springer.com/chapter/10.1007%2F978-3-662-08011-5_10

➢ https://www.kth.se/social/upload/52fcf25ff276543c8cd8a070/queuing_theory.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	V
CORE ELECTIVE	II
PAPER CODE	21USTE02
TITLE OF THE PAPER	STOCHASTIC PROCESSES
HOURS/WEEK	4
NO. OF CREDITS	4

Learning Objectives:

➢ To learn the concepts of stochastic process and stationary process.

➢ To equip Students with elements of stochastic models and its applications.

➢ To identify the situations which require stochastic modelling.

➢ To define birth and death processes in continuous time Markov chain.

➢ To learn the applications of Markov chain in disease and recovery.

Course Outcomes:

Students will be able to:

➢ Understand the classification of stochastic process based on time and space.

➢ Identify the elements and solve problems by using different types of stochastic processes.

- Study and interpret the characteristics of queueing environment using stochastic modelling.
- Apply Markov chain in social mobility and discount for Insurance premium.
- Understand the stationary models and concept of spectrum in time series.

UNIT – I   Stochastic Processes

Basic concepts – Elements of Stochastic Processes – Classification of general stochastic processes into discrete and continuous time, Discrete and Continuous State Spaces, Types of Stochastic Processes, Elementary problems.

UNIT – II   Markov Chain

Definitions and Examples – Transition Probability Matrix – Chapman - Kolmogorov equation – Classification of States – Transient and Recurrent States - Simple Problems.

UNIT – III   Stationary processes and time series

Strict and wide sense stationary models of Time series – Concept of Spectrum of Time Series.

UNIT – IV   Continuous Time Markov chain

Pure Birth process, Poisson process, Birth and Death processes – Simple Problems.

UNIT – V   Applications of Markov Chain

Social Mobility, Disease and Recovery – Consumer Behavior – Discount for Insurance Premium.

Reference Books:

1. Karlin S and Taylor H. M (1975), A First Course in Stochastic Processes, Academic Press, New York.
2. Medhi J (2002), Stochastic Processes, New Age International Publishers, New Delhi.
3. Prabhu N. U (2007), Stochastic Processes Basic Theory and Applications, World Scientific, Singapore.
4. Ross S. M (1983), Stochastic Processes, Wiley, New York.
5. Hoel P. G, Port S. C and Stone C. J (1991), Introduction to Stochastic Processes, Universal Book Stall, New Delhi
6. Parzen E (1962), Stochastic Processes, Holden-Day, San Francisco.
7. Taylor H. M and Karlin S (1999), Stochastic Modeling, Academic Press, New York.
8. Bhat U. N (1972), Elements of Applied Stochastic Processes, Wiley, New York.
9. Adke S. R and Manjunath S. M (1984), An Introduction to finite Markov Processes, Wiley Eastern.

10. Oliver Knill, Probability and Stochastic Processes with Applications, Overseas Press India Pvt. Ltd

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> https://web.ma.utexas.edu/users/gordanz/notes/introduction_to_stochastic_processes.pdf
> https://www.stat.auckland.ac.nz/~fewster/325/notes/325book.pdf
> https://dept.stat.lsa.umich.edu/~ionides/620/notes/cts_time_markov_chains.pdf
> https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/Chapter11.pdf
> http://www.columbia.edu/~ks20/stochastic-I/stochastic-I-CTMC.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	V
SBEC	II
PAPER CODE	21USTS02
TITLE OF THE PAPER	NON- PARAMETRIC TEST
HOURS/WEEK	3
NO. OF CREDITS	3

Learning objectives:

> To study the basic concepts of non-parametric statistics.
> To acquire knowledge about parametric and non-parametric tests
> To enable the students to gain knowledge about test for randomness and run test.
> To make the students to understand the concept of sign test and Wilcoxon Signed rank test.
> To learn chi-square test for independence as well as goodness of fit.

Course Outcomes:

The Students will be able to:

> Know the difference between parametric and nonparametric tests.
> Apply Mann Whitney U Test and Wilcoxon signed rank test for paired observations.

- ➢ Understand Kolmogorov – Smirnov test and chi-square test for goodness of fit.
- ➢ Identify the applications of nonparametric tests and use it for solving statistical problems.
- ➢ Understand the importance, advantages and limitations of nonparametric tests.

UNIT – I   Non-parametric Test

Introduction of Non-parametric Test – Its comparison with Parametric test – Advantage and Limitations of Non-parametric tests.

UNIT – II   Comparison of One and Two Populations

Test for Randomness – Run test – Test for Rank Correlation Coefficient – Sign test.

UNIT – III   Comparison of Two Populations

Median test – Mann Whitney U test – Wilcoxon Signed rank test for Paired observations.

UNIT – IV   Comparison of Several Populations

Median test for several samples – Kruskal Walli's test – Friedman ANOVA.

UNIT – V   Comparison of Several Populations

Testing of goodness of fit by Kolmogorov – Smirnov test – Chi-square test for uniformity of data – Distinction between non-parametric and parametric tests.

Books for References:

1. Agarwal B. L, Basic Statistics, New Age International Publishers, New Delhi.
2. Gibbons J. D (1976), Non-Parametric Methods for Quantitative Analysis, Hold Rinehart and Winston, New York.
3. Richard I Levin, Statistics for Management, Practice Hall of India, New Delhi.
4. Hogg R. V and Tanis E. A (1987), Probability and Statistical Inference, Macmillan Publishing Company, New York.
5. Gibbons J. D and Chakraborty S (2003), Nonparametric Statistical Inference, (Fourth Edition), Marcel Dekker, CRC.
6. Vijay K. Rohatgi and A.K Md. Ehsanes Saleh (2008), An Introduction to Probability and Statistics, John Wiley and Sons, New York.
7. Harold J. Larson (1982), Introduction to Probability Theory and Statistical Inference (Third Edition), John Wiley and Sons, New York.
8. Gupta S. C and Kapoor V. K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons,

New Delhi.

9. Daniel W. E (1978), Applied Nonparametric Statistics, Houghton Mifflin Company, Boston.

10. Siegel, S. and Castellan, N.J. (1988). *Non-Parametric Statistics for the Behavior Sciences*, 2nd Ed., International Edition.

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➢ https://www.statisticshowto.com/parametric-and-non-parametric-data/

➢ https://www.sciencedirect.com/topics/medicine-and-dentistry/nonparametric-test

➢ https://corporatefinanceinstitute.com/resources/knowledge/other/nonparametric-tests/

➢ https://statisticsbyjim.com/hypothesis-testing/nonparametric-parametric-tests/

➢ http://biostat.mc.vanderbilt.edu/wiki/pub/Main/AnesShortCourse/NonParametrics.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
CORE COURSE	VIII
PAPER CODE	21UST08
TITLE OF THE PAPER	DESIGN OF EXPERIMENTS
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

➢ To learn the basic principles of design of statistical experiments and models.

➢ To acquire knowledge in analysis of variance in the statistical field experiments.

➢ To impart knowledge about CRD, RBD, LSD and factorial design with suitable real life examples.

➢ To Study the interaction effect among factors through factorial experiments.

➢ To analyse the data relating to agriculture, biological sciences and industry.

Course Outcomes:

Students will be able to:

➢ Understand the principles of experimentation and employ suitable designs in experiments.

- ➢ Get basic knowledge of one way and two way analysis of variance and to compare more than two treatments with the help of F distribution.
- ➢ Apply post ANOVA tests and to use appropriate experimental designs for analysing experimental data.
- ➢ Estimate the missing observations in RBD and LSD.
- ➢ Know the advantages, disadvantages and efficiency of various designs.

UNIT – I   Analysis of Variance

Definition and Assumptions – Concept of Cochran's Theorem – ANOVA – One way and Two-way classifications with one observation per cell – Experimental error.

UNIT – II   Design of Experiments

Need, Terminology, Randomization, Replication and Local Control Techniques – Size of experimental unit – Methods of determination of experimental units – Completely Randomized Design (CRD) and its analysis – Randomized Block Design (RBD) and its analysis – Latin Square Design (LSD) and its analysis.

UNIT – III   Post ANOVA Tests

Multiple Range Tests – Newman-Keul's Test, Duncan's Multiple Range Test, Tukey's Test – Transformation – Square root, Angular and Log Transformations.

UNIT – IV   Missing Plot Techniques

Concept of Missing Plot Techniques - Estimation of missing values in RBD and LSD – Least square method of estimating one missing observation in RBD and LSD – Two missing observations in RBD and LSD.

UNIT – V   Factorial Experiments

Main and Interaction Effects – Definitions of contrast and orthogonal contrast – Analysis of 2^2, 2^3 and 3^2 Factorial experiments – Principles of Confounding – Partial and complete confounding in 2^3 and its analysis.

Reference Books:

1. Das M. N and Giri N. C (1986), Design and Analysis of Experiments, Wiley Eastern, New Delhi.
2. Montgomery, D.C. (2012). Design and analysis of Experiments. John Wiley &Sons, New Delhi.
3. Kapoor V. K and Gupta S. P (1978), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

4. Goon A. M, Gupta M. K and Das Gupta B (1994), Fundamentals of Statistics V-II, The World Press Ltd., Calcutta.

5. Cochran W. G and Cox G. M (1957), Experimental Design, John Wiley & Sons, New York.

6. Fisher R. A (1953), Design and Analysis of Experiments, Oliver and Boyd, London.

7. Dean A and Voss (2006), Design and Analysis of Experiments, Springer, New Delhi.

8. Panneer selvam R (2012), Design and Analysis of Experiments, Prentice Hall.

9. Giri N. C (1986), Analysis of Variance, South Asian Publisher, New Delhi.

10. John P. W. M (1998), Statistical Design and Analysis Experiments, Macmillan Company, New York.

Web Links:

- http://users.stat.umn.edu/~gary/book/fcdae.pdf
- https://www.mi.fu-berlin.de/inf/groups/ag tech/teaching/2012_SS/L_19540_Modeling_and_ Performance_Analysis_with_Simulation/13.pdf
- http://www.stat.tugraz.at/courses/files/DoE.pdf
- https://www3.nd.edu/~jnahas/DoE_I_Experimental_Design_V3.pdf
- https://www.itl.nist.gov/div898/handbook/pmd/section3/pmd31.htm

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
CORE COURSE	IX
PAPER CODE	21UST09
TITLE OF THE PAPER	APPLIED STATISTICS
HOURS/WEEK	5
NO. OF CREDITS	5

Learning Objectives:

- To enable the students to understand index numbers, time series and apply them to various fields.
- To introduce the basic statistical tools in time related variables and economic variables.
- To learn the concepts of time series, evaluation of trend and measurement of seasonal variations by various methods.
- To educate students about the importance of cost of living index numbers in real life problems.
- To acquire knowledge about the applications of statistics in Agriculture, Industries, Ministry and Financial Statistics in India.

Course Outcomes:

The students will be able to:

- Gain knowledge about components of time series and its applications to various fields.
- Understand the concepts of index numbers, optimum tests and their construction.
- Find the sources of time series data and measure secular trend and seasonal variation.
- Predict the future behaviour and to compare the present accomplishment with the past.
- Measure the changes from time to time which enable us to study the general trend of the economic activity.

UNIT – I   Analysis of Time Series

Concept of Time Series - Components of Time Series - Additive and Multiplicative Models – Definitions of Secular Trend, Seasonal Variation, Cyclic Variations and Irregular Fluctuations – Measurement of Trend – Graphic method, Method of Semi-average – Method of Moving averages and Method of least squares - Simple Problems.

UNIT – II   Seasonal Variations

Measurement of Seasonal Variations – Method of Simple Average – Ratio to Moving Average – Ratio to Trend – Link Relative Method – Cyclical Variation – Measurement of Cyclical Variation - Simple Problems.

UNIT – III   Index Numbers

Definition – Types of Index numbers – Problems in the construction of index numbers – Construction of simple index numbers – Simple aggregate method and Simple average of price relatives using A.M, G.M – Construction of weighted index numbers – Laspeyre's, Paasche's, Dorbish Bowley's, Marshall Edge worth and Fisher's ideal index numbers - Simple problems. Tests of adequacy of a good index numbers – Time Reversal Test, Factor Reversal Test – Uses of index numbers.

UNIT – IV   Cost of Living Index Number

Cost of living index number: Methods for Construction of Cost of living index number – Aggregate method – Family budget method – Uses of cost of living index number – Fixed Base Index numbers and Chain Base Index numbers – Conversion of F.B.I to C.B.I and C.B.I to F.B.I - Simple Problems.

UNIT – V   Official Statistics

Present Official Statistical Systems in India – Ministry of Statistics and Programme Implementation - NSSO, CSO and their functions - Registration of vital events – National Income Statistics – Agricultural Statistics.

Reference Books:

1. Goon A. M, Gupta M. K and Das Gupta B (1994), Fundamentals of Statistics V-II, The World Press Ltd., Calcutta.

2. Kapoor V. K and Gupta S. P (1978), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

3. Gupta S. P (1995), Statistical Methods, Sultan Chand & Sons, New Delhi.

4. Gupta S. P (1995), Indian Statistics, Sultan Chand & Sons, New Delhi.

5. Croxton F. E and Cowdon D. J, (1973), Applied General Statistics, Prentice Hall.

6. Mukhopadhyay P (1999, Applied Statistics, New Central Book Agency Private Ltd, Calcutta.

7. Agarwal B. L (1988), Basic Statistics, Wiley Eastern Ltd. New Delhi.

8. Kendall M. G and Stuart A, The advanced theory of Statistics, (Vol III) Charles Criffin.

9. Saluja M. R (2017), Indian Official statistical System, Publication of Indian Econometric Society.

10. Central Statistical Organisation (1979), Guide to Official Statistics, Department of Statistics, Ministry of Planning, India.

Web Links:

➢ https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm

➢ https://stat.ethz.ch/education/semesters/ss2015/atsa/ATSA_Scriptum_v1_SS15.pdf

➢ https://www.civilserviceindia.com/subject/Management/notes/index-numbers.html

➢ https://thefactfactor.com/facts/management/statistics/index-number/1576/

➢ https://www.undp.org/content/dam/india/docs/human-development/Introduction%20to% 20Indian%20Statistical%20System.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
CORE ELECTIVE	III
PAPER CODE	21USTE03
TITLE OF THE PAPER	OPERATIONS RESEARCH – II
HOURS/WEEK	4
NO. OF CREDITS	4

Learning Objectives:

➢ To enable the students to gain knowledge about various decision techniques.

➢ To learn Pure Strategic and mixed Strategic game methods for solving game theory problems.

➢ To acquire knowledge in various techniques of network planning.

➢ To understand the methods of analysing replacement problems.

➢ To impart the applications of operations research in management.

Course Outcomes:

Students will be able to:

- ➢ Take appropriate decisions for solving the problems of game theory.
- ➢ Solve the problems based on deterministic inventory model.
- ➢ Apply PERT and CPM techniques in research and construction projects.
- ➢ Know the decision making environments and methods.
- ➢ Know various O.R. techniques and to apply them in real life problems.

UNIT – I   Game Theory

Basic definitions – Two person's zero sum games – Pure strategic game – Maximin and Minimax Principles – Mixed strategic game – Dominance property – Graphical solutions of 2 x n and n x 2 games.

UNIT – II   Network Analysis

Network Analysis – Basic concepts – Construction of Network – Time calculations – Critical Path Method (CPM) – Program Evaluation Review Technique (PERT) – Finding optimum project duration and cost consideration in project scheduling.

UNIT – III   Replacement Problems

Replacement policy of items whose maintenance cost increases with time and the value of money remains constant – Replacement policy of items whose maintenance cost increases with time and the value of money also changes with time – Replacement of items that fail completely – Group replacement policy.

UNIT – IV   Inventory Control

Concept of Inventory Model – Types of Inventories – Inventory decisions – Costs associated with inventories – Inventory models – Factors affecting inventory control – Deterministic inventory problems with no shortages and shortages.

UNIT – V   Decision Theory

Introduction – Types of decision making environment – Decision making under uncertainty – Maximin criterion, Maximax criterion, Minimax criterion, Laplace criterion and Hurwitz criterion – Decision making under risk – EMV, EOL and EVPI – Decision tree analysis .

Reference Books:

1. Kanti Swarup, Gupta P. K, Man Mohan (1980), Operations Research, Sultan Chand and sons, New Delhi.

2. Sharma J. K (2001), Operations Research Theory and Applications, MacMillan and Company,

New Delhi.

3. Nita H. Shah, Ravi M. Gor, Hardik Soni (2010), Operations Research, PHI Learning Private Limited, New Delhi.

4. Dr. B. S. Goel & Dr. S. K. Mittal, Operations Research, Pragathi Prakasam Publishers.

5. Sharma J.K. (2013), Operations Research Problems and Solutions, (Fifth Edition) Macmillan India Ltd.

6. Taha H.A (2011), Operations Research: An Introduction, Ninth Edition, Prentice Hall Publishing Company.

7. Philips D. T, Ravindran A and Solberg J. J, Operations Research – Principles and Practice, John Wiley, India.

8. Hillier F. S and Lieberman G. J (1987), Operations Research, CBS Publishers and Distributors, New Delhi.

9. Gupta R. K (1985), Operations Research, Krishna Prakashan, Mandir Meerut.

10. Gupta, P.K., and Man Mohan. (1979). Operations Research: Linear Programming and Theory of Games, Third Edition, Sultan Chand and Sons, New Delhi.

Web Links:

➢ https://www.cs.umd.edu/~nau/cmsc421/game-theory.pdf

➢ http://www.yorku.ca/ptryfos/ch3000.pdf

➢ https://www.tradegecko.com/inventory-management/inventory-control

➢ http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=90027

➢ http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=90038

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
CORE ELECTIVE	IV
PAPER CODE	21USTE04
TITLE OF THE PAPER	ACTUARIAL STATISTICS
HOURS/WEEK	5
NO. OF CREDITS	4

Learning Objectives:

➢ To impart the basic concepts in actuarial studies and enable the students to get the career in insurance companies.

➢ To understand the methodologies of computing the present value and accumulated values of an annuity and the methods of loan redemption.

➢ To enable the students to know the principles of insurance and basic features of various types of assurance and the concept of mortality and construction of life tables.

Course Outcomes:

Students will be able to

- ➢ Explain the concept of probability and describe and derive the different types of annuities.
- ➢ Derive formula from different types of perpetuity and redemption of loans by uniform yearly payment and sinking fund.
- ➢ Understand the methods of computing assurance benefits and premiums of various insurance plans and to apply the various methods in framing mortality tables.

UNIT – I   Basic Concepts

Present value and accumulated value at fixed rate and varying rates of interest – Effective rate of interest corresponding to a nominal rate of interest and vice-versa – Simple problems – Annuity – Types of Annuities - Derivation of the formula for present values of immediate annuity a_{n1} and annuity due a_{n1}, accumulated values of immediate annuity S_{n1} and annuity due S_{n1}.

UNIT – II   Annuity and Sinking Fund

Derivation of the formula for present value of immediate annuity payable p times a year, Present Value of annuity due payable p times a year, accumulated value of immediate annuity payable p times a year, accumulated value of annuity due payable p times a year – Redemption of loan by uniform early payment – Definitions of sinking fund – Redemption of loan by a sinking fund (uniform early payment).

UNIT – III   Mortality Table

Definition - Uses – Mentioning the types and the construction of a mortality table – Complete and incomplete mortality table – Computing the probabilities of survival and death using LIC (1970-1973) Mortality table - Defining expectation of life, complete expectation of life and central death rate.

UNIT – IV   Insurance and Assurance

Principles of Insurance – Assurance – Types of assurance – Pure endowment assurance, Endowment assurance, Term assurance, Whole life assurance, Double endowment assurance, Increasing temporary and whole life assurance – Commutation functions D_x , C_x , M_x and R_x expression for present values of assurance benefits and simple problems.

UNIT – V   Premium

Definitions of premium, natural premium level, annual premium, net premium and office premium – Expressions for level annual premium under temporary assurance, pure endowment assurance, Endowment assurance and whole life assurance plans – Simple problem involving the calculations of level annual present annual premium, office premium and the four types of plans only.

Reference Books:

1. Mathematical Basis of Life Assurance (IC-81), Published by Insurance Institute of India, Bombay.

2. Donald D. W. A (1975), Compound Interest and Annuities Certain, Heinemann, London.

3. Frank Ayres J. R (1983), Theory and Problems of Mathematics of Finance, Schaum's Outline Series, McGraw Hill Book Company, Singapore.

4. Mc Cutcheon J. J and Scott (1989), Mathematics of Finance, Heinemann, London.

5. Neill A (1977), Life Contingencies, Heinemann, London.

6. Benjamin and Pollard J. H (1980), Analysis of Mortality and other Actuarial Statistics, Second Edition, Heinemann, London.

7. Gupta, S. C and Kapoor, V. K (2001), Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.

8. Shaillaja R Deshmuk (2009), Actuarial Statistics an Introduction using R, University Press, India.

9. Dale S Borowiak and Arnold F Shapiro, Financial and Actuarial Statistics: An Introduction (Second Edition), CRC Press.

10. Charles L. Trowbridge (1989), Fundamental Concepts of Actuarial Science, Actuarial Education.

Web Links:

- https://www.math.umd.edu/~slud/s470/BookChaps/01Book.pdf
- https://www.actuariayfinanzas.net/images/sampledata/Conceptos-fundamentales-de-la-Ciencia-Actuarial.pdf
- https://previa.uclm.es/profesorado/fjareno/DOCS/Springer.pdf
- https://www.actuariayfinanzas.net/images/sampledata/FundamentalsofActuarialMathematics_S.DavidPromislow2015.pdf
- https://www.iwu.edu/math/IntroductionToActuarialScience_DerekEngland.pdf

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
CORE PRACTICAL	III (Based on Core Theory V, VI and VIII)
PAPER CODE	21USTP03
TITLE OF THE PAPER	CORE PRACTICAL – III
HOURS/WEEK	3
NO. OF CREDITS	3

Learning Objectives:

- To enable the students to gain practical knowledge of test of significance in large and small samples.

- To provide practical application of hypothesis testing based on single sample and two samples, using averages and proportions.

- To acquire practical knowledge in analysis of variance and factorial experiments.

Course Outcomes:

The Students will be able to:

➢ Gets a clear understanding of tests of hypothesis about population parameters using sample statistic and draw appropriate conclusions.

➢ Apply the theoretical concepts and solve the problems based on one missing observation and two missing observations in RBD and LSD.

➢ Analyse and interpret data for 2^2 and 2^3 factorial experiments by using Yates Algorithm.

UNIT – I   Test of Significance for Large sample

Large Sample test for single mean and proportion – Difference of two means and proportions.

UNIT – II   Test of Significance for Small sample

Student t - test for Single mean, Difference between two means, Paired t – test , F - test for equality of two variances – Chi square test for independence of attributes - Confidence intervals for mean and variance.

UNIT – III   Analysis of Variance

Analysis of variance for one-way and two-way classifications – Analysis of Completely Randomized Design (CRD), Randomized block design (RBD) and Latin Square Design (LSD).

UNIT – IV   Missing plot techniques

Estimation of one missing observation and two missing observations in RBD and LSD

UNIT – V   Factorial experiments

Analysis of 2^2 and 2^3 factorial experiments using Yates algorithm – Analysis of 3^2 factorial experiments.

Note:

Question Paper Setting:

5 questions are to be set without omitting any unit. All questions carry equal marks.

Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	**60 Marks**

CIA (Including Practical Record)	40 Marks
Total	100 Marks

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
CORE PRACTICAL	IV
PAPEER CODE	21USTP04
TITLE OF THE PAPER	CORE PRACTICAL – IV
HOURS/WEEK	3
NO. OF CREDITS	3

Learning Objectives:

➢ To gain the practical knowledge of time series analysis and index numbers.

➢ To provide practical applications in construction of control charts of variables and attributes.

➢ To enable the students to apply the techniques of SQC in industries for manufacturing goods of high quality at low cost.

Course Outcomes:

The Students will be able to:

➢ Draw $\bar{X}$ R and σ control charts for variables and p, np and c charts for attributes to interpret them.

➢ Know about the practical applications of acceptance sampling plan of attributes and construct OC, AOQ, ASN and ATI curves for single sampling plan and double sampling plan.

➢ Understand the basic concepts of Index number, time series data and their construction and applications in various fields.

Unit – I   Construction of Control Charts for Variables and Attributes

Control Charts for Variables: $\bar{X}$ R and σ control charts – Control Charts for Attributes: p, np and c charts.

Unit – II   Acceptance Sampling Plan for Attributes

Construction of OC, AOQ, ASN and ATI curves for Single sampling plan and Double sampling plan.

Unit – III   Time Series

Estimation of trend by moving averages – Least square methods – First degree and Second degree polynomials – Computation of quarterly and monthly trends.

Unit – IV   Time Series

Estimation of seasonal indices by simple average method – Ratio-to-trend, ratio-to-moving average and Link relative methods.

Unit – V   Index Numbers

Estimation of weighted index number by Laspeyre's, Paache's, Fisher's, Marshall and Edge worth, Dorbish and Bowley's methods – Time reversal test and Factor reversal test – Cost of living index number by aggregate expenditure and family budget method.

Note:

Question Paper Setting:

5 questions are to be set without omitting any unit. All questions carry equal marks.

Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	60 Marks
CIA (Including Practical Record)	40 Marks
Total	100 Marks

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
SBEC	III
PAPER CODE	21USTS03
TITLE OF THE PAPER	STATISTICAL DATA ANALYSIS USING 'EXCEL'
HOURS/WEEK	3
NO. OF CREDITS	3

Learning objectives:

- To perform the statistical analysis with MS-Excel software.
- To develop the data processing skill in MS-Excel.
- To develop the data analysis and data visualization skill.
- To understand EXCEL and its roles in problem solving.

> To learn the basic statistical software which will help the students to switch over to any other statistical software easily in future.

Course Outcomes:

The student will be able to:

> Create the data base in Excel sheets.

> Compute the statistical measures.

> Perform the statistical analysis and interpret the results

> Understand data handling and its analysis.

> Understand logical functions, text functions and statistical Functions

UNIT I   Introduction to MS Excel

MS Excel options – Ribbon - Sheets - Saving Excel file as PDF, CSV and older versions - Using Excel Shortcuts - Copy, Cut, Paste, Hide, Unhide, and Link the data in rows, columns and sheet - Using paste special options - Formatting cells, rows, columns and sheets - Protecting and Unprotecting cells, rows, columns and sheets with or without password - Page layout and printer properties.

UNIT II   Functions and Charts

Logical functions - Date and Time functions - Information functions – Statistical functions - Text functions

UNIT III   Creating Graphs in EXCEL

Charts: Simple Bar Chart – Multiple Bar Chart – Subdivided Bar Chart – Pie Chart – Donut Chart - Line Chart – Histogram – Scatter Plot.

UNIT IV   Statistical Measures

Descriptive statistics: min, max - Measures of Central Tendency -   Partition values - Measures of Dispersion - Skewness and Kurtosis – Correlation coefficient and Linear regression.

UNIT V   Statistical Inference

Testing of Hypothesis - Large sample test - z-test - Compute p-values - Small sample tests - t-test, Paired t test, F-test, Chi-square test of independence and Goodness of fit.

Books for Reference:

1. Curtis D. Frye, Microsoft Excel 2016 Step by Step, Microsoft Press, Washington.

2. Bernd Held, Microsoft Excel Functions and Formulas, Word Ware Publishing, Inc. US.

3. Wayne L. Winston Redmond, Microsoft Excel 2010 Data Analysis and Business Modelling, Microsoft Press, Washington.

4. Andrei Besedin, 150 Most Powerful Excel Shortcuts: Secrets of Saving Time with MS Excel, Andrei Besedin Via Publish Drive.

5. Davinder Singh Minhas, All You Wanted to Know About Creating Worksheet Using MS Excel, New Dawn, An Imprint of Sterling Publishers (P) Ltd, New Delhi.

6. Conrad Carlberg, Statistical Analysis: Microsoft Excel 2016, Que Publishing, India.

7. Apte D P, Statistical Tools for Managers (using MS EXCEL), published by Anurag Jain for Excel Books, New Delhi.

8. Thomas J. Quirk, Excel 2013 for Business Statistics: A Guide to Solving Practical Business, Springer, New York.

9. Mark Harmon, Practical and Clear Graduate Statistics in Excel - The Excel Statistical Master, Mark Harmon Publishing.

10. Hansa Lysander Manohar, Data Analysis and Business Modelling Using Microsoft Excel, PHI Learning Private Limited, New Delhi.

Web Links:

➤ http://www.bikeprof.com/uploads/9/0/6/5/9065192/excel_stats_handout_npl.pdf

➤ https://www.digitalvidya.com/blog/using-excel-for-statistical-analysis/

➤ http://home.ubalt.edu/ntsbarsh/excel/excel.htm

➤ https://www.excel-easy.com/examples/column-chart.html

➤ https://www.wallstreetmojo.com/percentile-rank-formula/

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	B.Sc. STATISTICS
SEMESTER	VI
SBEC	IV
PAPER CODE	21USTS04
TITLE OF THE PAPER	STATISTICAL DATA ANALYSIS USING 'R' PROGRAMMING
HOURS/WEEK	3
NO. OF CREDITS	3

Learning Objective:

➤ This course will review and expand the core topics of statistics and to initiate the beneficiaries of R in statistical computing.

- To impart knowledge about efficient data handling techniques, the practice of graphical interpretation and the Statistical inference by using `R'.
- To equip the students with the statistical programming skills based on real life examples and data sets

Course Outcomes:

The students will be able to:

- Understand the preliminaries about R language.
- Write R programs for statistical tools.
- Understand the data and Write R programs for sampling distribution.
- Test the hypothesis, p-value and confidence interval.
- Understand and draw inferential conclusion by using data.

UNIT I   Introduction to R

Overview of R environment – R Editor – work space – R as a calculator - statistical software and a programming language - R preliminaries - getting help, data inputting methods (direct and importing from other spread Sheet applications like Excel), data accessing and indexing, Graphics in R, built in functions, saving, storing and retrieving work.

UNIT II   Diagrams and Graphs

Bar diagram – Pie diagram - Plot a graph - Histograms – Frequency polygon – Ogive curves .

UNIT III   Descriptive Statistics

Measures of central tendency, Partition values, Measures of dispersion – Skewness and Kurtosis.

UNIT IV   Statistical inference

Testing of Hypothesis - Large sample test- z-test – Compute p-values - Small sample tests - t-test, Paired t test, F-test, Chi-square test of independence and Goodness of fit.

UNIT V   Analysis of Variance, Correlation and Regression

One-way ANOVA and Two- way ANOVA - Simple Correlation - Linear Regression

Reference Books:

1. Gardener M (2012), Beginning R: The Statistical Programming Language, Wiley Publications.
2. Garrett Grolemund, Hands -On programming with R, O'Reilly Media Publications.

3. Norman Matloff, The Art of R programming by Norman, No Starch Press, US.

4. Hadley Wickham, R Packages: Organize Test, Document, and Share Your Code, Shroff/O'Reilly Publications.

5. Peter Dalgaard, Introductory Statistics with R , Springer Publications.

6. Andy Field, Discovering Statistics Using R, SAGE Publications Ltd.

7. Joseph Schmuller, Statistical Analysis with R For Dummies, Wiley, US.

8. Robert Stinerock, Statistics with R: A Beginner's Guide, SAGE Publications Ltd, UK.

9. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, Publications.

10. John Braun R. W and Duncan J. Murdoch, Cambridge (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York.

Web Links:.

➢ https://www.coursera.org/course/statistics

➢ https://www.coursera.org/course/stats1

➢ https://www.coursera.org/course/compdata

➢ https://learningstatisticswithr.com/

➢ https://www.statmethods.net/stats/index.html

ALLIED COURSE OFFERED BY UG STATISTICS BOARD (OBE PATTERN)

(For the candidates admitted from 2021 – 2022 onwards)

Statistics Professors should handle the subjects and valuation of papers should be done only by Statistics Board. For University Practical Examinations both Internal and External Examiners should be appointed from Statistics Department.

S.N	COURSE	SEM	PAPER CODE	TITLE OF THE PAPER
1	B.Sc. Mathematics / B.Sc. Mathematics (CA)	I or III		MATHEMATICAL STATISTICS
2		II or IV		INFERENTIAL STATISTICS

3		Paper I & II		ALLIED STATISTICS PRACTICAL
4	B.Sc. (CS)/B.Sc. (IS)/ B.C.A	I or III		STATISTICAL METHODS AND THEIR APPLICATIONS – I
5		II or IV		STATISTICAL METHODS AND THEIR APPLICATIONS – II
6		Paper I & II		ALLIED STATISTICS PRACTICAL
7	B.Sc. (Geography)	III		STATISTICAL METHODS – I
8		IV		STATISTICAL METHODS – II
9		Paper I & II		ALLIED STATISTICS PRACTICAL
10	B.Sc. (BT)/(BC)	III		BIO-STATISTICS
11	B.Com/B.Com (CA)/B.Com (CS)	III		BUSINESS STATISTICS – I
12		IV		BUSINESS STATISTICS – II
13	B.A (Economics)	III		STATISTICAL METHODS FOR ECONOMICS
14		IV		APPLIED STATISTICS FOR ECONOMICS
15	B.B.A/B.B.A (Retail Management)	I		BUSINESS MATHEMATICS AND STATISTICS – I
16	B.B.A (CA)/ B.B.A (International Business)	II		BUSINESS MATHEMATICS AND STATISTICS – II

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Mathematics/B.Sc. Mathematics (CA)
SEMESTER	I or III/II or IV
ALLIED THEORY	PAPER – I
PAPER CODE	
TITLE OF THE PAPER	MATHEMATICAL STATISTICS

Course Objectives:

- ➤ To introduce the basic concepts of probability theory, random variables, probability distributions.
- ➤ To introduce the statistical concepts and develop analytical skills.

Course Outcomes:

The students will be able to:

➢ Understand the random experiment and axioms of probability in real life situations.

➢ Compute Bernoulli trails and understand the rare case population.

➢ Learn the usage of central tendencies, dispersion and skewness.

➢ Obtain the relationship between two random variables.

UNIT – I   Probability, Random Variable and Mathematical Expectation

Definitions – Addition and Multiplication Theorem of Probability – Conditional probability – Random variable (discrete and continuous) – Distribution functions – Marginal and Conditional Distributions – Mathematical Expectation – Moment generating function - Characteristic function (concept only) – Tchebychev's inequality - Simple Problems.

UNIT – II   Discrete and Continuous Distributions

Binomial and Poisson Distributions – Derivations – Properties and Applications - Simple Problems – Normal distribution – Derivations – Properties and Applications - Simple Problems.

UNIT – III Measures of Central Tendency, Measures of Dispersion and Skewness

Definitions – Mean , Median , Mode , Geometric mean , Harmonic mean – Merits and demerits – Range , Quartile deviation , Mean deviation and their coefficients - Standard deviation – Co-efficient of Variation - Merits and demerits – Measure of Skewness – Karl Pearson's and Bowley's Coefficient of Skewness.

UNIT – IV Curve Fitting

Method of least square – Fitting of a straight line and second degree Parabola, Fitting of Power Curve and Exponential Curves – Simple Problems.

UNIT – V   Correlation and Regression

Definition – Types and methods of measuring correlation – Scatter diagram , Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient - Regression lines - Regression coefficients – Properties – Regression equations .

Books for Reference:

1. Gupta S. C and Kapoor V. K (2004), Fundamentals of Mathematical Statistics, (11th edition), Sultan Chand & Sons, New Delhi.

2. Gupta. S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.

3. Sancheti D. C and Kapoor V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.

4. Robert V. Hogg, Allen T. Craig, Joseph W. McKean , Introduction to mathematical statistics, Pearson Education.

5. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

6. Marek Fisz, Probability theory and Mathematical Statistics, John Wiley and Sons.

7. Rohatgi V. K, An Introduction to Probability theory and Mathematical Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

8. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

9. Vittal P. R, Mathematical Statistics, Margham Publications, Chennai.

10. Hoel P. G, Introduction to Mathematical Statistics, Asia Publishing House, New Delhi.

Web Links:

- https://seeing-theory.brown.edu/probability-distributions/index.html
- https://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/9557
- https://www.stat.berkeley.edu/~stark/SticiGui/Text/location.htm
- https://www.originlab.com/index.aspx?go=Products/Origin/DataAnalysis/CurveFitting
- https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Mathematics/B.Sc. Mathematics (CA)
SEMESTER	I or III/II or IV
ALLIED THEORY	PAPER – II
PAPER CODE	
TITLE OF THE PAPER	INFERENTIAL STATISTICS

Learning Objectives:

- To equip students with theoretical knowledge for estimating unknown parameters.
- To introduce the concepts of testing of hypothesis, significance and chi-square test.

Course Outcomes:

The students will be able to:

- Know the importance of good estimators, maximum likelihood estimator, types of estimation, Cramer Rao inequality.
- Know the importance of statistical hypothesis, large samples and small samples.

UNIT – I   Point Estimation

Population and Sample – Parameter and Statistic – Point Estimation – Consistency – Unbiasedness – Efficiency (Cramer – Rao inequality) and Sufficiency (Rao – Blackwell Theorem).

UNIT – II   Methods of Estimation and Interval Estimation

Maximum likelihood Estimator (MLE) and Methods of Moments – Properties of these estimators – Interval estimation (concept only).

UNIT – III   Test of Significance

Concept of Statistical Hypothesis – Simple and Composite Hypothesis – Null and Alternative Hypothesis – Critical region – Type I and Type II Errors – Power of a test – Neyman-Pearson Lemma.

UNIT – IV   Test of Significance (Large Sample Tests)

Sampling distribution – Standard error – Large sample tests with regard to Mean, Difference of Means, Proportions and Difference of Proportions – Simple Problems.

UNIT – V   Test of Significance (Small Sample Tests)

Exact sample test based on 't' and F   Distributions with regard to Means, Variance and Correlation coefficient – Chi-square test , Goodness of fit and independence of attributes.

Books for Reference:

1. Gupta. S. C. and Kapoor. V. K. (2004) – Fundamentals of Mathematical Statistics – (11th Edition), Sultan Chand & Sons, New Delhi.
2. Saxena H.C, Statistical Inference, S. Chand & Company Private Ltd, New Delhi.
3. Goon A M, Gupta M K, Das Gupta B: Fundamentals of Statistics (Vol-I), The World Press Pvt. Ltd., Kolkata.
4. Mood A. M, Graybill F. A and Boes D. C (1983), Introduction to the theory of Statistics, McGraw Hill, New Delhi.

5. Sancheti. D. C. and Kapoor. V. K. Statistics (7th Edition), Sultan Chand & Sons, New Delhi.

6. Snedecor G.W and Cochran W.G., Statistical Methods, Oxford Press and IBH.

7. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

8. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

9. Vittal P. R, Mathematical Statistics, Margham Publications, Chennai.

10. Robert V. Hogg, Elliot A. Tanis, Probability and statistical inference, Macmillan.

Web Links:

➢ http://www.sjsu.edu/faculty/gerstman/StatPrimer/estimation.pdf

➢ https://www.tutorialspoint.com/statistics/

➢ https://www.statisticshowto.datasciencecentral.com/

➢ https://www.investopedia.com/terms/c/chi-square-statistic.asp

➢ http://onlinestatbook.com/2/introduction/inferential.html

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Mathematics/B.Sc. Mathematics (CA)
SEMESTER	I or III/II or IV
ALLIED PRACTICAL	Based on Theory Paper I & II
PAPER CODE	
TITLE OF THE PAPER	ALLIED STATISTICS PRACTICAL

Learning Objectives:

➢ To impart knowledge about the basis of data analysis related to various activities like production, consumption, distribution, bank transactions, insurance and transportation.

Course Outcomes:

The students will be able to:

➢ Acquire practical knowledge through statistical analysis.

UNIT – I   Measures of Central Tendency and Dispersion

Computation of Measures of Central Tendency – Measures of Dispersion (absolute and relative measures) - Coefficient of Skewness.

UNIT – II   Theoretical Distributions

Distributions – Fitting of Binomial distribution, Poisson distributions and Normal distribution – Testing the Goodness of fit.

UNIT – III   Method of Least Square

Curve fitting - Method of least square – Fitting of a straight line $(y = a + bx)$, Second degree parabola $(y = a + bx + cx^2)$, Fitting of Power Curve $(y = ax^b)$ and Exponential Curve   ($y = ae^{bx}$ and $y = ab^x$) – Simple Problems.

UNIT – IV   Correlation and Regression

Computation of Karl Pearson's co-efficient of correlation – Spearman's rank correlation coefficient – Regression equations.

UNIT – V   Large and Small Sample Tests

Large sample tests with regard to Mean, Difference between Means, Proportions and Difference of Proportions.

Small sample tests with regard to Mean, Difference between Means and Paired't' test , F –test, Chi-square test for independence of attributes.

Note:

Question Paper Setting:

5 questions are to be set without omitting any unit. All questions carry equal marks.

Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	**60 Marks**
CIA (Including Practical Record)	**40 Marks**
Total	**100 Marks**

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	**For B.Sc. Computer Science Common for B.Sc. (Information Science) and B.C.A**
SEMESTER	**I or III/II or IV**
ALLIED THEORY	**PAPER – I**
PAPER CODE	
TITLE OF THE PAPER	**STATISTICAL METHODS AND THEIR APPLICATIONS – I**

Learning Objectives:
  ➢ To introduce basic concepts in statistics and develop data reduction techniques.

Course Outcomes:

The students will be able to:

- ➢ Analyse the sample data and its usage in different ways such as locations, dispersion.
- ➢ Understand the relationship between variables and forecasting the future values.
- ➢ Understand the concept of sampling, sampling errors, and types of sampling.

UNIT – I **Collection and Presentation of Statistical Data**

Nature and Scope of Statistics – Limitations – Types of data – Classification and Tabulation of Data – Construction of Frequency Distribution – Diagrammatic and Graphical Representation of Data.

UNIT – II **Measures of Central Tendency**

Mean, Median, Mode, Geometric mean, Harmonic mean – Characteristics of a good average – Merits and demerits.

UNIT – III **Measures of Dispersion**

Range – Quartile deviation – Mean deviation and their coefficients – Standard deviation – Coefficient of variation – Merits and demerits.

UNIT – IV **Correlation and Regression**

Types and Methods for Measuring Correlation - Scatter diagram – Karl Pearson's co-efficient of correlation – Spearman's rank correlation coefficient – Regression equations of two variables –   Simple Problems.

UNIT – V **Probability**

Definition of Probability – Addition and Multiplication Theorems – Conditional probability – Simple Problems.

Books for Reference:

1. Gupta S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Gupta. S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi
3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.

4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.

5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

6. Murthy M. N (1978), Sampling Theory and Methods, Statistical Publishing Society, Kolkata.

7. Pillai R. S. N. And Bagavathi. V. (1987), Practical Statistics, S. Chand & Company Ltd., New Delhi.

8. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

9. Gupta C. B (1978), An Introduction to Statistical Methods, Vikas Publishing House, New Delhi.

10. Snedecor G.W and Cochran W.G., Statistical Methods, Oxford Press and IBH.

Web Links:

- https://www.tutorialspoint.com/statistics/data_collection.htm
- https://www.surveysystem.com/correlation.htm
- https://www.investopedia.com/terms/r/regression.asp
- https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression
- https://course-notes.org/statistics/sampling_theory

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Computer Science (Common for B.Sc. (Information Science) and B.C.A)
SEMESTER	I or III/II or IV
ALLIED THEORY	PAPER – II
PAPER CODE	
TITLE OF THE PAPER	STATISTICAL METHODS AND THEIR APPLICATIONS – II

Learning Objectives:

- To impart statistical concepts with rigorous mathematical treatment.
- To introduce concepts of statistical hypothesis.

Course Outcomes:

The students will be able to:

- ➢ Understand the concept of random variables and expected average.
- ➢ Compute Bernoulli trails and understand the rare case population.
- ➢ Learn the usage of normal curve and curve fitting by using the method of least squares.
- ➢ Learn about the large samples and theory of attributes.

UNIT – I   Random Variable and Mathematical Expectation

Definitions – Random variable – Discrete and Continuous Random variable – Distribution functions and Density function – Mathematical Expectation and its Properties - Simple Problems.

UNIT – I   Discrete Probability Distribution

Binomial and Poisson Distributions – Mean and Variance of Distributions – Recurrence formula – Fitting of Binomial and Poisson Distributions - Simple Problems.

UNIT – III   Continuous Probability Distribution and Curve Fitting

Definition of Normal distribution – Characteristics of Normal distribution (Simple Problems) – Curve fitting – Fitting of Straight line and Second degree Parabola - Simple Problems.

UNIT – IV   Test of Significance (Large Samples Tests)

Concept of Statistical Hypothesis – Simple and Composite Hypothesis – Null and Alternative Hypothesis – Critical region – Type I and Type II Errors – Sampling distribution and Standard Error – Test of Significance: Large Sample Tests for Proportion, Difference of Proportions, Mean and Difference of Means - Simple Problems.

UNIT – V   Test of Significance (Small Samples Tests)

Small sample tests with regard to Mean, Difference between Means and Paired 't' test , F-test - Definition of Chi-square test – Assumptions – Characteristics – Chi-square tests for Goodness of fit and Independence of attributes – Simple Problems.

Books for Reference:

1. Gupta S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Gupta S. C and Kapoor V. K, (2004), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.

4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.

5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

6. Murthy M. N (1978), Sampling Theory and Methods, Statistical Publishing Society, Kolkata.

7. Gupta S. C, Fundamentals of Statistics, Himalaya Publishing House Pvt. Ltd., New Delhi.

8. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

9. Gupta C. B (1978), An Introduction to Statistical Methods, Vikas Publishing House, New Delhi.

10. Snedecor G.W and Cochran W.G., Statistical Methods, Oxford Press and IBH.

Web Links:

- https://www.tutorialspoint.com/statistics/data_collection.htm
- https://seeing-theory.brown.edu/probability-distributions/index.html
- https://statisticsbyjim.com/regression/curve-fitting-linear-nonlinear-regression/
- https://www.investopedia.com/terms/c/chi-square-statistic.asp
- http://onlinestatbook.com/2/introduction/inferential.html

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Computer Science (Common for B.Sc. (Information Science) and B.C.A
SEMESTER	I or III/II or IV
ALLIED PRACTICAL	Based on Theory Paper I & II
PAPER CODE	
TITLE OF THE PAPER	ALLIED STATISTICS PRACTICAL

Learning Objectives:

- To impart knowledge about the basis of data analysis related to various activities like production, consumption, distribution, bank transactions, insurance and transportation.

Course Outcomes:

The students will be able to:

➢ Acquire practical knowledge through statistical analysis.

UNIT – I   Collection and Presentation of Statistical Data

Construction of Uni-variate frequency distribution – Diagrammatic and Graphical Representation of Statistical Data.

UNIT – II   Measures of Central Tendency and Dispersion

Computation of Measures of Central Tendency – Computation of Measures of Dispersion (absolute and relative measures) – Coefficient of Variation.

UNIT – III   Correlation and Regression

Computation of Karl Pearson's Coefficient of Correlation and Spearman's Rank Correlation Coefficient – Regression equations (two variables only).

UNIT – IV Theoretical Distributions and Methods of Least Squares

Fitting of Binomial and Poisson Distributions – Test for Goodness of fit – Fitting of a Straight line $(y = a + bx)$, Second degree Parabola $(y = a + bx + cx^2)$ by the method of least square.

UNIT – V   Large and Small Sample Tests

Large sample tests with regard to Mean(s) and Proportion(s) – Small sample tests with regard to Mean(s) Variance - Chi-square test for independence of attributes.

Note:

Question Paper Setting:

5 questions are to be set without omitting any unit. All questions carry equal marks.

Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	**60 Marks**
CIA (Including Practical Record)	**40 Marks**
Total	**100 Marks**

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	**For B.Sc. Geography**
SEMESTER	**I or III/II or IV**
ALLIED THEORY	**PAPER – I**
PAPER CODE	
TITLE OF THE PAPER	**STATISTICAL METHODS – I**

Learning Objectives:

➢ To introduce basic concepts in Statistics and develop data reduction techniques.

Course Outcomes:

The students will be able to:

- ➢ Analyse the statistical data and its usage in the measures of location and dispersion.
- ➢ Understand the relationship between variables and forecasting the future values.
- ➢ Understand the concept of sampling, sampling errors and types of sampling.

UNIT – I   Collection and Presentation of Statistical Data

Nature and scope of statistical methods – Limitations – Types of data – Classification and tabulation of data – Construction of frequency distribution – Diagrammatic and graphical representation of data.

UNIT – II   Measures of Central Tendency

Definitions – Mean – Median – Mode – Geometric mean – Harmonic mean – Characteristics of a good average – Merits and demerits.

UNIT – III   Measures of Dispersion

Range – Quartile deviation – Mean deviation and their coefficients – Standard deviation – Coefficient of variation – Merits and demerits.

UNIT – IV   Correlation and Regression

Definitions – Types and methods of measuring correlation - Scatter diagram – Karl Pearson's coefficient of correlation – Spearman's rank correlation co-efficient – Regression - Regression equations of two variables – Simple Problems.

UNIT – V   Probability

Definition of probability – Addition and multiplication theorems – Conditional probability   - Simple Problems .

Books for Reference:

1. Gupta S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Gupta. S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi
3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.
5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.
6. Murthy M. N (1978), Sampling Theory and Methods, Statistical Publishing Society, Kolkata.
7. Gupta S. C, Fundamentals of Statistics, Himalaya Publishing House Pvt. Ltd., New Delhi.
8. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

9. Peter A Rogerson, Statistical Methods for Geography, SAGE Publications Ltd., India.

10. Zamir Alvi, Statistical Geography: Methods and Applications, Rawat Publisher, India.

Web Links:

➢ https://www.tutorialspoint.com/statistics/data_collection.htm

➢ https://www.surveysystem.com/correlation.htm

➢ https://www.investopedia.com/terms/r/regression.asp

➢ https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression

➢ https://course-notes.org/statistics/sampling_theory

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Geography
SEMESTER	I or III/II or IV
ALLIED THEORY	PAPER – II
PAPER CODE	
TITLE OF THE PAPER	STATISTICAL METHODS – II

Learning Objectives:

➢ To introduce the concepts of probability theory, statistical hypothesis, chi-square test, analysis of variance and time series analysis.

Course Outcomes:

The students will be able to:

➢ Understand the random experiment and axioms of probability in real life situations.

➢ Understand the sampling distribution, large samples test and theory of attributes.

➢ Learn and understand the difference between one way and two way ANOVA.

➢ Understand the application of business forecasting model with time series analysis.

UNIT – I **Sampling Methods**

Definitions – Sampling methods – Simple, Stratified and Systematic Sampling (concept only) – Merits and demerits – Concept of sampling and Non - Sampling errors.

UNIT – II **Test of Significance (Large sample test)**

Sampling distribution and Standard error – Hypothesis - Types of hypothesis - Types of errors - Test of Significance: Large sample tests for proportion, difference of proportions, mean and difference of means - Simple problems.

UNIT – III **Test of Significance (Small Sample Test)**

Small sample tests with regard to Mean(s) t-test – Chi-square test – Assumptions – Characteristics and its Applications – Chi-square test for independence of attributes - Simple Problems.

UNIT – IV **Analysis of Variance**

F-test – Analysis of Variance (ANOVA) – Test procedure for One way and Two way classifications – Simple Problems.

UNIT – V **Time Series**

Analysis of Time Series – Definition – Components and Uses of Time Series – Measures of Secular trend – Measure of Seasonal variation – Method of Simple average only.

Books for Reference:

1. Gupta S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Gupta. S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi
3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.
5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

6. Murthy M. N (1978), Sampling Theory and Methods, Statistical Publishing Society, Kolkata.

7. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

8. Gupta S. C, Fundamentals of Statistics, Himalaya Publishing House Pvt. Ltd., New Delhi.

9. Desraj, (1976), Sampling Theory, Tata McGraw Hill, New York.(Reprint 1979).

10. Rajagopalan M and Dhanavanthan P (2012), Statistical Inference. PHI Learning Pvt. Ltd., New Delhi.

Web Links:

➢ https://www.tutorialspoint.com/statistics/

➢ https://www.surveysystem.com/correlation.htm

➢ https://www.investopedia.com/terms/c/chi-square-statistic.asp

➢ https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/hypothesis-testing/anova/

➢ https://en.www.inegi.org.mx/

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. (Geography)
SEMESTER	I or III/II or IV
ALLIED PRACTICAL	Based on Theory Paper I & II
PAPER CODE	
TITLE OF THE PAPER	ALLIED STATISTICS PRACTICAL

Learning Objectives:

➢ To impart knowledge about the basis of data analysis related to various activities like production, consumption, distribution, bank transactions, insurance and transportation.

Course Outcomes:

The students will be able to:

➢ Acquire practical knowledge through statistical analysis.

UNIT – I   Collection and Presentation of Statistical Data

Construction of Univariate Frequency Distribution – Diagrammatic and Graphical Representation of Statistical Data.

UNIT – II Measures of Central Tendency and Dispersion

Computation of Measures of Central Tendency – Computation of Measures of Dispersion (absolute and relative measures) – Coefficient of Variation.

UNIT – III Correlation and Regression

Computation of Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient – Regression equations (two variables only).

UNIT – IV Large and Small Sample Tests

Large sample tests with regard to Mean(s), Proportion(s) – Small sample tests with regard to Mean(s) and variance - Chi-square test for independence attributes.

UNIT – V   ANOVA and Time Series

ANOVA for One way and Two way classification – Measures of Secular Trend: Method of least square - Measure of Seasonal variation: Method of Simple average.

Note:

Question Paper Setting:

5 questions are to be set without omitting any unit. All questions carry equal marks.

Any 3 questions are to be answered in 3 hours duration.

Examinations	Distribution of Marks
University Examinations (Written Practical)	**60 Marks**
CIA (Including Practical Record)	**40 Marks**
Total	**100 Marks**

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Sc. Bio-technology and Bio-Chemistry
SEMESTER	III
ALLIED THEORY	PAPER – I
PAPER CODE	
TITLE OF THE PAPER	BIO–STATISTICS

Learning Objectives:

➢ To introduce the applications of statistics in Bio-Technology, Bio-Chemistry and Microbiology.

Course Outcomes:

The students will be able to:

➢ Understand and apply the statistical methods like measures of location, dispersion and the relationship between two variables in bio-statistics.

➢ Understand large and small samples in laboratory study to apply it in real life problems.

UNIT – I   Collection and Presentation of Statistical Data

Biostatistics – Definition – Types of data – Primary and secondary data – Methods of Collection of data – Sources of data in life science – Limitations and Uses of Statistics – Classification and Tabulation of data – Diagrammatic and Graphical representation of data.

UNIT – II   Measures of Central Tendency

Definitions – Mean – Median – Mode – Geometric mean – Harmonic mean – Characteristics of a good average – Merits and demerits.

UNIT – III   Measures of Dispersion

Range – Quartile deviation – Mean deviation and their co-efficients – Standard deviation – Co-efficient of variation – Merits and demerits.

UNIT – IV   Correlation and Regression

Definitions – Types and Methods of Correlation –Karl Pearson's coefficient of correlation – Spearman's Rank correlation coefficient – Regression: Simple regression equations (two variables) – Simple Problems.

UNIT – V   Test of Significance

Sampling distribution - Standard error – Test of Hypothesis: Simple hypothesis, Null hypothesis and Alternative Hypothesis – Test of significance: Large sample tests based on Mean, Differences of Means, Proportion and Difference of Proportions - Small sample test based on Mean, Difference of Means, Paired 't' test - F-test - Chi-square test.

Books for Reference:

1. Gupta S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
3. P.S.S. Sundar Rao, J. Richard (2012). Introduction to Bio-Statistics and Research methods, Prentice Hall of India Pvt Ltd, New Delhi.
4. Gurumani. N (2005), An introduction to Bio-Statistics, 2nd Revised Edition, MJP Publishers.
5. Daniel. W. W, (1987), Bio-Statistics, John Wiley and Sons, New York.
6. Beth Dawson, Robert G Trapp (2004), Basic and Clinical Biostatistics, McGraw Hill, New Delhi.
7. Zar J, Bio Statistical Analysis, Prentice Hall, India.
8. Bernard Rosner, Fundamentals of Biostatistics, (8th edition), Cengage Learning, USA.

9. Rossi R. J (2010), Applied Biostatistics for Health Science, John Wiley, New York.

10. Rao C. R, Advanced Statistical Methods in Biometric Research, John Wiley, New York.

Web links:

➢ https://faculty.franklin.uga.edu/dhall/sites/faculty.franklin.uga.edu.dhall/files/lec1.pdf

➢ https://www.tutorialspoint.com/statistics/

➢ http://www.stat.yale.edu/Courses/1997-98/101/sigtest.htm

➢ http://biostat.jhsph.edu/~jleek/teaching/2011/754/lecture1.pdf

➢ http://homepage.divms.uiowa.edu/~dzimmer/applied-multivariate/lecturenotesold.pdf

Note: The question paper 50% theory and 50% problems to be considered.

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Com/B.Com (CA)/B.Com(CS)
SEMESTER	III
ALLIED THEORY	PAPER – I
PAPER CODE	
TITLE OF THE PAPER	BUSINESS STATISTICS – I

Learning Objectives:

➢ To expose and familiarize the students with basic concepts of business statistics.

Course Outcome

The students will be able to:

- ➢ Understand the usage of central tendencies, dispersion and skewness.
- ➢ Study the relationship between two variables.
- ➢ Understand economic statistics and compute the different types of index numbers.
- ➢ Understand the chorological data in business.

UNIT – I **Collection, Presentation of Data and Measures of Central Tendency**

Introduction – Types of data – Classification and Tabulation of Statistical data – Definitions – Mean – Median – Mode – Geometric mean - Harmonic mean - Combined mean.

UNIT – II **Measures of Dispersion**

Definitions – Range - Quartile deviation - Mean deviation and their co-efficients – Standard deviation and Coefficient o f variation - Measure of skewness – Karl Pearson's and Bowley's Coefficient of Skewness.

UNIT – III **Correlation and Regression**

Definitions – Types and measures of correlation – Scatter diagram - Karl Pearson's coefficient of correlation – Spearman's rank correlation co efficient – Regression analysis - Regression lines and Regression equations.

UNIT – IV **Index Numbers**

Index Numbers – Definition and Uses of Index Numbers – Construction of Index Numbers – Simple and Weighted Index Numbers – Time Reversal and Factor Reversal Tests – Fixed and Chain Base Index – Cost of living index numbers.

UNIT – V **Time Series**

Analysis of Time Series – Definition – Components and Uses of Time Series – Measures of Secular Trend - Measure of Seasonal Variation – Method of Simple average only.

Books for Reference:

1. Gupta. S. P & Gupta. M. P, Business Statistics,. Sultan Chand & Sons, New Delhi
2. Pillai. R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
3. Sancheti. D. C. and Kapoor. V. K, Statistics – Theory, Methods & Applications, Sultan Chand & Sons, New Delhi.

4. Kapoor. V. K, Fundamentals of Statistics for Business and Economics, Sultan Chand & Sons, New Delhi

5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

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10. Kamat B. C, Business Statistics, Vikram publishers' Pvt Ltd, Andhra Pradesh, India.

Web Links:

➢ https://www.tutorialspoint.com/statistics/

➢ https://www.surveysystem.com/correlation.htm

➢ https://www.investopedia.com/terms/r/regression.asp

➢ https://www.academia.edu/2191454/Chapter5_Index_number

➢ https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.Com/B.Com (CA) /B.Com(CS)
SEMESTER	IV
ALLIED THEORY	PAPER – II
PAPER CODE	
TITLE OF THE PAPER	BUSINESS STATISTICS – II

Learning Objectives:

➢ To impart the basic concepts of mathematics and statistical decision techniques.

Course Outcomes:

The students will be able to:

- ➢ Explore and understand the concept of matrix and numerical methods.
- ➢ Understand random experiment and axioms of probability in real life situations.
- ➢ Know the role and importance of LPP, transportation and assignment problems in a company.

UNIT – I   Matrix

Definitions – Operation on Matrices – Determinant of Matrix – Inverse of a Matrix – Solving of linear equations – Matrix inverse method and Cramer's rule.

UNIT – II   Sequence, Series and Interpolation

Sequence and Series – Arithmetic Progression and Geometric Progression – Interpolation - Binomial Expansion Method, Newton's Forward and Backward Method and Lagrange's Method.

UNIT – III   Probability

Definition of Probability – Addition and Multiplication Theorems – Conditional Probability – Simple Problems.

UNIT – IV   Nature of OR and LPP

Definition of OR – Nature of OR – Uses of OR – Linear Programming Problem – Formation of LPP – Solution to LPP - Graphical method – Simplex method (two variables only).

UNIT – V   Transportation and Assignment Problem Transportation Problem – Initial Basic Feasible Solution – North West Corner Method – Least Cost Method – Vogel's Approximation Method – Assignment Problem – Balanced and Unbalanced Assignment Problem - Hungarian Method.

Books for Reference:

1. Gupta. S. P, Gupta. P.K, Manmohan, Elements of Business Statistics and Operation Research, Sultan Chand & Sons, New Delhi.
2. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Sons,
3. P.A. Navanithan (2007), Business Statistics, Jai Publishers, Trichy.
4. Pillai. R. S. N. and Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
5. Sancheti. D. C. and Kapoor. V. K, Statistics – Theory, Methods & Applications, Sultan Chand & Sons, New Delhi.
6. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

7. Vittal P. R, Business Statistics, Margham Publications, Chennai.

8. Kapoor V. K, Problems and Solutions in Operations Research, S. Chand & Company Ltd., New Delhi.

9. Sharma A. K, Text Book of Linear Programming I, Discovery Publishing House , New Delhi.

10. Dr. H. Premraj, Elements of Operations Research, Margham Publications, Chennai.

Web Links:

➢ https://www.maths.ed.ac.uk/~v1ranick/papers/matrices.pdf

➢ http://www.cimt.org.uk/projects/mepres/alevel/fpure_ch6.pdf

➢ https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/amsbook.mac.pdf

➢ http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf

➢ http://www.maths.unp.ac.za/coursework/MATH331/2012/transportation_assignment.pdf

Note: The question paper 20% theory and 80% problems to be considered.

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.A (Economics)
SEMESTER	III
ALLIED THEORY	PAPER – I
PAPER CODE	
TITLE OF THE PAPER	STATISTICAL METHODS FOR ECONOMICS

Learning Objectives:

➢ To introduce statistical concepts and develop analytical skills through economic barometers.

Course Outcomes:

The students will be able to:

- ➢ Understand the scope and functions of statistics.
- ➢ Emphasis the necessity of data collection.
- ➢ Understand the various types of diagrams and graphs.
- ➢ Compute mathematical averages, positional averages and dispersion.

UNIT – I   Collection, Classification and Tabulation of Data

Nature and scope of statistics - Limitations – Types of data – Primary data and secondary data – Methods of collection of data – Classification and tabulation of data.

UNIT – II   Diagrammatic Representation of Data

Formation of frequency distribution – Diagrammatic representation – Simple bar diagram – Multiple bar diagram – Subdivided bar diagram – Percentage bar diagram – Pie diagram.

UNIT – III   Graphical representation of Data

Graphical representation – Histogram – Frequency polygon – Frequency curve – Ogives curve and Lorenz curve.

UNIT – IV   Measures of Central Tendency

Definitions – Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean, weighted arithmetic mean and their uses in Economics – Simple Problems.

UNIT – V   Measures of Dispersion

Definitions - Absolute and Relative Measures of Dispersion – Range , Quartile deviation , Mean deviation and their coefficients – Standard deviation and co-efficient of variation.

Books for Reference:

1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Sons, New Delhi.
2. Kapoor. V. K, Fundamentals of Statistics for Business and Economics, Sultan Chand & Sons, New Delhi
3. Pillai. R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
4. Sancheti. D. C. and Kapoor. V. K, Statistics – Theory, Methods & Applications, Sultan Chand & Sons, New Delhi.
5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.
6. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

7. Vittal P. R, Business Statistics, Margham Publications, Chennai.

8. Sharma J.K, Business Statistics, 5th Edition, Vikas Publishing House, New Delhi.

9. P.A. Navanithan (2007), Business Statistics, Jai Publishers, Trichy.

10. Dhingra I. C & Des Raj, Statistics for Economics, Sultan Chand & Sons, New Delhi. .

Web Links:

➢ https://www.tutorialspoint.com/statistics/

➢ http://pages.intnet.mu/cueboy/education/notes/statistics/presentationofdata.pdf

➢ https://www3.nd.edu/~dgalvin1/10120/10120_S17/Topic15_8p2_Galvin_2017_short.pdf

➢ https://www3.nd.edu/~dgalvin1/10120/10120_S16/Topic16_8p3_Galvin.pdf

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Note: The question paper 20% theory and 80% problems to be considered.

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.A (Economics)
SEMESTER	IV
ALLIED THEORY	PAPER – II
PAPER CODE	
TITLE OF THE PAPER	APPLIED STATISTICS FOR ECONOMICS

Learning Objectives:

➢ To enable the students to understand the elementary concepts in statistical analysis.

Course Outcomes:

The students will be able to:

➢ Understand the correlation co-efficient from different methods of measurements.

➢ Understand the concept of time series and estimate the trend values using various methods.

➢ Understand the concept, purpose and its types of index numbers.

➢ Understand the concept of sampling, sampling errors and types of sampling.

UNIT – I   Correlation

Definition of Correlation – Types of Correlation – Measures of Correlation – Scatter diagram – Karl Pearson's correlation coefficient – Spearman's rank correlation coefficient and their interpretation.

UNIT – II   Regression

Meaning of Regression – Fitting of Regression lines – Regression Equations – Uses in Economics.

UNIT – III   Time Series

Time series analysis – Definition – Uses – Components of Time series – Measures of Trend – Graphic method – Semi-average method – Moving average method – Least square method – Measure of Seasonal variation - Simple average method.

UNIT – IV   Index Number

Definition – Uses of Index Number – Types of Index Number – Methods of construction – Simple index number - Weighted index number –Time Reversal and Factor Reversal Test – Cost of living index number.

UNIT – V   Sampling Methods

Basic sampling methods – Probability sampling - Simple Random Sampling – Systematic Sampling – Stratified Random Sampling – Non Probability sampling - Quota Sampling – Purposive Sampling - Errors – Difference between probability and non- probability sampling.

Books for Reference:

1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Sons, New Delhi.
2. Kapoor. V. K, Fundamentals of Statistics for Business and Economics, Sultan Chand & Sons, New Delhi
3. Pillai. R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
4. Sancheti. D. C. and Kapoor. V. K, Statistics – Theory, Methods & Applications, Sultan Chand & Sons, New Delhi.

5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

6. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

7. Vittal P. R, Business Statistics, Margham Publications, Chennai.

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9. Sharma J.K, Business Statistics, 5th Edition, Vikas Publishing House, New Delhi.

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➢ https://www.surveysystem.com/correlation.htm

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Note: The question paper 20% theory and 80% problems to be considered.

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	**For B.B.A/B.B.A (Retail Management)/ For B.B.A (CA) /B.B.A (International Business)**
SEMESTER	**I**
ALLIED THEORY	**PAPER – I**
PAPER CODE	
TITLE OF THE PAPER	**BUSINESS MATHEMATICS AND STATISTICS – I**

Learning Objectives:

➢ To introduce the mathematical, statistical concepts and their development of analytical skills in business management.

Course Outcomes:

The students will be able to:

➢ Understand the sequence, series, matrix operations and determinants.

➢ Understand the usage of central tendencies and dispersion.

UNIT – I   **Sequence and Series**

Definition of Sequence – Series – Arithmetic Progression – Geometric Progression – Harmonic progression - Simple Problems.

UNIT – II   **Matrix**

Definition of Matrices – Types of Matrices – Operations on Matrix – Determinant of Matrix – Inverse of a Matrix – Solving of linear equations – Matrix inverse method and Cramer's rule.

UNIT – III   **Collection Presentation of Statistical Data**

Definition of Statistics – Scope and Limitations – Sources and Collection of data – Classification and Tabulation of data – Diagrams *and* graphs.

UNIT – IV   **Measures of Central Tendency**

Definitions – Mean – Median – Mode – Geometric Mean – Harmonic Mean and Combined Mean – Merits and Demerits – Simple Problems.

UNIT – V   **Measures of Dispersion**

Definition – Absolute and Relative Measures – Range – Quartile deviation – Mean Deviation and their Coefficients - Standard Deviation and Co-efficient of variation.

Books for Reference:

1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Company Ltd., New Delhi.
2. P. R. Vittal, Business Mathematics and Statistics, Margham Publications.
3. Gupta. S. P. and Gupta. P.K. Business Statistics and Business Mathematics, Sultan Chand & Company Ltd., New Delhi.
4. Stafford, Business Mathematics and Statistics, Sultan Chand & Company Ltd., New Delhi.
5. Pillai. R. S. N. and Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
6. Sancheti. D. C. and Kapoor. V. K, Statistics – Theory, Methods & Applications, Sultan Chand & Sons, New Delhi.

7. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

8. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

9. Vittal P. R, Business Statistics, Margham Publications, Chennai.

10. Navaneetham. P, Business Mathematics and Statistics, Jai Publications.

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- https://www.maths.ed.ac.uk/~v1ranick/papers/matrices.pdf
- http://www.cimt.org.uk/projects/mepres/alevel/fpure_ch6.pdf
- https://www.tutorialspoint.com/statistics/
- https://www3.nd.edu/~dgalvin1/10120/10120_S17/Topic15_8p2_Galvin_2017_short.pdf
- https://www3.nd.edu/~dgalvin1/10120/10120_S16/Topic16_8p3_Galvin.pdf

Note: The question paper 20% theory and 80% problems to be considered.

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	For B.B.A/B.B.A (Retail Management)/ For B.B.A (CA) /B.B.A (International Business)
SEMESTER	II
ALLIED THEORY	PAPER – II
PAPER CODE	
TITLE OF THE PAPER	BUSINESS MATHEMATICS AND STATISTICS – II

Learning Objectives:

- To study and analyse business problems using statistical tools.

Course Outcomes:

The students will be able to:

- Understand the importance of Mathematics of Finance, Newton's Forward, Backward and Lagrange's methods.
- To study linear relationship between dependent and independent variable and to fit regression models.
- Understand the concept of time series and estimate the trend values using various methods.
- Understand the concept, purpose of Index Numbers and its types.

UNIT – I   Mathematics in Finance

Simple and Compound Interest – Annuity – Present Value of Annuity – Sinking Fund – Percentages – Discounts.

UNIT – II   Interpolation

Binomial Expansion Method, Newton's Forward, Backward Method and Lagrange's Method – Simple problems.

UNIT –III   Correlation and Regression

Definition –Types and measures of Correlation – Scatter Diagram – Karl Pearson's Coefficient of Correlation – Spearman's Rank Correlation Coefficient – Regression - Regression Lines – Regression Equations.

UNIT – IV   Time Series

Definition – Time Series Analysis – Components of Time Series – Measures of Secular Trend – Free Hand Method , Semi Average Method ,Moving Average Method and Method of Least Square – Measures of Seasonal Variation - Simple Average Method.

UNIT –V   Index Numbers

Definition – Construction of Index Number – Unweighted and Weighted Index Number – Fixed and Chain Base Index Number – Test for Time Reversal and Factor Reversal Tests – Cost of Living Index Number.

Books for Reference:

1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Company Ltd., New Delhi.
2. Gupta. S. P. and Gupta. P.K. Business Statistics and Business Mathematics, Sultan Chand & Company Ltd., New Delhi.
3. Vittal P. R., Business Mathematics and Statistics, Margham Publications, Chennai.

4. Navaneetham. P, Business Mathematics and Statistics, Jai Publishers.

5. Stafford, Business Mathematics and Statistics, Sultan Chand & Company Ltd., New Delhi.

6. Pillai. R. S. N. and Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.

7. Sancheti. D. C. and Kapoor. V. K, Statistics – Theory, Methods & Applications, Sultan Chand & Sons, New Delhi.

8. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

9. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

10. Richard I. Levin and David S. Rubit, Statistics for Management, Pearson Education, India.

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➢ https://www.academia.edu/2191454/Chapter5_Index_number

➢ https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm

Note: The question paper 20% theory and 80% problems to be considered.

NON MAJOR ELECTIVE COURSE OFFERED BY

UG STATISTICS BOARD (OBE PATTERN)

(For the candidates admitted from the Academic year 2021 –2022 onwards)

S.N	COURSE	SEM	PAPER CODE	TITLE OF THE PAPER
1	NMEC – I	III	21USTN01	BASIC STATISTICS – I
2	NMEC – II	IV	21USTN02	BASIC STATISTICS – II

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	NMEC – I
SEMESTER	III
PAPER CODE	21USTN01
TITLE OF THE PAPER	BASIC STATISTICS – I

Learning Objectives:

➢ To enable the students to understand the basic concepts of statistics, collection of data, presentation of data and analysis of data.

➢ To acquire knowledge of statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.,

Course Outcomes:

The students will be able to:

➤ Distinguish between population and sample.

➤ Know the concepts of random sampling and non-random sampling.

➤ Frame a questionnaire and collect primary and secondary data.

➤ Analyze statistical data and draw graphs, histograms, frequency polygons and Ogives.

UNIT – I   Introduction Meaning and Scope

Statistics – Definition – Scope – Limitations – Population and Sample – Concepts of Random sampling and Non-random sampling – Basic concepts only.

UNIT – II   Collection of Data

Primary and Secondary data – Methods of collecting primary and secondary data - sources of data – Preparation of Questionnaire and Schedule.

UNIT – III   Presentation of Data

Classification of data – Types – Frequency distributions for discrete and continuous data – Construction of tables with one, two factors of classification.

UNIT – IV   Diagrammatic Representation of Data

Bar Diagrams: Types of one dimensional and two dimensional bar diagrams - Pie-diagrams – Uses.

UNIT – V   Graphical Representation of Statistical Data

Histogram – Frequency Polygon – Frequency curve and Cumulative frequency curve – Ogive curves – Lorenz curve – Uses.

Books for Reference:

1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Company Ltd., New Delhi.
2. Pillai. R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
3. Sancheti. D. C. and Kapoor. V. K, Statistics (7th Edition), Sultan Chand & Sons, New Delhi.

4. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

5. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

6. Vittal P. R, Business Statistics, Margham Publications, Chennai.

7. Shukla M. C and Gulshan S. S, Statistics, Sultan Chand & Sons, New Delhi.

8. Simpson G and Kafka F, Basic Statistics, Oxford and IBH, Calcutta.

9. Freud J. E, Modern Elementary Statistics, Prentice Hall of India, New Delhi.

10. Saxena H. C (1983), Elementary Statistics, Sultan Chand & Sons, New Delhi.

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➢ https://www.tutorialspoint.com/statistics/

➢ https://www.emathzone.com/tutorials/basic-statistics/collection-of-statistical-data.html

➢ https://byjus.com/commerce/meaning-and-objectives-of-classification-of-data/

➢ https://byjus.com/commerce/diagrammatic-presentation-of-data/

➢ https://byjus.com/maths/graphical-representation/

Note: Problems: 80 %; Theory: 20%.

(For the candidates admitted from the Academic year 2021 –2022 onwards)	
COURSE	NMEC – II
SEMESTER	IV
PAPER CODE	21USTN02
TITLE OF THE PAPER	BASIC STATISTICS – II

Learning Objectives:

➢ To enable the students understand and compute the measures of central tendency and dispersion.

➢ To learn the concepts of time series, evaluation of trend and measurement of seasonal variations by using various methods.

- ➤ Acquire knowledge about index numbers, cost of living index numbers and calculate an indices from real life problems.

Course Outcomes:

The Students will be able to:

- ➤ Analyze statistical data using measures of central tendency and dispersion.
- ➤ Understand and compute various statistical measures of correlation.
- ➤ Gain knowledge about the sources of time series and measure secular trend.
- ➤ Understand the concepts of index numbers, optimum tests and its construction.

UNIT – I   Measures of Central Tendency

Definitions and concepts of Arithmetic mean Median and Mode – Merits and Demerits – Uses - Simple Problems.

UNIT – II   Measures of Dispersion

Range, Quartile deviation and their relative measures - Standard deviation and Coefficient of variation   - Simple Problems.

UNIT – III   Correlation

Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient – Simple Problems.

UNIT – IV   Time series

Measures of trend – Graphic method – Semi average method and Moving average method - Simple Problems.

UNIT – V   Index Numbers

Unweighted and Weighted Index Numbers: Laspeyre's, Paasche's and Fisher's method – Cost of living index numbers – Simple Problems.

Books for Reference:

1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Company Ltd., New Delhi.
2. Pillai. R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
3. Sancheti. D. C. and Kapoor. V. K, Statistics (7th Edition), Sultan Chand & Sons, New Delhi.

4. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.

5. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.

6. Vittal P. R, Business Statistics, Margham Publications, Chennai.

7. Shukla M. C and Gulshan S. S, Statistics, Sultan Chand & Sons, New Delhi.

8. Simpson G and Kafka F, Basic Statistics, Oxford and IBH, Calcutta.

9. Freud J. E, Modern Elementary Statistics, Prentice Hall of India, New Delhi.

10. Saxena H. C (1983), Elementary Statistics, Sultan Chand & Sons, New Delhi.

Web Links:

➢ https://byjus.com/maths/central-tendency/

➢ https://byjus.com/maths/dispersion/

➢ https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression

➢ http://www.stat.columbia.edu/~rdavis/lectures/Session6.pdf

➢ https://www.civilserviceindia.com/subject/Management/notes/index-numbers.html

Note: Problems: 80 %; Theory: 20%.

MODEL QUESTION PAPERS

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Data collected from newspaper is called
   (a) Primary data   (b) Secondary data   (c) Original data   (d) Sample data
2. Geographical classification means classification of data according to

(a) time   (b) location   (c) attributes   (d) variable

3. Histogram is used for determining
   (a) mean   (b) median   (c) mode   (d) quartiles

4. The sum of deviations taken from their arithmetic mean is always
   (a) minimum   (b) zero   (c) maximum   (d) one

5. The correct relationship between AM, GM and HM is
   (a) $AM = GM = HM$ (b) $GM \geq AM \geq HM$ (c) $HM \geq GM \geq AM$ (d) $AM \geq GM \geq HM$

6. Which one of the given measure of dispersion is considered best?
   (a) standard deviation   (b) coefficient of variation   (c) quartile deviation   (d) range

7. Skewness is the lack of
   (a) asymmetry   (b) symmetry   (c) kurtosis   (d) correlation

8. Moments about an arbitrary origin are called_____moments
   (a) raw   (b) central   (c) absolute   (d) ordinary

9. If $\beta_1 = 0$ and $\beta_2 = 3$, then the curve is known as
   (a) Platykurtic   (b) mesokurtic   (c) leptokurtic   (d) asymmetric

10. The limits of correlation co-efficient is
    (a) $-1 \leq r \leq 1$ (b) $0 \leq r \leq 1$ (c) $-1 \leq r \leq 0$ (d) $1 \leq r \leq 2$

11. The rank correlation co-efficient was developed by
    (a) Karl Pearson   (b) Pascal   (c) Spearman   (d) Edge worth

12. The formula for co-efficient of concurrent deviation is
    (a) $+\sqrt{\dfrac{2C-N}{N}}$ (b) $-\sqrt{\dfrac{2C-N}{N}}$ (c) $\pm\sqrt{\dfrac{2C-N}{N}}$ (d) $\pm\sqrt{\pm\dfrac{2C-N}{N}}$

13. When the two regression lines coincide, then r is
    (a) 0   (b) - 1   (c) 1   (d) 0.5

14. In a regression line of Y on X, the variable X is known as
    (a) independent variable (b) dependent variable   (c) explanatory variable   (d) variable

15. If b_{xy} and b_{yx} are two regression co-efficients, then they have
    (a) same sign   (b) nothing can be said   (c) either same or opposite (d) opposite sign

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Describe the different methods of collecting primary data.
17. Explain the method of drawing Lorenz curve.
18. What is kurtosis? Explain the meaning of moments.
19. Prove that the correlation co-efficient 'r' lies between -1 and +1.
20. Find the two regression equations from the following data:

Price	10	12	13	12	16	15
Amount demanded	40	38	43	45	37	43

PART – C (5×10=   50 Marks)
Answer ALL Questions

21. (a) Draw a suitable diagram for the following data.

Item of Expenditure	Family A	Family B
Food	200	300
Clothing	48	75
Education	32	40
House rent	40	75
Miscellaneous	80	110

(Or)

(b) Draw Histogram, frequency polygon and frequency curve for the following frequency distributions.

C.I	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
F	7	12	18	39	75	90	44	22	18

22. (a) Find arithmetic mean, median and mode form the following data:

Marks(Below)	10	20	30	40	50	60	70	80
No. of students	15	35	60	84	96	127	198	250

(Or)

(b) Find Standard deviation and co-efficient of variation for the given data.

Age	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
No. of persons	56	65	74	87	110	83	76	55	45

23. (a) Find a measure of skewness by using quartiles for the following data:

Sales (Rs.'000)	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of firms	30	195	240	115	54	10	6	15	15

(Or)

(b) Calculate the first four moments about mean and also the value of skewness and kurtosis:

Class intervals	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	5	12	18	40	15	7	3

24. (a) Calculate Karl Pearson's correlation co-efficient for the following data.

X	43	44	46	40	44	42	45	42	38	40	42	57
Y	29	31	19	18	19	27	27	29	41	30	26	10

(Or)

(b) Ten competitors in a beauty contest are ranked by three judges in the following data, discuss which pair of Judges have the nearest approach to common tastes in beauty.

Judge I	1	5	4	8	9	6	10	7	3	2
Judge II	4	8	7	6	5	9	10	3	2	1
Judge III	6	7	8	1	5	10	9	2	3	4

25. (a) Find the regression co-efficient of the marks obtained by sixty students at an examination in two subjects economics and statistics.

Marks in statistics	Marks in economics			
	5-15	15-25	25-35	35-45
0-10	1	1	-	-
10-20	3	6	5	1
20-30	1	8	9	2
30-40	-	3	9	3
40-50	-	-	4	4

(Or)

(b) From the following data of rainfall and production of wheat, form the two regression equations and find the most likely production corresponding to the rainfall of 40 inches.

	Rainfall(inches)	Production (Quintals)
Mean	35	50
Standard deviation	5	8

Correlation co-efficient = 0.8

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The probability of the sample space Ω is equal to
   (a) 1   (b) 0   (c) -1   (d) 0.5
2. A coin is tossed 6 times, the possible number of outcome is
   (a) 12   (b) 16   (c) 32   (d) 64

3. If A and B are dependent events then P(A/B) is

(a) $\dfrac{P(A\cap B)}{P(B)}$ (b) $\dfrac{P(A\cap B)}{P(A)}$ (c) $\dfrac{P(A\cup B)}{P(B)}$ (d) $\dfrac{P(A\cup B)}{P(A)}$

4. A real number assigned to each outcome of a random experiment is called

(a) random numbers   (b) random variable   (c) random experiment   (d) random sample

5. When 'x' is a continuous random variable, then a function f(x) is said to be the

(a) distribution function   (b) distribution function   (c) p.m.f   (d) p.d.f

6. If F(x) is the distribution function of X, then F($-\infty$) is

(a) -1   (b) 0   (c) 1   (d) $-\infty$

7. If two variables are studied simultaneously in respect of their distribution, then they are known as

(a) bivariate r.v   (b) bivariate discrete r.v   (c) bivariate continuous r.v (d) uni-variate r.v

8. For the joint p.d.f $f(x, y)$, the marginal distribution of Y given X= x is given as:

(a) $\sum\limits_{all\ x} f(x, y)$ (b) $\int\limits_{-\infty}^{\infty} f(x, y)\, dx$ (c) $\int\limits_{-\infty}^{\infty} f(x, y)\, dxdy$ (d) $\int\limits_{-\infty}^{\infty} \int\limits_{-\infty}^{\infty} f(x, y)\, dx$

9. Joint cumulative distribution function F(x,y) lies between

(a) -1 and 1   (b) -1 and 0   (c) 0 and 1   (d) 0.5 and 1

10. Two independent random variables X and Y are said to be independent if

(a) E(XY) = 1   (b) E(XY)= any constant value (c) E(XY) = E(X) E(Y)   (d) E(XY) = 0

11. The variance of random variable X is 4 and its mean is 2 then $E(X)^2$ is

(a) 8   (b) 6   (c) 4   (d) 2

12. If X is a random variable with mean μ, then $E(x-\mu)^2$ represents

(a) variance   (b) second central moment   (c) second raw moment   (d) both (a) & (b)

13. If X is a random variable, E(e^{tx}) is known as

(a) M.G.F   (b) characteristic function   (c) cumulative function   (d) p.d.f

14. If x is a random variable, then the Cumulant generating function $K_x(t)$ is

$(a)\ M_x(t)$ $(b)\ \phi_x(t)$ $(c)\ log_e M_x(t)$ $(d)\ log_e \phi_x(t)$

15. $M_{CX}(t)$ =

(a) $M_X(t)$ (b) $M_C(t)$ (c) $M_X(ct)$ (d) $M_C(xt)$

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. What is Probability? State and Prove the Addition theorem on probability.
17. Define distribution function and write its properties.
18. Explain (i) bivariate random variables (ii) Marginal and conditional distribution functions.
19. State and prove Chebychev's inequality.
20. Define Moment Generating Function. Also write its properties.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) In a bolt factory machines A_1, A_2, A_3 manufacture respectively 25%, 35% and 40% of the total output. Out of these 5, 4, and 2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine A_1, A_2, A_3?

(Or)

(b) A bag contains 6 red and 8 black balls. Two balls are drawn at random. What is the probability that (i) both are white (ii) both are black (iii) one white and one black.

22. (a) A random variable 'x' has the following probability distribution:

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) Find $(0 < x < 5)$ (iii) Find $P(x < 6)$ and   (iv) Find $P(x \geq 6)$

(Or)

(b) Let 'x' be a continuous random variable with p.d.f given by

$$f(x)= \begin{cases} kx & ; 0 \leq x \leq 1 \\ k & ; 1 \leq x < 2 \\ -kx + 3x & ; 2 \leq x < 3 \\ 0 & ; elsewhere \end{cases}$$

(i) Determine the constant 'k'   (ii) $P(x \leq 1.5)$

23. (a) If the distribution of the random variable (x,y) is given below, test whether x and y are independent

$$f(x, y) = \begin{cases} 4xy & 0 < x < 1, \quad 0 < y < 1 \\ 0 & otherwise \end{cases}$$

(Or)

 (b) The joint probability density function of a two-dimensional random variable (X,Y) is given by $f(x, y) = 2 - x - y, \ 0 \leq x \leq 1, 0 \leq y \leq 1$. Find (i) marginal probability density function of X and Y (ii) conditional density functions   and (iii) V(x) and V(y).

24. (a) Let x be a random variable with the following probability distribution. Find $E(X^2) \ and \ E(X)^2$. Using the laws of expectation evaluate $E(3X + 1)^2$.

X	-1	0	1
P(X)	0.2	0.3	0.5

(Or)

(b) The p.d.f of a random variable 'x' is given by $f(x) = k \, x \, (2 - x), 0 \leq x \leq 2$. Find the value of 'k' and its mean and variance.

25. (a) Let the random variable X assume the value 'r' with the probability law $P(X = r) = q^{r-1}p ; \quad r = 1, 2, 3, \dots$ Find the m.g.f of X and hence find its mean and variance.

(Or)

(b) State Weak Law of Large Numbers and write its applications.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. In which distribution the mean is always greater than variance
   (a) Binomial distribution   (b) Gamma distribution
   (c) Normal distribution   (d) Poisson distribution

2. If X is a random variable, then $E(e^{itx})$ is known as
   (a) Moment generating function   (b) Probability generating function
   (c) Moments   (d) all the above

3. The parameters of Binomial distribution are
   (a) n and p   (b) p and q
   (c) p and 1-p   (d) npq

4. In which probability distribution each successive draw varies?
   (a) Hyper geometric distribution   (b) Geometric distribution
   (c) Binomial distribution   (d) Uniform distribution

5. The parameters of Hyper geometric distribution are
   (a) N,K,n   (b) N,K,p
   (c) N,K,q   (d) all the above

6. In which distribution the mean and variance are equal?
   (a) Binomial distribution   (b) Normal distribution
   (c) Poisson distribution   (d) Geometric distribution

7. For a normal curve, the ratio of Q.D, M.D and S.D are
   (a) 5:6:7   (b) 10:12:15
   (c) 2:3:4   (d) 10:11:15

8. The parameters of Normal distribution are
   (a) μ and σ^2 (b) μ and Θ (c) Θ (d) μ

9. In Normal distribution, all odd order moments are
   (a) zero   (b) one   (c) two   (d) all the above

10. The parameters of Beta distribution of first kind is
    (a) m and n   (b) m+n   (c) m-n   (d) m/n

11. Gamma distribution is also called as
    (a) Incomplete distribution   (b) Normal distribution
    (c) Exponential distribution   (d) none of the above

12. The mean of exponential distribution is
    (a) Θ (b) 2Θ (c) Θ^2 (d) none

13. Student's t distribution was invented by
    (a) G. W Snedecor   (b) R. A Fisher
    (c) W. S Gosset   (d) A. L Bowley

14. F distribution was invented by
    (a) R. A Fisher   (b) G. W Snedecor
    (c) W. S Gosset   (d) A. L Bowley

15. Chi-square distribution is used for the test of
    (a) goodness of fit   (b) hypothetical value of population variance
    (c) both (a)& (b)   (d) all the above

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Derive the mean and variance of Binomial distribution.
17. Derive the MGF of Poisson distribution.
18. Derive Mean deviation about mean for Normal distribution.
19. Explain Beta distribution.
20. Write the test procedure for testing the equality of two population variances.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain the recurrence relation for Moments of Binomial distribution.

(Or)

(b) Fit a binomial distribution to the following data.

X	0	1	2	3	4	5	6
F	13	25	52	58	32	18	4

22. (a) Derive the mean and variance of Hyper geometric distribution.

(Or)

(b) Fit a Poisson distribution to the following data.

No. of mistakes per page	0	1	2	3	4
No. of pages	211	90	19	5	0

23. (a) Explain the properties of Normal distribution.

(Or)

(b) Fit a normal distribution to the following data by the method of ordinates.

C.I	10-20	20-30	30-40	40-50	50-60	60-70	70-80
F	8	12	30	24	12	10	4

24. (a) Derive the mean and variance of Gamma distribution.

(Or)

(b) Derive the mean and variance of Beta distribution of first kind.

25. (a) Derive the density function of t distribution.

(Or)

(b) Explain the relationship between t, χ^2 and F distributions.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. A Population consisting of the results of the conceptually repeated trials is known as
   (a) hypothetical Population   (b) finite Population
   (c) infinite Population   (d) real Population

2. The discrepancies between sample estimate and population parameter is termed as
   (a) human error   (b) formula error
   (c) non sampling error   (d) Sampling error
3. Another name of population is
   (a) Sample   (b) Universe   (c) Statistic   (d) all the above
4. Simple random sample can be drawn with the help of
   (a) Random number tables   (b) Chit method
   (c) Roulette wheel   (d) all the above
5. If the observations recorded on five sampled items are 3,4,5,6,7, then the sample variance is
   (a) 1   (b) 0   (c) 2   (d) 2.5
6. Which of the following statement is not true?
   (a) Standard error cannot be zero   (b) Standard error cannot be 1
   (c) Standard error cannot be negative   (d) all the above
7. Stratified random sampling comes under the category of
   (a) Unrestricted sampling   (b) Subjective sampling
   (c) Purposive sampling   (d) Restricted sampling
8. How many types of optimum allocation is in common use?
   (a) one   (b) two   (c) three   (d) four
9. Under proportional allocation one gets
   (a) an optimum sample   (b) a self weighing sample
   (c) both (a) & (b)   (d) none of the above
10. Selected units of systematic sample are
    (a) not easily locatable   (b) easily locatable
    (c) not locate the whole population   (d) all the above
11. A systematic sample yield good results if
    (a) each unit has an equal probability of inclusion in the sample (b) units at regular intervals are correlated
    (c) both (a) & (b)   (d) none of the above
12. The magnitude of the S.E of an estimate is an index of its
    (a) accuracy   (b) precision   (c) efficiency   (d) all the above
13. Which sampling design is most appropriate for Cluster sampling?
    (a) SRS without replacement   (b) SRS with replacement
    (c) Stratified random sampling   (d) Quota sampling
14. Judgement Sampling is also known as
    (a) Purposive sampling   (b) Quota sampling
    (c) Probability sampling   (d) none of the above
15. In Convenience sampling, selection is made from
    (a) Available source   (b) primary source
    (c) unavailable source   (d) all the above

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain the preparation of questionnaire and schedule in sampling.
17. Describe Simple random sampling and state its merits and demerits.
18. Explain the Principles of stratification.
19. State the advantages and disadvantages of Systematic sampling.
20. Explain Quota sampling.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain the Principles steps in a sample survey and different types of sampling.

(Or)

(b) Explain the applications of sampling techniques in different fields.

22. (a) Explain with replacement and without replacement selections in SRS.

(Or)

(b) In SRSWOR, show that the variance of the sample means is given by $V(\bar{y}) = \left(\frac{N-n}{N}\right)\frac{s^2}{n}$

23. (a) In Stratified random sampling with given cost function $C = a + \sum_{i=1}^{k} c_i n_i$. Show that the $V(\bar{y})_{st}$ is minimum if n_i a $\frac{N_i S_i}{\sqrt{C_i}}$.

(Or)

(b) Show that $(\bar{y})_{st} = \left(\frac{N-n}{N}\right)\frac{S_w^2}{n}$

24. (a) Prove that $V(\bar{y})_{st} \le V(\bar{y})_{sys} \le V(\bar{y})_{ran}$ if the population consists of a linear trend.

(Or)

(b) Explain the estimation of mean and variance for Systematic sampling.

25. (a) Explain Convenience sampling and Judgement sampling.

(Or)

(b) Explain Cluster sampling with estimation of mean and variance.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Estimate and estimator are
    (a) Samples   (b) different

(c) related to population   (d) all the above

2. Bias of estimator can be
   (a) positive
   (b) negative
   (c) either positive or negative
   (d) always zero

3. Consistency is specifically named as
   (a) Simple consistency
   (b) Unbiasedness
   (c) Mean-squared consistency
   (d) all the above

4. Factorization theorem for sufficiency is known as
   (a) Rao-Blackwell theorem
   (b) Cramer-Rao theorem
   (c) Fisher-Neyman theorem
   (d) none of the above

5. Cramer-Rao inequality is valid in the case of
   (a) continuous variables
   (b) discrete variables
   (c) both (a) and (b)
   (d) none of the above

6. Rao-Blackwell theorem enables us to obtain MVUE through
   (a) Unbiased estimators
   (b) Complete statistics
   (c) Efficient estimators
   (d) Sufficient statistics

7. The maximum likelihood estimators are necessarily
   (a) Unbiased   (b) Sufficient   (c) Most efficient   (d) Unique

8. If X is an MLE of μ of a normal population then $\bar{X}$ is
   (a) Unbiased   (b) Sufficient statistics   (c) Efficient   (d) all the above

9. Maximum likelihood estimation was invented by
   (a) R. A Fisher
   (b) Students' t
   (c) Neyman-Pearson
   (d) none of the above

10. Method of moments was invented by
    (a) R. A Fisher   (b) J. Neyman   (c) Laplace   (d) Karl Pearson

11. Method of least square estimators is
    (a) Consistent
    (b) Asymptotically normal
    (c) Efficient
    (d) all the above

12. The minimum variance approach was invented by
    (a) Gauss   (b) Markov   (c) Fisher   (d) all the above

13. For a fixed confidence coefficient, the most preferred confidence interval for the parameter Ө is
    (a) With shortest width
    (b) With largest width
    (c) With an average width
    (d) none of the above

14. Confidence region is the estimation of
    (a) Confidence interval for a parameter
    (b) Conf. interval for two or more parameters
    (c) both (a) and (b)
    (d) none of the above

15. Confidence limits for population mean difference can be found only when
    (a) two variables are paired
    (b) two variables are correlated
    (c) both (a) and (b)
    (d) neither(a) nor (b)

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Define Estimation, Unbiasedness and Consistency.
17. Explain Invariance property of sufficient estimator.
18. Describe the method of MLE.
19. Explain the methods of moments.
20. Explain the construction of confidence interval for proportions.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain sufficient condition for consistency and Prove that T = X is a consistent estimator of Ө if X follows Normal population with mean Ө and variance σ^2.

(Or)

(b) Explain briefly the invariance property of consistent estimator.

22. (a) State and prove Rao-Blackwell theorem.

(Or)

(b) State and prove Cramer Rao inequality.

23. (a) State the properties of MLE . Also find the MLE of the parameter of Poisson variate.

(or)

(b) If random sample of size n is drawn from N (μ, σ^2), estimate μ and σ^2 by the method of MLE.

24. (a) Estimate the parameters μ and σ^2 of the normal distribution by the method of moments.

(Or)

(b) Describe the least square method of estimation.

25. (a) Find 95% confidence limits for $N(\mu,\sigma^2)$, when σ^2 is known.

(Or)

(b) Explain the confidence limits for the ratio of variances in F-distribution.

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Time: Three Hours   Maximum: 75 Marks

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. A Hypothesis may be classified as
    (a) Simple Hypothesis   (b) Composite Hypothesis
    (c) Null Hypothesis   (d) All the above

2. Power of a test is related to
   (a) Type I error
   (b) Type II error
   (c) Non sampling error
   (d) Sampling error
3. Level of significance is the probability of
   (a) Type I error
   (b) Type II error
   (c) Not committing error
   (d) none of the above
4. The value of Likelihood ratio test is in the interval
   (a) (0,1)
   (b) (1,0)
   (c) (0,.5)
   (d) (.5,0)
5. The Critical region for the test statistic of LR test is
   (a) $\lambda(x)$
   (b) $\lambda(x+y)$
   (c) $\lambda(x-y)$
   (d) none of the above
6. The Likelihood ratio test is under the entire parametric space
   (a) True
   (b) False
   (c) Ratio
   (d) None of the above
7. Which test is used for testing a hypothesis about proportion of items in a data?
   (a) t- test
   (b) F-test
   (c) Z-test
   (d) None of the above
8. A Sample of 40 taken from a normal population with mean 64 and variance of 25 with population mean 50. To test $H_0 : \mu=50$ Vs $H_1 : \mu \neq 50$, we have
   (a) Z-test
   (b) F-test
   (c) t- test
   (d) all the above
9. Large sample test based on
   (a) sample size
   (b) sample
   (c) population
   (d) all the above
10. Student's t-test was invented by
    (a) R. A Fisher
    (b) G. W Snedecor
    (c) W. S Gosset
    (d) W. G Cochran
11. The ratio between sample variance and within sample variance follows
    (a) F-distribution
    (b) Z- distribution
    (c) t- distribution
    (d)none of the above
12. Paired t-test is applicable when the observation in two samples is
    (a) paired
    (b) correlated
    (c) equal in number (d) all the above
13. Coefficient of contingency is calculated when
    (a) Attributes are independent
    (b) Attributes are associated
    (c) both (a) &(b)
    (d) none of the above
14. (2x2) contingency table was given by
    (a) Karl Pearson
    (b) Pascal
    (c) Demoivre
    (d) R. A Fisher
15. The value of χ^2 statistic depends on the difference between
    (a) theoretical and expected frequencies
    (b) sample and population
    (c) parameter and statistic
    (d) none of the above

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain the Two types of errors.
17. State the properties of LR test.
18. Describe the test procedure for large sample test for difference of two means.
19. Explain F test for equality two variances.
20. State the applications of χ^2 distribution.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) State and prove Neyman Pearson lemma.

(Or)

(b) Find the MPT to test $H_0:\mu=\mu_0$ against $H_1:\mu=\mu_1$ using a random sample of 'n' observations from $N(\mu, {}^2)$, at level α.

22. (a) Explain the LR test for equality of (i) means and (ii) variances of two normal populations.

(Or)

(b) Let sample observations from a normal populations with mean μ and variance σ^2, test $H_0:\mu=\mu_0$ by the method of LR test.

23. (a) Explain the large sample test procedure for testing (i) single proportion and (ii) difference of two proportions.

(Or)

(b) A sample of size 400 was drawn and the sample mean was found to be 99. Test whether this sample could have come from a normal population with mean 100 and variance 64 at 5% level of significance.

24. (a) Explain t- test for difference of two means.

(Or)

(b) Two random samples were drawn from two normal populations and their values are:

A: 66 67 75 76 82 84 88 90 92

B: 64 66 74 78 82 85 87 92 93 95 97

Test whether the two populations have the same variance at the 5% level of significance.

25. (a) Explain χ^2 -test for independence of attributes.

(Or)

(b) Fit a Poisson distribution to the following data, and test the goodness of Fit.

X	0	1	2	3	4	5	6
F	143	90	42	12	9	3	1

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Time: Three Hours   Maximum: 75 Marks

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Variation due to assignable causes in the product occurs because of
    (a) faulty process   (b) carelessness of operators
    (c) poor quality of raw material   (d) all the above
2. Chance variation in the manufactured product is

(a) controllable   (b) not controllable

(c) both (a)and (b)   (d) none of the above

3. Main tools of statistical quality control are

    (a) Shewhart charts   (b) Acceptance sampling plan

    (c) both (a) and (b)   (d) none of the above

4. Control charts consists of

    (a) three control lines   (b) upper and lower limits

    (c) the level of the process   (d) all the above

5. The Control limits delimited by the consumer are called

    (a) modified control limits   (b)natural control limits

    (c) specified control limits   (d) none of the above

6. R charts are economical than

    (a) σ chart   (b) Mean chart

    (c) both (a)and (b)   (d) None of the above

7. Inspection by attributes requires

    (a) less time   (b) less skill

    (c) less calculations   (d) all the above

8. No. of defects follows

    (a) Poisson distribution   (b) Normal distribution

    (c) Geometric distribution   (d) None of the above

9. Fraction defectives for control charts are known as

    (a) σ chart   (b) p chart   (c) np chart   (d) c chart

10. The probability of rejecting a lot having process average defectives is known as

    (a) Consumer's risk   (b)Type II error   (c) Producer's risk   (d) all the above

11. Acceptance sampling are preferable due to

    (a) economy in inspection   (b) protection to items

    (c) increased efficiency   (d) all the above

12. A curve showing the probability of accepting a lot of quality p is known as:

    (a) OC curve   (b) ASN curve   (c) Compertz curve   (d) Normal curve

13. In a double sampling plan, a decision about the acceptance or rejection of a lot

    (a) will never reach   (b) always reach

    (c) sometimes reach   (d) none of the above

14. In a SPRT, the sample size is

    (a) discrete random variable   (b) continuous random variable

    (c) average sample number   (d) none of the above

15. A Sequential sampling plan is

    (a) an infinite process   (b) finite process

    (c) a process terminates with probability one   (d)all the three

PART-B (2x5=10 Marks)
Answer any TWO Questions

16. Distinguish between process control and product control.
17. Explain the control limits, specification and natural tolerance limits as used in SQC.
18. Describe the applications of theory of runs in quality control.
19. Explain the concepts of producer's risk and consumer's risk.
20. Explain Double sampling plan.

PART-C (5x10=50 Marks)
Answer ALL Questions

21. (a) Explain the different methods of quality of design.

(Or)

(b) What are the techniques of SQC used in an industrial organization?

22. (a) Explain the construction of mean chart and range chart .

(Or)

(b) A machine is set to deliver the packets of a given weight. Ten samples of size five each were examined and the following results were obtained:

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

Construct mean chart and range chart and also comment on your findings.

23. (a) Explain the construction of p-chart and c-chart .

(Or)

(b) The number of defects on 20 items are given below:

Item No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. of defects	2	0	4	1	0	8	0	1	2	0	6	0	2	1	0	3	2	1	0	2

Draw a suitable chart and comment on your findings.

24.   (a) Explain Single sampling plan and its implications.

(Or)

(b) Explain the construction of OC, AOQ, ASN and ATI curve for single sampling plan.

25.(a) Explain Sequential sampling plan and SPRT.

(Or)

(b) Explain the construction of OC, AOQ, ASN and ATI curve for Double sampling plan.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Experimental error is due to
    (a) Experimenter's mistake   (b) Variation in treatment effects
    (c) Extra factors   (d) None of the above
2. In ANOVA for one way classification, sources of variation are

(a) Two components   (b) One component

(c) Three components   (d) none of the above

3. Analysis of variance is the ratio of

(a) Two component variances   (b) One component

(c) Three component variances   (d) All the above

4. Local control in the field is maintained through

(a) Uniformity trials   (b) Randomization   (c) Natural factors   (d) All the above

5. The number of times a treatment is repeated in an experiment is called

(a) Replication   (b) Randomization

(c) Local control   (d) All the above

6. A Completely randomized design is also known as

(a) Unsystematic design   (b) Non-restricted design

(c) Single block design   (d) All the above

7. Out of many multiple range tests, the test which is considered superior is

(a) Newman kuel's test   (b) Duncan's multiple range test

(c) Tukey's test   (d) None of the above

8. Which one of the test take care of the distance between two means in an ordered set of treatment means ?

(a) Newman kuel's test   (b) Tukey's test

(c) Duncan's multiple range test   (d) None of the above

9. Tukey's test utilizes

(a) w- procedure   (b) q - procedure   (c) λ- procedure   (d) all the above

10. Missing value in an experiment is estimated by the method of

(a) Minimizing the error mean square   (b) Analysis of covariance

(c) Both(a) and (b)   (d) Neither(a) nor (b)

11. Two missing values in a Randomized block design with 4 blocks and 5 treatments, the error degrees of freedom is

(a) 10   (b) 15   (c) 25   (d) 28

12. One missing value of a Latin square design invented by

(a) F. Yates   (b) R. A Fisher   (c) W. G Cochran   (d) A. L Bowley

13. Two types of effects measured in a factorial experiment are

(a) Main and interaction effects   (b) Simple and complex effects

(c) Both (a) and (b)   (d) Neither (a) nor (b)

14. The method of confounding is a device to reduce the size of

(a) Experiments   (b) Replication   (c) Blocks   (d) All the above

15. If the same factorial effect is confounded in all the replications is called

(a) Partial confounding   (b) Complete confounding

(c) Balanced confounding   (d) None of the above

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain the concept of Cochran's theorem and analysis of variance.
17. Define the following: Experimental design and Experimental unit.
18. Describe the angular and log transformations.
19. Explain the concept of missing plot techniques in experimental design.
20. What are the effects measured in factorial experiments.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Describe One-way classification.

(Or)

(b) Explain two-way classification.

22. (a) What are the basic principles of fundamental design? Explain.

(Or)

(b) Explain the statistical analysis for RBD.

23. (a) What is Duncan's multiple range test and explain.

(Or)

(b) Explain Newman kuel's test.

24. (a) Discuss the statistical analysis for RBD with one missing value.

(Or)

(b) Explain the statistical analysis for LSD with one missing value.

25. (a) Give the details of Yate's method of analysis of a 2^2 factorial experiments.

(Or)

(b) Explain the principles of Confounding, Partial and Complete confounding.

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Time: Three Hours   **Maximum Marks: 75**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The time series analysis helps:
   (a) to compare two or more series   (b) to know the behavior of business
   (c) to make predictions   (d) all the above
2. A Time series consists of

(a) Two components   (b) Three components
(c) Four components   (d) Five components

3. Least square method of fitting a trend is
   (a) Most exact   (b) Least exact
   (c) Full of subjectivity   (d) all the above

4. Simple average method is used to calculate
   (a) Trend values   (b) Cyclic variations
   (c) Seasonal indices   (d) none of the above

5. The best method for finding seasonal variation is
   (a) Simple average method   (b) Ratio-to moving average method
   (c) Ratio-to-trend method   (d) none of the above

6. Ratio-to-trend method for seasonal indices provides if
   (a) Periods are of long duration   (b) Periods are given six monthly
   (c) Periods are of short duration (d) all the above

7. Index numbers are also known as
   (a) Economic barometers   (b) Signs and guide posts
   (c) both (a) and (b)   (d) None of the above

8. Base period for an index number should be
   (a) a year only   (b) a normal period
   (c) a period at distant past   (d) none of the above

9. Fisher's ideal formula does not satisfy
   (a) Time reversal test   (b) Circular test
   (c) Factor reversal test   (d) Unit test

10. Cost of living index number is same in
    (a) Consumer price index   (b) diffusion index number
    (c) value index   (d) all the above

11. Consumer price index is constructed on
    (a) weekly basis   (b) hourly basis
    (c) monthly basis   (d) all the above

12. The chain base index number is not suitable for
    (a) Short term comparison   (b) Long range comparison
    (c) Year wise comparison   (d) All the above

13. Vital statistics is mainly concerned with
    (a) Births   (b) Deaths   (c) Marriages   (d) all the above

14. The registration of vital statistics in India suffers from
    (a) Incomplete reporting (b) Incomplete coverage   (c) Lack of accuracy   (d) all the above

15. A life table consists of
    (a) 7 columns   (b) 8 columns   (c) 9 columns   (d) 6 columns

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Define time series and explain its components.
17. Explain the seasonal variation.
18. Explain the problems in the construction of index numbers.
19. Define (i) Time reversal test and (ii) Factor reversal test.
20. Explain the functions of CSO.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Obtain the trend values by 3 yearly Moving average, also find its short-term fluctuations.

Year	1980	1981	1982	1983	1984	1985	1986
Production (in tonnes)	80	90	92	83	94	99	92

(Or)

(b) Given below, fit a straight line trend of production of a sugar factory.

Year	1989	1990	1991	1992	1993	1994	1995
Sales	77	88	94	85	91	98	90

22. (a) Calculate seasonal indices by the method of link relatives.

Quarters	1	2	3	4	5
1	30	35	31	31	34
2	26	28	29	31	36
3	22	22	28	25	26
4	31	36	32	35	33

(Or)

(b) Describe the method of ratio-to-trend of measuring seasonal variations.

23. (a) For the following information, calculate price index by (i) Laspeyre's (ii) Paasche's (iii) Fisher's (iv)Dorbish Bowley's and (v)Marshall Edge worth Index methods.

Commodities	2009		2008	
	Price	Quantity	Price	Quantity
A	2	8	4	6
B	5	10	6	5
C	4	14	5	10
D	2	19	2	13

(Or)

(b) From the following data, construct Fisher's ideal index and show that it satisfies Factor Reversal and Time reversal test.

Commodities	Price (in Rs)		Quantity(in Kg)	
A	6	10	50	56
B	2	2	100	120
C	4	6	6	60
D	10	12	30	24
E	8	12	40	36

24. (a) Explain the methods of construction of Cost of living index numbers.

(Or)

(b) From the following data relating to production of electricity, construct (i) Fixed base and (ii) Chain base index numbers

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Production	25	27	30	24	28	29	31	35	40	41	36	32	37	38	39	40

25. (a) Explain the National Sample Survey Organization and its functions.

(Or)

(b) Explain the Registration procedures in vital statistics.

(For the candidates admitted from 2021 –2022 onwards)
B.SC STATISTICS DEGREE EXAMINATION
Fifth Semester
OPERATIONS RESEARCH – I

21USTE01

Time: Three Hours   Maximum: 75 Marks

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Operations research is a very powerful tool for
   (a) research   (b) decision-making   (c) analysis   (d) operations
2. Physical model is an example of
   (a) an iconic model   (b) an analogue model

(c) a verbal model   (d) a mathematical model

3. While plotting constraints on a graph paper, terminal points on both the axes are connected by a straight line because
   (a) the resources are limited in supply   (b) the objective function as a linear function
   (c) the constraints are linear equations or inequalities   (d) all of the above

4. The variable used in the following constraint $10x_1 - 3x_2 + 6x_3 \geq 100$, to get equality is known as
   (a) slack variable   (b) surplus variable
   (c) negative artificial variable   (d) non- negative artificial variable.

5. Minimum of z is equal to
   (a) max (-z)   (b) –max (z)   (c) –min (-z)   (d) – max (-z)

6. The dual of the dual is
   (a) dual   (b) primal   (c) minimal   (d) undefined

7. MODI method is used to find the optimum solution for
   (a) Assignment problem   (b) Sequencing problem   (c) Transportation problem   (d) LP problem

8. A (3 x 4) transportation problem will have a non-degenerate solution if the numbers of basic variables are
   (a) 7   (b) 8   (c) 6   (d) 12

9. The non- degeneracy condition to the (m X n) transportation problem is
   (a) m+n   (b) m+n-1   (c) m-n   (d) m-n+1

10. Assignment problem is a special case of
    (a) Inventory problem   (b) LPP
    (c) Transportation problem   (d) Sequencing problem

11. Hungarian method is used to solve
    (a) Transportation problem   (b) Assignment Problem
    (c) Traveling salesman   (d) LPP

12. The Hungarian method for solving an assignment problem can also be used to solve
    (a) A transportation problem   (b) A travelling salesman problem
    (c) A L P problem   (d) Both a & b

13. In an M/M/1 queue, the arrival rate follows
    (a) Poisson Distribution   (b) Exponential Distribution
    (c) Gamma Distribution   (d) Binomial Distribution.

14. The expected waiting time in the system in (M/M/1) : (∞/FI/F0) is
    (a) $1/(\lambda-\mu)$ (b) $1/(\mu-\lambda)$ (c) $\lambda/(\mu-\lambda)$ (d) $\mu/(\mu-\lambda)$

15. The time between two successive request arriving is called as
    (a) inter-arrival time   (b) arrival time
    (c) Poisson distribution   (d) average residual service time

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. State the uses of Operations Research.
17. Define (i) Feasible solution (ii) Optimal solution.
18. Write the steps for finding IBFS to a TP by NWCR.
19. Explain the balanced and unbalanced assignment problem.
20. Explain (a/b/c):(d/e) queuing model.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain various Models in Operations Research.

<div align="center">(Or)</div>

     (b) Write the characteristics of a good model.

22. (a) Solve the following LPP by simplex method.

<div align="center">120</div>

Maximize Z = 5x+7y
Subject to
$$12x + 12y \leq 840$$
$$3x + 6y \leq 300$$
$$8x + 4y \leq 480 \text{ and } x, y \geq 0$$

(Or)

(b) A dietician wishes to mix two types of food in such a that the vitamin contents of the mixture contains at least 8 units of vitamin A and 10 units of vitamin B. Food I contains 2 units per kg of vitamin A and I unit of vitamin B while food II contains 1 unit per kg of vitamin A and 2 units of vitamin B. It costs Rs. 5 per kg to purchase food I and Rs. 8 per kg of food II. Formulate this as a LPP and find the optimal solution.

23. (a) Solve the following Transportation problem.

	A	B	C	Supply
I	16	19	12	14
II	22	13	19	16
III	14	28	6	12
Demand	10	15	17	

(Or)

(b) Write the steps for finding IBFS to a TP by Least cost method and VAM.

24. (a) Solve the following AP.

Workers/Jobs	1	2	3	4
A	160	130	175	190
B	135	120	130	160
C	140	110	125	170
D	50	50	80	80

(Or)

(b) There are nine jobs, each of which must go through two machines P and Q in the order PQ, the processing times (in hours) are given below. Find the sequence that minimizes the total elapsed time T. Also calculate the total idle time for the machines in this period.

Machine	Job (s)								
	A	B	C	D	E	F	G	H	I
P	2	5	4	9	6	8	7	5	4
Q	6	8	7	4	3	9	3	8	11

25. (a) Jobs arrive at a facility at an average rate of 5 in 8 hours shift. The arrival of the jobs follows Poisson distribution. The average service time of a job on the facility is 40 minutes. The service time follows exponential distribution. Find (i) the average waiting time of a job in the queue (ii) Idle time (in hours) at the facility per shift

(Or)

(b) Write the applications of Queuing theory in practice.

(For the candidates admitted from 2021 –2022 onwards)
B.SC STATISTICS DEGREE EXAMINATION
Fifth Semester
STOCHASTIC PROCESSES

21USTE02

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Stochastic process is
   (a) Collection of sets   (b) Collection of domains
   (c) Collection of random variables   (d) Collection of values
2. The set of all possible values are known as

(a) State space   (b) Parametric space
(c) Transition probability   (d) stochastic matrix

3. The number of classifications in Stochastic process   is
(a) 5   (b) 4   (c) 6   (d) 3

4. In Markov process if state space is discrete then it is known as
(a) Parametric space   (b) Markov chain
(c) Probability   (d) Transition probability

5. A non- recurrent state is said to be
(a) Recurrent   (b) Ergodic   (c) Periodic   (d) Transient

6. If i and j are communicative then
(a) $i \rightarrow j$ (b) $j \rightarrow I$ (c) $i \leftrightarrow j$ (d) $i = j$

7. Auto regressive process can be represented by
(a) Stochastic process   (b) Moving average process
(c) Random process   (d) Stationary process

8. Covariance function is_____definite.
(a) even and positive   (b) even and negative
(c) odd and positive   (d) odd and negative

9. If the time parameters are continuous , then the stochastic process is
(a) Wide sense stationary   (b) Covariance stationary
(c) Purely random process   (d) Moving average process

10. Counting process is also known as
(a) Stochastic process   (b) Stationary process
(c) Random process   (d) Poisson process

11. Probability that more than one event happens in the small interval denoted by
(a) ρ (h)   (b) λ (h)   (c) o (h)   (d) P_1 (h)

12. $\lambda j = j \lambda$ then Birth and death process becomes
(a) Birth process   (b) Death process
(c) Linear process   (d) Linear death process

13. Brownian motion process is also known as
(a) stochastic process   (b) Wiener process
(c) Poisson process   (d) Stationary process

14. _____is an example of Bernoulli trails.
(a) Random work   (b) Theory of Dam
(c) Stochastic process   (d) Stationary process

15. Markov process with continuous state space is also known as _____
(a) Markov chain Death process   (b) Drift co-efficient
(b) Diffusion process   (d) Parametric space

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Write some examples of stochastic process.
17. Explain limiting behaviour of transition probability.
18. Explain Moving average process.
19. What are the properties of Poisson process?
20. Explain First passage time.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain stochastic process.

(Or)

(b) What are all the classifications of stochastic process and explain.

22.   (a) State and prove Chapmen Kolmogorov equation.

(Or)

(b) Explain classifications of states.

23. (a) Explain stationary process.

(Or)

(b) Explain Auto regressive process of order two.

24. (a) What is Poisson process? Explain?

(Or)

(b) Derive Birth and Death process.

25. (a) Obtain the distribution of the maximum of a Wiener process.

(Or)

(b) Explain in detail about Kolmogorov equation.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Which one of the following is a part of every game theory model?
    (a) players   (b) payoff   (c) strategies   (d) all the above
2. A game is said to be fair if
    (a) minimax ≠ maximin   (b) minimax = maximin = 1

(c) minimax = maximin = 0   (d) minimax = maximin ≠ 0

3. A game is said to be strictly determinable if
   (a) minimax ≠ maximin   (b) minimax = maximin = 1
   (c) minimax = maximin = value of the game   (d) minimax = maximin ≠ 0

4. The slack for an activity is equal to
   (a) LF-LS   (b) EF-ES   (c) LS-ES   (d) EF-LS

5. In PERT, the completion time for the project is assumed to have the
   (a) Beta distribution   (b) Exponential distribution
   (c) Normal distribution   (d) Be constant

6. The expected time in any activity in PERT is
   (a) $t_e = (t_0 + t_p + 4t_m)/4$ (b) $t_e = (t_0 + t_p + 4t_m)/6$
   (c) $t_e = (t_0 + t_p - 4t_m)/4$ (d) $t_e = (t_0 + t_p - 4t_m)/6$

7. Which is concerned with the prediction of replacement and determination of the most economic replacement policy?
   (a) search theory   (b) theory of replacement   (c) LP programming   (d) theory of game

8. The time elapsed from the point of machine failure to perform its function to the point it is repaired and brought into operating condition is known as
   (a) down time   (b) break Down time   (c) both (a) and (b)   (d) idle time

9. Total productive maintenance aims at
   (a) less idle time   (b) increase in productivity   (c) zero down time   (d) idle time

10. Buffer stock is the level of stock
    (a) half of the actual stock
    (b) at which the ordering process should start
    (c) minimum stock level below which actual stock should not fall
    (d) maximum stock in inventory

11. The following classes of costs are usually involved in inventory decisions except
    (a) cost of ordering   (b) carrying cost   (c) cost of shortages   (d) machining cost

12. The cost of insurance and taxes are included in
    (a) cost of ordering   (b) cost of shortages   (c) inventory carrying cost   (d) set up cost

13. A pessimistic decision-making criterion is
    (a) maximax   (b) equally likely   (c) under certainty   (d) maximin

14. Pessimistic decision makers tend to_____favorable outcomes.
    (a) magnify   (b) ignore bad   (c) discount   (d) both a and b

15. In decision making under_____there are several possible outcomes for each alternative, and the decision maker knows the probability of occurrence of each outcome.
    (a) risk   (b) utility   (c) certainty   (d) probability

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain Two- Persons zero-sum game with an example.
17. Draw the network diagram to the following activity: A < DI; B < GF; D < GF; C < E; E < HK; F < HK; GH < J.
18. Find the present worth factor of the money to be spent in a year, if the money is worth 5% per year.
19. Write the four types of deterministic inventory models.
20. State the criterions for decision making under uncertainty.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Solve the following game.

Player A	Player B		
	B_1	B_2	B_3
A_1	1	3	1
A_2	0	-4	-3
A_3	11	5	-1

(Or)

(b) Solve the following game using graphical approach:

A's Strategies	Payoff Matrix Players			
	B's Strategies			
	B_1	B_2	B_3	B_4
A_1	8	5	-7	9
A_2	-6	6	4	-2

22. (a) A project schedule has the following characteristics.

Activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time (days)	5	4	1	1	1	6	5	7	4	8	1	2

From the above information, you are required to (i) Construct a network diagram (ii) Compute the earliest and latest event time (iii) Determine the critical path and total project duration.

(Or)

(b) The following table shows the jobs of a network along with their time estimates.

Jobs	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
a (days)	1	2	2	2	7	5	5	3	8
m (days)	7	5	14	5	10	5	8	3	17
b (days)	13	14	26	8	19	17	29	9	32

Draw the project network and find the probability of project completion in 40 days.

23. (a) The following table gives the running costs per year and resale price of certain equipment, whose purchase price is Rs.5000. In what year is the replacement due?

Year	1	2	3	4	5	6	7	8
Running cost	1500	1600	1800	2100	2500	2900	3400	4400
Resale value	3500	2500	1700	1200	800	500	500	500

(Or)

(b) The cost of a machine is Rs. 61,000 and its scrap value is Rs.1000. The maintenance costs found from the past experiences are as follows. When should the machine be replaced?

Year	1	2	3	4	5	6	7	8
Maintenance cost	1000	2500	4000	6000	9000	12000	16000	20000

24. (a) A manufacturer has to supply his customer with 600 units of his products per year. Shortages are not allowed and storage cost amounts to 60 paise per unit per year. The set-up cost is Rs 80.00. Find:

       i) EOQ and the minimum average yearly cost

       ii) The optimum number of orders per year

       iii) The optimum period of supply per optimum order

(Or)

(b) The demand for an item is 12000 per year and the shortage is allowed. If the unit cost is Rs.15 and the holding cost is Rs.20 per year per unit determine the optimum total yearly cost. The cost of placing one order is Rs.6000 and the cost of one shortage is Rs.100 per year. b). Write the characteristics of a good model.

25. (a) Explain EMV, EVPI and EOL criterions.

(Or)

(b) A grocery receives its weekly supply of eggs every Thursday morning. This shipment must last until the following Thursday when a new shipment is received. Any eggs left unsold by Thursday are destroyed. Eggs sell for $10 per hundred and cost $8 per hundred. The weekly demand for eggs at this grocery varies from week to week. From past experience, the following probability distribution is assigned to weekly demand (W.D):

W.D (hundreds of eggs)	10	11	12	13	14
Probabilities	0.1	0.2	0.4	0.2	0.1

Determine the payoff table and find the best alternative under EMV criterion.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. If a capital of C is invested at compound interest i per annum for n years then the accumulated value is
   (a) $(1+i)^n$ (b) $C(1+i)^n$ (c) $C.i^n$ (d) $(C+1+i)^n$

2. The discounted value is also called the
   (a) Accumulated value   (b) Discounting   (c) Present value   (d) Interest

3. If the successive payments of the annuity are made at the end of the successive periods, then the annuity is called an
   (a) Annuity   (b) Immediate Annuity   (c) Level Annuity   (d) Annuity Due
4. The present value of an immediate annuity of 1p.a. for n years under which payments are made p times a year, the rate of interest being i p.a. is denoted by
   (a) a_{n1} (b) s_{n1} (c) $a_{n1}^{(p)}$ (d) $s_{n1}^{(p)}$
5. The loan is repaid by a uniform payment made at the end of each year is known as
   (a) Level annual payment   (b) Uniform yearly payment
   (c) Equated payment   (d) all the above
6. The general expression for the interest contained in the mth yearly installment is given by
   (a) $1-v^{n-m+1}$ (b) $1+v^{n-m+1}$ (c) v^{n-m+1} (d) $1/v^{n-m+1}$
7. Which function gives the table the name "mortality table"?
   (a) l_x (b) d_x (c) p_x (d) q_x
8. If fractions of the year are taken into account, then it is called as
   (a) expectation of life   (b) curtate expectation of life
   (c) complete expectation of life   (d) incomplete expectation of life
9. The expression for central death rate is
   (a) $2q_x/2-q_x$ (b) $2q_x/2+q_x$ (c) $2m_x/2-m_x$ (d) $2m_x/2+m_x$
10. The periodical payments made by the life assured are called
    (a) single premium   (b) premium
    (c) annual premium   (d) level premium
11. The benefit is payable in case of death of a person during the given period, the assurance is known as
    (a) Temporary   (b) Pure endowment
    (c) Endowment   (d) Whole life
12. If the period covers the entire life span of the insured person, then the assurance is known as
    (a) Temporary   (b) Pure endowment
    (c) Endowment   (d) Whole life
13. The lump sum contribution of the policy holder to secure benefits under an assurance plan is called
    (a) single premium   (b) net premium
    (c) annual premium   (d) level premium
14. If mortality and interest are used in calculating level annual premiums then it is known as
    (a) natural premium   (b) office premium
    (c) simple premium   (d) net premium
15. The value of office premiums =
    (a) Value of benefits / Value of expenses   (b) Value of benefits * Value of expenses
    (c) Value of benefits + Value of expenses   (d) Value of benefits - Value of expenses

<center>

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

</center>

16. Explain the effective and nominal rate of interest.
17. Find the present value of an immediate annuity of Rs. 250/-p.a. payable quarterly for 8 years at a rate of interest 7%p.a. convertible half yearly.
18. Explain the central death rate.
19. Discuss the principles of life assurance.
20. Define level annual premium and its advantages.

<center>

PART – C (5×10= 50 Marks)
Answer ALL Questions

</center>

21. (a) Define Annuity and explain the types of annuities.

<div align="center">(Or)</div>

(b) Derive the following (i) a_{n1} (ii) $\ddot{a}_{n1}$ (iii) s_{n1}

22. (a) Derive the formula of $a_{n1}^{(p)}$ and $s_{n1}^{(p)}$

<div align="center">(or)</div>

(b) A loan of Rs. 7500/- is made subject to repayment by 15 level annual payments, the first to made at the end of 6 years. If the rate of interest is 10%, find

      (i)   The level annual payment

      (ii)   The principal contained in the fifth payment

23. (a) Fill up the blanks in the following life table

x	i_x	d_x	q_x	p_x
10	1000000	-	0.00409	-
11	-	-	0.00370	-
12	-	-	-	0.99653
13	-	-	-	0.99658
14	-	-	0.00342	-

<div align="center">(Or)</div>

(b) Explain the probabilities of survival and death

24. (a) Explain the types of Assurance.

<div align="center">(Or)</div>

(b) Obtain the expression for temporary and pure endowment assurance in terms of commutation functions.

25. (a) Explain the natural and office premiums.

<div align="center">(Or)</div>

(b) Derive the expression for level annual premium under endowment and whole life assurance plans.

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(For the candidates admitted from 2021 –2022 onwards)
B.SC STATISTICS DEGREE EXAMINATION
Third Semester
SBEC – I: REGRESSION ANALYSIS

</div>

21USTS01

Time: Three Hours   **Maximum: 75 Marks**

<div align="center">

Part – A (15×1 = 15 Marks)
Answer ALL Questions

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1. In coefficient of partial correlation when two variables are under study , all other variables are kept
   (a) deviated   (b) residual mean   (c) constant   (d) not fixed

2. A coefficient which examines the association between a dependent variable and an independent variable after factoring out the effect of other independent variables is known as:

(a) A partial correlation coefficient

(b) A correlation coefficient

(c) A regression coefficient

(d) All of the above

3. The range of partial correlation coefficient is

(a) 0 to 1   (b) 0 to ∞ (c) -1 to +1   (d) not fixed

4. The multiple correlation coefficients R

(a) Can vary within the range from — 1 to +1

(b) Can be less than the correlation between some of the independent variables

(c) Can vary within the range from 0 to +1

(d) Cannot achieve an absolute value of unity

5. The coefficient of multiple determinations is

(a) the intercept or constant in the regression equation (b) the total regression sum of squares

(c) the square of the multiple correlation coefficient   (d) the multiple correlation coefficient

6. The multiple correlation coefficient $R_{1.23}$ of X_1 with X_2 and X_3 variable is always

(a) greater than the correlation coefficient of zero order

(b) less than the correlation coefficient of zero order

(c) equal to each of the correlation coefficient of zero

(d) all the above

7. Find the odd one

(a) $Y = ab^x$ (b) $Y = ae^{bx}$ (c) $Y = a + bX$ (d) $Y = aX^b$

8. In the regression line Y = a+ bX, here 'a' is the

(a) slope of the line   (b) intercept of the line   (c) neither 'a' nor 'b'   (d) both 'a' and 'b'

9. The line of regression intersect at the point

(a) (X,Y)   (b) $(\overline{X}\overline{Y})$ (c) (0,0)   (d) (1,1)

10. Multiple regression

(a) is an extension of bivariate regression

(b) examines the linear relationship between a predictor and a criterion

(c) looks at the influence of more than one predictor

(d) all of these

11. Multiple regression can be used to

(a) look at the predictiveness of a particular set of variables (b) control for the effect of certain variables

(c) determine the minimum number of predictors   (d) all of these

12. The number of regression equations with four predictors is

(a) 4   (b) 8   (c) 15   (d) 16

13. If the linear matrix equation is Y = XA + E, then the solution of A is

(a) $A = (X^TX)^{-1}X^TY$ (b) $A = (X^TX)(X^TY)^{-1}$ (c) $A = (X^TX)^{-1}XY$ (d) $A = (X^TX)(XY)^{-1}$

14. If n=3 in regression matrix with constant error terms and are uncorrelated then covariance matrix is

(a) $\begin{pmatrix} \sigma^2 & 0 & 0 \\ 0 & \sigma^2 & 0 \\ 0 & 0 & \sigma^2 \end{pmatrix}$

(b) $\begin{pmatrix} \sigma^2 & 1 & 1 \\ 0 & \sigma^2 & 1 \\ 0 & 0 & \sigma^2 \end{pmatrix}$

(c) $\begin{pmatrix} \sigma^2 & 0 & 0 \\ 1 & \sigma^2 & 0 \\ 1 & 1 & \sigma^2 \end{pmatrix}$

(d) $\begin{pmatrix} \sigma^2 & 1 & 1 \\ 1 & \sigma^2 & 1 \\ 1 & 1 & \sigma^2 \end{pmatrix}$

15. The regression in matrix, the normal equations can be derived directly from the minimization of

(a) $Q = (Y - X\beta)'(Y - X\beta)$ with respect to β (b) $Q = (Y + X\beta)'(Y + X\beta)$ with respect to β

(c) $Q = (X - Y\beta)'(X - Y\beta)$ with respect to β (d) $Q = (X + Y\beta)'(X + Y\beta)$ with respect to β

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. If $r_{12} = 0.6$, $r_{13} = 0.5$ and $r_{23} = 0.8$ then find $r_{12.3}$.
17. Write the advantages and limitations of multiple correlations.
18. Write the properties of linear regression coefficients.
19. In a tri-variate distribution $\sigma_1 = 2$, $\sigma_2 = 3$ and $\sigma_3 = 3$, and $r_{12} = 0.6$, $r_{13} = 0.5$ and $r_{23} = 0.8$. Find $b_{12.3}$.
20. Explain covariance matrix of a random vector.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Prove that with usual notations, $r_{12.3} = \dfrac{co(K_{1.3}, K_{2.3})}{\sqrt{Va(K_{1.3})\ Var(K_{2.3})}}$

(Or)

(b) If $r_{12} = 0.77$, $r_{13} = 0.72$ and $r_{23} = 0.52$ then find $r_{12.3}$, $r_{23.1}$ and $r_{13.2}$

22. (a) Write the properties of multiple correlation coefficient.

(Or)

(b) Show that any standard deviation of order p may be expressed in terms of a standard deviation of order (p- 1) and a partial correlation coefficient of order (p-1).

23. (a) Fit an exponential curve of the form $Y = ab^X$ to the data below.

X	1	2	3	4	5	6	7	8
Y	1.0	1.2	1.8	2.5	3.6	4.7	6.6	9.1

(Or)

(b) Derive the angle between two regression lines.

24. (a) Show that the correlation coefficient between the residuals $X_{1.23}$ and $X_{2.13}$ is equal and opposite to that between $X_{1.3}$ and $X_{2.3}$.

(Or)

(b) Write the assumptions of multiple linear regression model.

25. (a) Explain the simple linear regression model in matrix form.

(Or)

(b) Show that the multiple linear regression in matrix form,
   (i)   Let $\hat{} = Xb$ be the empirical predictor of y .Then $\hat{Y}$ has the same value for all solutions b of $X'Xb = X'y$.
   (ii) $S(\beta)$ attains the minimum for any solution of $X'Xb = X'y$.

****

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Non parametric methods are based on
   (a) mild assumptions   (b) stringent assumptions   (c) only one assumption   (d) no assumption
2. Most of the nonparametric methods utilise measurements on

(a) interval scale   (b) ratio scale   (c) ordinal scale   (d) nominal scale

3. Most commonly used assumption about the distribution of a variable is
   (a) continuity of the distribution   (b) symmetry of the distribution
   (c) both (a) and (b)   (d) neither (a) nor (b)

4. Run test is a test of
   (a) randomness   (b) tied rank   (c) positioning   (d) ordering

5. Sign test utilizes_____distribution.
   (a) Binomial   (b) Poisson   (c) Normal   (d) Uniform

6. Most frequently used method of breaking the ties is the_____method.
   (a) ranking   (b) mid rank   (c) summing   (d) squaring

7. We can use Wilcoxon signed rank test when the sample size is greater than_____.
   (a) 30   (b) 25   (c) 20   (d) 15

8. By Mann-Whitney U test, one can test the identicalness of_____.
   (a) several parameters   (b) several populations
   (c) two parameters   (d) two population

9. By median test, one can test the equality of_____.
   (a) location parameters   (b) several populations
   (c) two populations   (d) variances

10. The statistic H under the Kruskal-Wallis test is approximately distributed as:
    (a) Student's t- test   (b) Snedecor's F- test
    (c) Chi-square test   (d) Normal deviate z- test

11. Kruskal-Wallis H with k treatments and n blocks is approximated , then the Chi-square has ------ d.f
    (a) (n-1)   (b) (n-1) (k-1)
    (c) (k-1)   (d) K(n-1)

12. Friedmen's -F is distributed as
    (a) Student's t- test   (b) Snedecor's F- test
    (c) Chi-square test   (d) Normal deviate z- test

13. Kolmogorov-Smirnov test is a
    (a) one left-sided test   (b) one right-sided test
    (c) two-sided test   (d) all the above

14. Kolmogorov-Smirnov test is used as
    (a) test of goodness of fit   (b) a test of identicalness of two populations
    (c) a measure of confidence band   (d) all the above

15. Given W = 0.5, n = 6 and k = 3 the computed value of Chi-square for testing the significance of W is equal to:
    (a) 5.5   (b) 6.5
    (c) 7.5   (d) 8.5

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Write the disadvantages of Non-parametric tests.
17. Explain one-sample sign test.
18. Write the steps involved in Mann-Whitney U test.
19. Explain Kruskal-Wallis test with the help of an example.
20. Distinguish between nonparametric methods and distribution free methods.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Discuss the advantages of nonparametric methods.

(Or)

(b) When should the nonparametric methods be preferably used?

22. (a) The following are the measurements of breaking strength of a certain kind of 2-inch cotton ribbon in pounds:

| 163 | 165 | 160 | 189 | 161 | 171 | 158 | 151 | 169 | 162 |
| 163 | 139 | 172 | 165 | 148 | 166 | 172 | 163 | 187 | 173 |

Use the sign test, to test the null hypothesis $\mu = 160$ Vs $\mu > 160$ at the 0.05 level of significance.

(Or)

(b) Test the hypothesis that X and Y are independent against the alternative that they are dependent if for a sample of size n= 50 pairs of observations we find that $r_s = -0.2$. Use $\alpha = 5\%$.

23. (a) The nicotine contents of two brands of cigarettes, measured in milligrams was found to be as follows:

Brand A	2.1	4.0	6.3	5.4	4.8	3.7	6.1	3.3		
Brand B	4.1	0.6	3.1	2.5	4.0	6.2	1.6	2.2	1.9	5.4

Test the hypothesis at 5% level, that the average nicotine contents of the two brands are equal against the alternative that they are unequal.

(Or)

(b) A study is run to evaluate the effectiveness of an exercise program in reducing systolic blood pressure (sbp) in patients with pre-hypertension (defined as a systolic blood pressure between 120-139 mmHg or a diastolic blood pressure between 80-89 mmHg). A total of 15 patients with pre-hypertension enroll in the study, and their systolic blood pressures are measured. Each patient then participates in an exercise training program where they learn proper techniques and execution of a series of exercises. Patients are instructed to do the exercise program 3 times per week for 6 weeks. After 6 weeks, systolic blood pressures are again measured. The data are shown below.

Patient No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sbp before exercise	125	132	138	120	125	127	136	139	131	132	135	136	128	127	130
Sbp after exercise	118	134	130	124	105	130	130	132	123	128	126	140	135	126	132

Is there is a difference in systolic blood pressures after participating in the exercise program as compared to before?

24. (a) Use Kruskal-Wallis test to test for differences in mean among the three samples. If $\alpha = 1\%$, what are your conclusions?

Sample I	95	97	99	98	99	99	99	94	95	98
Sample II	104	102	102	105	99	102	111	103	100	103
Sample III	119	130	132	136	141	172	145	150	144	135

(Or)

(b) An I.Q test was given to a random sample of 15 male and 20 female students of a University. Their scores were recorded as below:

Male : 56, 66,62,81,75,73,83,68,48,70,60,77,86,44,72

Female : 63,77,65,71,74,60,76,61,67,72,64,65,55,89,45,53,68,73,50,81

Use median test to determine whether I.Q. of male and female students is same in the University.

25. (a) Below is the table of observed frequencies, along with the expected frequency under a normal distribution.

Test score	51-60	61-70	71-80	81-90	91-100
Observed frequency	30	100	440	500	130
Expected frequency	40	170	500	390	100

Find

(i) The K-S statistic.

(ii) Can we conclude that this distribution does not follow a normal distribution at α = 10 %

(Or)

(b) Explain briefly Non-parametric and distribution free tests.

****

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Microsoft Excel is a/an
   (a) table   (b) graph sheet   (c) electronic spreadsheet   (d) charts
2. The intersection of rows and columns are called

(a) Sheet   (b) Cell   (c) workbook   (d) book

3. What is the default extension of Microsoft Excel 2003 saved file?

    (a) .xls   (b) .xsl   (c) .xlsx   (d) .xlxs

4. Which one of the logical functions in Excel?

    (a) IF   (b) AND   (c) TRUE   (d) all the above

5. Which function will you use to enter current time in a worksheet cell?

    (a) = current time ()   (b) = time ()   (c) = now ()   (d) all the above

6. The Microsoft Excel_____function returns a value converted to text with a specified format.

    (a) TEXT   (b) ATAN   (c) VLOOPUP   (d) SUM

7. Which chart is also known as X Y chart?

    (a) Pie chart   (b) Bar chart

    (c) Area chart   (d) Scatter chart

8. In excel, which one of the chart type is not available

    (a) Radar   (b) Buble

    (c) Doughnut   (d) Sphere

9. What type of chart is useful for comparing values over categories/

    (a) Pie chart   (b) Bar chart

    (c) Area chart   (d) Column chart

10. Which function in Excel represents number of numeric entries?

    (a) NUM   (b) COUNT

    (c) SUM   (d) CHKNUM

11. All statistical test formula should be start with_____.

    (a) =   (b) ≠   (c) if =   (d) if ≠

12. What is the key used to find the minimum of the given numbers?

    (a) mini   (b) minimum   (c) min   (d) small

13. Large sample test formula in EXCEL is

    (a) ZTEST ()   (b) ZTEST ()   (c) ZTES ()   (d) ZTESTED ()

14. In which menu contain the t-test.

    (a) insert   (b) data   (c) tool   (d) home

15. The syntax of Chi-square test is

    (a) CHISQ.TEST   (b) CHI.TEST   (c) CHI.TET   (d) CHISQ.TES

Part – B (2×5=10 Marks)
Answer Any TWO Questions

16. What is ribbon?
17. Differentiate COUNT, COUNTA, COUNTIF and COUNTBLANK with example.
18. How do you use text functions in Excel?
19. How do you find averages in MS Excel?
20. Write the procedure to find the z-test.

Part – C (5×10=50)
Answer ALL Questions

21. (a) Specify the order of operations used for evaluating formulas in Excel.

(Or)

(b) How to cut copy and paste in a worksheet? Explain.

22. (a) Explain the logical functions in Excel.

(Or)

(b) Explain the various statistical functions in Excel.

23. (a) Explain the various chart template with example.

(Or)

(b) How to create a bar chart at Excel? Explain.

24. (a) How to find the maximum and minimum value of the given numbers.

(Or)

(b) Write the procedure for finding average with example.

25. (a) Explain with example for t-test and paird t- test.

(Or)

(b) Write detailed notes on chi-square test with example in excel programs.

****

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1.   "R" is an_____programming language.
   (a) closed sor\urce   (b) GPL   (c) Open source   (d) definite source
2.   The_____function returns a list of all the formal arguments of a function.

(a) formals()   (b) funct()   (c) formal()   (d) fun()

3. Which function helps you to perform sorting in R language?
   (a) Order   (b) Inorder   (c) Simple   (d) Library

4. More than two variables will be represented as a_____which is used for creating the group bar chart and stacked bar chart.
   (a) Array   (b) Matrix   (c) Table   (d) All the above

5. barplot(H, xlab, ylab, main, names.arg, col), from the above R code the word 'xlab' is denotes_____.
   (a) title of the bar char (b) lable for x-axi   (c) lable for y-axis   (d) none of the above

6. The Syntax for creating a pie-chart using R is
   (a) pie() function   (b) piec() function   (c) pi() function   (d) pc() function

7. Many quantitative analysts use R as their_____tool?
   (a) leading tool   (b) programming tool   (c) statistical tool   (d) all the above

8. Which of the following is a primary tool for debugging?
   (a) debug ()   (b) trace()   (c) browser()   (d) formal()

9. For finding skewness and kurtosis which library is used
   (a) moment   (b) ggplots   (c) plots   (d) moments

10. How many methods exist for normalizing the data?
    (a) one   (b) two   (c) three   (d) profiler

11. Which of the R statement used for perform paired samples t-test comparing the means of two paired samples (x & y)?
    (a) t.test(x, y, paired = TRUE, alternative = "two.sided")
    (b) t.test(x, y, paired = TRUE, alternative = "two_sided")
    (c) t.test(x, y, paired = FALSE, alternative = "two.sided")
    (d) t.test(x, y, paired = FALSE, alternative = "two_sided")

12. Which keyword is used to perform the chi-square test in the R programming?
    (a) chisquare.test(data)   (b) chisq.test(data)
    (c) chi_sq.test(data)   (d) chi_square.test(data)

13. Analysis of variance in short form is?
    (a) ANOV   (b) AVA   (c) ANOVA   (d) ANVA

14. 14In R programming, cor() computes the
    (a) correlation coefficient   (b) concurrent deviation
    (c) coefficient of variation   (d) covariance

15. What plot(s) are used to view the linear regression?
    (a) Scatterplot   (b) Box plot
    (c) Density plot   (d) Scatterplot, Boxplot, Density plot

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain "R" program.
17. Explain the basic keywords for drawing chart using R program.
18. Write the procedure for standard deviation using R Program.
19. Write the program for z-test with example.
20. Write the procedure for writing R programming for simple correlation.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) In R how you can import Data?

(Or)

(b) Explain what is With () and By () function in R is used for?

22. (a) What are the data structures in R that is used to perform statistical analyses and create graphs?

(Or)

(b) Write R programing to create pie chart for the following data:

Housing	Food	Cloths	Entertainment	Others
600	300	150	100	200

23. (a) Write the step by step procedure for mean and median.

(Or)

(b) Write the step by step procedure for summarize the numerical data.

24. (a) Explain what is t-tests in R?

(Or)

(b) Write the R program for F-test with an example.

25. (a) Write R program for linear regression with an example.

(Or)

(a) Explain ANOVA test with an example.

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(For the candidates admitted from 2021 –2022 onwards)
B.Sc DEGREE EXAMINATION
First and Third Semester
Allied: Mathematical Statistics
(Common for B.Sc Mathematics and B.Sc Mathematics (CA))

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Probability can take values from

(a) $-\infty$ to $+\infty$ (b) $-\infty$ to 1   (c) 0 to +1   (d) -1 to +1

2. A set of numerical values assigned to a sample space is called
   (a) random sample   (b) random variable   (c) random numbers   (d) all the above
3. If c is a constant, then E (c) is
   (a) 0   (b) 1   (c) c f (c)   (d) c
4. Binomial distribution applies to
   (a) rare events   (b) repeated alternatives   (c) three events   (d) one event
5. In a parametric distribution the mean is equal to variance is
   (a) binomial   (b) normal   (c) Poisson   (d) all the above
6. The standard normal distribution is represented by
   (a) $N(0,0)$ (b) $N(1,1)$ (c) $N(1,0)$ (d) $N(0,1)$
7. The best measure of central tendency is
   (a) Arithmetic mean   (b) Harmonic mean   (c) Geometric mean   (d) Median
8. If $Q_1 = 30$ and $Q_3 = 50$, then coefficient of quartile deviation is
   (a) 20   (b) 40   (c) 10   (d) 0.25
9. In a symmetrical distribution the coefficient of skewness is
   (a) one   (b) zero   (c) equal   (d) none of these
10. The process of fitting functions to data is known as
    (a) Curve fitting   (b) distribution function   (c) probability function   (d) all the above
11. The method of_____is the most systematic procedure to fit a unique curve from given data
    (a) least squares   (b) least cube   (c) square   (d) none of these
12. Fitting of a Power Curve is
    (a) $y = ax^b$ (b) $y = ab^x$ (c) $y = ae^{bx}$ (d) $y = ax$
13. Limits of the correlation coefficient is
    (a) $-1 \leq r \leq 1$ (b) $0 \leq r \leq 1$ (c) $-1 \leq r \leq 0$ (d) $-1 \leq r \leq 2$
14. If $\sum d^2 = 0$, then rank correlation coefficient is
    (a) 0   (b) 1   (c) -1   (d) 0.05
15. In a straight line equation $Y = a + bX$, then constant 'b' represent the
    (a) Intercept of the line   (b) slope of the line   (c) mean   (d) correlation

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Define (i) Mathematical Probability and (ii) Statistical Probability.
17. Find the M.G.F of Binomial distribution.
18. What do you mean by measures of central tendency?
19. Explain the principle of least square.
20. Explain the Spearman's rank correlation coefficient.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Let x be a continuous random variable with p.d.f
$$f(x) = \begin{cases} ax; & 0 \leq x \leq 1 \\ a; & 1 \leq x \leq 2 \\ -ax + 3a; & 2 \leq x \leq 3 \\ 0; & elsewhere \end{cases}$$
    Determine the constant 'a'.

(Or)

(b) State and prove Chebychev's inequality.

22. (a) Assuming that one in 80 births in a case of twins, calculate the probability of 2 or more sets of twins on a day when 30 births occurs. Compare the results obtained by using (i) the binomial and (ii) Poisson distribution.

(Or)

(b) Students of a class were given an aptitude test. Their marks were found to be normally distributed with mean 60 and standard deviation 5. What percentage of students scored?
i) More than 60 marks (ii) Less than 56 marks (iii) Between 45 and 65 marks

23. (a) Calculate the mean, median and mode for the following data:

Size	60-63	63-66	66-69	69-72	72-75
Frequency	5	18	42	27	8

(Or)

(b) Calculate coefficient of variation for the following data:

Class interval	10-20	20-30	30-40	40-50	50-60
Frequency	8	10	12	8	4

24. (a) Fit a Second degree Parabola of the form $y = a + bX + cX^2$

Age (X)	1	2	3	4	5	6	7	8	9	10
Weight (Y)	52.5	58.7	65	70.2	75.4	81.1	87.2	5.5	101.2	108.4

(Or)

(b) Fit a curve $y = ab^x$ to the following data:

X	1	2	3	4	5	6	7
Y	1	1.2	1.8	2.5	3.6	4.7	6.6

25. (a) Calculate Karl Pearson's correlation coefficient for the given data:

X	65	66	67	69	70	72	67
Y	67	68	65	68	72	69	71

(Or)

(b) In a correlation study, the following values are obtained

	X	Y
Mean	65	67
S.D	2.5	3.5
Correlation coefficients	0.8	

Find the two regression equations that are associated with the above values.

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(For the candidates admitted from 2021 –2022 onwards)
B.Sc DEGREE EXAMINATION
Second and Fourth Semester
Allied: Inferential Statistics
(Common for B.Sc Mathematics and B.Sc Mathematics (CA))

Time: Three Hours   Maximum: 75 Marks

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The method of obtaining the most likely value of the population parameter using statistic is called

(a) estimation   (b) estimator   (c) biased estimate   (d) standard error

2. An estimator is a sample statistic used to estimate a

(a) sample size   (b) biased estimate   (c) population parameter   (d) census

3. _____ is a relative property, which states that one estimator is efficient relative to another.

(a) efficiency   (b) sufficiency   (c) unbiased   (d) consistency

4. The method of maximum likelihood estimators which was initially formulated by

(a) R. A Fisher   (b) C. R Rao   (c) C. F Gauss   (d) Karl Pearson

5. The method of moments is a method of _____ of population parameters.

(a) estimation   (b) evaluate   (c) equal   (d) statistic

6. An estimate of a population parameter given by two numbers between which the parameter would be expected to lie is called _____ of the parameter.

(a) point estimate   (b) an interval estimation   (c) standard error   (d) confidence

7. A measure characterizing a sample such as 's' is called

(a) Population   (b) Statistic   (c) Universe   (d) Mean

8. Alternative hypothesis is

(a) Always Left Tailed   (b) Always Right Tailed   (c) Always One Tailed   (d) One or Two Tailed

9. Area of the critical region depends on

(a) Size of type I error   (b) Size of type II error   (c) sampling error   (d) all the above

10. Large sample theory is applicable when

(a) $n > 30$ (b) $n < 30$

(c) $n < 100$ (d) $n > 100$

11. Large sample test is applicable, when the parent population is

(a) normal distribution   (b) binomial distribution

(c) Poisson distribution   (d) none of these

12. In a test if $z_0 \leq z_e$, what is your conclusion about the null hypothesis?

(a) rejected H_0 (b) accepted H_0

(c) significant   (d) not significant

13. t – distribution range from

(a) o to 1   (b) -1 to 1

(c) o to ∞ (d) $-\infty$ to ∞

14. Chi-square distribution is _____ distribution.

(a) continuous   (b) multimodal

(c) discrete   (d) symmetrical

15. If n is the degree of freedom of chi-square distribution then its variance is

(a) n   (b) n–1

(c) 2n   (d) n+1

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. State Rao-Blackwell theorem and mention its importance.
17. Explain the methods of estimation.
18. Write a short note on Type I error and Type II error.
19. Explain the procedure of the test of significance for single mean for large samples.
20. What are the characteristics of Chi-square test?

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) State and prove Cramer Rao inequality.

(Or)

(b) Explain the following (i) Consistency (ii) Unbiasedness (iii) Efficiency (iv) Sufficiency.

22. (a) Explain maximum likelihood estimation and method of moments.

(Or)

(b) State the properties of MLE method of estimator.

23. (a) Explain (i) Simple hypothesis (ii) Critical region (iii) Power of a test.

(Or)

(b) State and prove Newman Pearson Lemma.

24. (a) 1000 articles from a factory A are examined and found to have 3% defectives. 1500 similar articles from a second factory B are found to have only 2% defectives. Can it be reasonably concluded that the product of the first factory is inferior to the second?

(Or)

(b) The means of two large samples of 1000 and 2000 items are 67.5 cms and 68.0 cms respectively. Can the samples be regarded as drawn from the population with standard deviation 2.5 cms. Test at 5% level of significance.

25. (a) Two random samples drawn from two normal populations are
    Sample I: 20 16 26 27 22 23 18 24 19 25
    Sample II: 27 33 42 35 32 34 38 28 41 43 30 37
    Obtain the estimates of the variance of the population and test 5% level of significance, whether the two populations have the same variance.

(Or)

(b) Out of 800 persons, 25% were literates and 300 had travelled beyond the limits of their district 40% of the literates were among those who had not travelled. Test of 5% level whether there is any relation between travelling and literacy.

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(For the candidates admitted from 2021 –2022 onwards)
B.Sc DEGREE EXAMINATION
First and Third Semester
Allied: Business Statistical Methods and Their Applications – I
(Common for BCA, B.Sc Computer Science and B.Sc (IT))
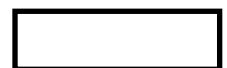
Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The origin of statistics can be traced to

(a) state	(b) commerce	(c) economics	(d) industry

2. Tabulation follows
   (a) classification   (b) numerical values   (c) rows   (d) columns
3. Squares are_____dimensional diagrams
   (a) one   (b) two   (c) three   (d) four
4. Mean is a measure of
   (a) location   (b) dispersion   (c) correlation   (d) regression
5. The positional measure of central tendency is
   (a) A.M   (b) median   (c) G.M   (d) H.M
6. Mode of the series is 12, 5, 10, 9, 3, 6
   (a) 6   (b) 9   (c) No mode   (d) 3
7. Sum of the deviations about mean is
   (a) minimum   (b) maximum   (c) zero   (d) one
8. The mean of squared deviations about the mean is called
   (a) standard deviation   (b) variance   (c) mean deviation   (d) range
9. Which of the following is a unit less measure of dispersion?
   (a) standard deviation   (b) mean deviation   (c) coefficient variation   (d) range
10. Limits for correlation coefficient is
    (a) $-1 \leq r \leq 1$ (b) $0 \leq r \leq 1$ (c) $-1 \leq r \leq 0$ (d) $-1 \leq r \leq 2$
11. If $\sum d^2 = 0$, then rank correlation is
    (a) 0   (b) 1   (c) -1   (d) 0.05
12. In a straight line equation $Y = a + bX$, then constant 'b' represent the
    (a) Intercept of the line   (b) slope of the line   (c) mean   (d) correlation
13. Mathematical probability may also be termed as_____probability.
    (a) statistical   (b) classical   (c) empirical   (d) posteriori
14. Probability can take values between
    (a) -1 and 1   (b) 0 and 1   (c) less than 1   (d) greater than 1
15. If two dice are thrown, then the probability that the sum is greater than 8 is
    (a) 1/3   (b) 1/2   (c) 5/18   (d) 7/18

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. What do you mean by tabulation? Mention its objectives.
17. Explain the properties of a good average.
18. Explain coefficient of variation.
19. Explain the concepts of correlation and regression and state their numerical measures.
20. State and prove the addition theorem on probability.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain in detail about scope of statistics and its limitations.

<div align="center">(Or)</div>

    (b) Draw a suitable diagram for the following items.

Items of Expenditure	Family A	Family B
Food	16,000	12,000
Clothing	8,000	6,000
Rent	6,000	5,000

Light and Fuel	2,000	1,000
Miscellaneous	8,000	6,000

22. (a) Calculate the mean, median and mode for the data given below:

Daily Earnings (in Rs.)	50-53	53-56	56-59	59-62	62-65	65-68	68-71	71-74	74-77
No. of Persons	3	8	14	30	36	28	16	10	5

(Or)

(b) Calculate geometric mean and harmonic mean for the following data:

Marks	20	30	40	50	60	70
No. of Students	8	12	20	10	6	4

23. (a) Calculate the mean deviation for the following data:

Value of x	2-4	4-6	6-8	8-10
Frequency	3	4	2	1

(Or)

(b) Calculate coefficient of variation for the following data:

Class interval	10-20	20-30	30-40	40-50	50-60
Frequency	8	10	12	8	4

24. (a) The following are the ranks obtained by 10 students in Statistics and Mathematics. Find the Rank correlation co-efficient.

Statistics	1	2	3	4	5	6	7	8	9	10
Mathematics	1	4	2	5	3	9	7	10	6	8

(Or)

(b) Compute the two regression equations from the following data.

X	10	12	13	12	16	15
Y	40	38	43	45	37	43

25. (a) A box containing 5 green, 6 red, and 4 yellow balls, A ball is drawn at random from a box and determine the probability that the ball drawn is (i) green (ii) Red (iii) yellow (iv) Green or Red (v) not yellow.

(Or)

(b) A bag contains 6 red and 8 black balls. Another bag contains 7 red and 10 black balls. A bag is selected and a ball is drawn. Find the probability that it is a red ball.

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. A set of numerical numbers assigned to a sample space is called

(a) random sample   (b) random variable

(c) random experiment   (d) random numbers

2. Probability mass function is always

    (a) 0   (b) greater than 0   (c) greater than equal to 0   (d) less than 0

3. Mathematical expectation of a random variable 'X' is known as

    (a) mean   (b) median   (c) mode   (d) probability

4. The mean of a binomial distribution is

    (a) np   (b) npq   (c) pq   (d) nq

5. The variance of a binomial distribution is 2. Its S.D is

    (a) 2   (b) 4   (c) 0.5   (d) $\sqrt{2}$

6. The standard deviation of Poisson distribution with parameter λ is

    (a) λ (b) λ^2 (c)$\sqrt{\lambda}$ (d) nq

7. Normal distribution is a

    (a) continuous dist.   (b) discrete dist.   (c) both   (d) none

8. The normal curve is

    (a) bell shaped   (b) U – shaped   (c) J – shaped   (d) L – shaped

9. The normal equations in the second degree parabola are

    (a) 2   (b) 3   (c) 4   (d) 1

10. The measure characterizing a sample such as $\bar{X}$ or s is called

    (a) universe   (b) population   (c) mean   (d) statistic

11. Rejecting the hypothesis it is true is called

    (a) type I error   (b) type II error   (c) both (a) & (b)   (d) sample error

12. Large sample theory is applicable when

    (a) n>30   (b) n<30

    (c) n<100   (d) n>100

13. t – distribution range from

    (a) o to 1   (b) -1 to 1

    (c) o to ∞ (d) $-\infty$ to ∞

14. Chi-square distribution is

    (a) continuous   (b) multimodal

    (c) discrete   (d) symmetrical

15. In a 3 × 2 contingency table, there are_____cells

    (a) 12   (b) 9

    (c) 8   (d) 6

PART – B (2×5 = 10 Marks)

Answer any TWO Questions

16. Define (i) Random Variable (ii) Mathematical Expectation.
17. Obtain the binomial distribution for which mean is 10 and variance is 5 then find P(x ≤ 3).
18. Write a short note on Normal distribution.
19. Explain (i) Null Hypothesis and (ii) Standard Error.
20. State the properties of t-distribution.

PART – C (5×10= 50 Marks)

Answer ALL Questions

21. (a) State and prove addition theorem of Mathematical Expectation.

(Or)

(b) Find the mean and variance for the given probability density function"

$$f(x) = \begin{cases} x & ; 0 \leq x \leq 1 \\ 2 - x & ; 1 \leq x \leq 2 \\ 0 & ; otherwise \end{cases}$$

22. (a) A set of three similar coins are tossed 100 times with the following results:

No. of heads	0	1	2	3
Frequency	36	40	22	2

Fit a binomial distribution.

(Or)

(b) Derive the mean and variance for Poisson distribution.

23. (a) If the random variable X is normally distributed with mean 12 and standard deviation 4. Find (i) $P(x \geq 20)$ (ii) $P(x \leq 20)$ (iii) $P(0 < x < 12)$.

(Or)

(b) Fit a parabola of the form $y = a + bx + cx^2$.

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	0

24. (a) Write the test procedure for testing the significance of difference between the sample means and population proportions.

(Or)

(b) A college conducts both day and night classes intended to be identical. A sample of 100 day students yields examination results as under: $\bar{x}_1 = 72.4$ and $\sigma_1 = 14.8$, a sample of 200 night students yields examination results as under: $\bar{x}_2 = 73.9$ and $\sigma_1 = 17.9$, Are the two means are statistically equal at 10% level?

25. (a) Ten flower stems are chosen at random from a population and their heights are found to be (in cms) 63, 63, 66, 67, 68, 69, 70, 70, 71 and 71. Discuss whether the mean height of the population is 66 cms.

(Or)

(b) Out of 800 persons, 25% were literates and 300 had travelled beyond the limits of their district 40% of the literates were among those who had not travelled. Test whether there is any relation between travelling and literacy at 5% level

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(For the candidates admitted from 2021 –2022 onwards)
B.Sc DEGREE EXAMINATION
First and Third Semester
Allied: Statistical Methods – I
(Common for Geography)

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. From which language the word statistics is derived
   (a) greek   (b) latin   (c) english   (d) hindi
2. Tabulation follows

| | (a) classification | (b) numerical values | (c) rows | (d) columns |

3. Squares are_____dimensional diagrams
   (a) one   (b) two   (c) three   (d) four

4. Mean is a measure of
   (a) location   (b) dispersion   (c) correlation   (d) regression

5. The positional measure of central tendency is
   (a) A.M   (b) median   (c) G.M   (d) H.M

6. Mode of the series 12, 5, 10, 9, 3, 6 is
   (a) 6   (b) 9   (c) No mode   (d) 3

7. Range is
   (a) L-S   (b) L+S   (c) L-S/L+S   (d) L+S/L-S

8. Variance is the_____of Standard deviation.
   (a) cube   (b) equal   (c) square   (d) square root

9. Which of the following is a rough measure of dispersion?
   (a) standard deviation   (b) mean deviation   (c) coefficient variation   (d) range

10. Limits for correlation coefficient is
    (a) $-1 \leq r \leq 1$ (b) $0 \leq r \leq 1$ (c) $-1 \leq r \leq 0$ (d) $-1 \leq r \leq 2$

11. If $\sum d^2 = 0$, then rank correlation co-efficient is
    (a) 0   (b) 1   (c) -1   (d) 0.05

12. In a straight line equation $Y = a + bX$, then constant 'b' represents the
    (a) Intercept of the line   (b) slope of the line   (c) mean   (d) correlation

13. Statistical probability may also be termed as_____probability.
    (a) mathematical   (b) classical   (c) empirical   (d) priori

14. Probability can take values between
    (a) -1 and 1   (b) 0 and 1   (c) less than 1   (d) greater than 1

15. If two dice are thrown, then the probability that the sum is greater than 8 is
    (a) 1/3   (b) 1/2   (c) 5/18   (d) 7/18

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. What are the main parts of an ideal table? Explain.
17. What are the measures of central tendency?
18. What are the merits and demerits of range?
19. State the properties of regression coefficients.
20. Find the probability that a leap year selected at random will contain 53 Sundays.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) What do mean by statistics and write its limitations.

    (Or)

    (b) Draw a suitable diagram for the following items.

Year	Company A Profit	Company B
1998	195	80
1999	200	87
2000	165	45
2001	140	32

22. (a) Calculate the mean, mode for the data given below:

Class Intervals	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	8	12	20	10	7	3

(Or)

(b) Calculate the Median and Harmonic Mean for the following data:

X	2	3	4	5	6	7
F	8	12	20	10	6	4

23. (a) Calculate the quartile deviation for the following data:
    180, 1050, 250, 1400, 490

(Or)

(b) Calculate coefficient of variation for the following data:

Class interval	10-20	20-30	30-40	40-50	50-60
Frequency	8	10	12	8	4

24. (a) Calculate coefficient of rank correlation for the following data:

Price of Tea	88	90	95	70	60	75	50
Price of coffee	120	134	150	115	110	140	100

(Or)

(b) Compute the two regression equations from the following data.

X	1	2	3	4	5	6
Y	4	8	12	15	17	23

25. (a) State and prove addition theorem of probability.

(Or)

(b) A bag contains 6 red and 8 black balls. Another bag contains 7 red and 10 black balls. A bag is selected and a ball is drawn. Find the probability that it is a red ball.

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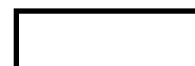
Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. A population consisting of unlimited number of units is called
   (a) infinite population   (b) finite population   (c) census   (d) sampling

2. The list of all the items of a population is known as
   (a) sampling   (b) sample size   (c) sample frame   (d) sampling unit
3. For homogeneous population_____sampling is better than stratified random sampling.
   (a) systematic   (b) simple random   (c) complete enumeration   (d) survey
4. Alternative hypothesis is
   (a) always left tailed   (b) always right tailed   (c) one tailed or two tailed   (d) always one tailed
5. When the hypothesis is false and the test accepts it is called
   (a) type I error   (b) type II error   (c) both (a) & (b)   (d) sampling error
6. Large sample theory is applicable when
   (a) n>30   (b) n<30   (c) n<100   (d) n>100
7. Student's t- test is applicable in case of
   (a) large samples   (b) more samples   (c) small samples   (d) equal samples
8. Paired t-test is applicable only when the observations are
   (a) paired   (b) correlated   (c) equal in number   (d) unequal
9. Chi-square distribution is
   (a) continuous   (b) multimodal   (c) discrete   (d) symmetrical
10. Analysis of variance (ANOVA) is one of the statistical tools developed by
    (a) Alfred   (b) Fisher   (c) Cowdon   (d) A.L Bowley
11. In the case of one-way classification the total variation can be split into
    (a) Two components   (b) Three components   (c) Four components   (d) one component
12. With 90, 35, 25 as TSS, SSR and SSC respectively in case of two way classification, SSE is
    (a) 50   (b) 40   (c) 30   (d) 20
13. A time series consists of
    (a) two components   (b) three Components   (c) four components   (d) five Components
14. An additive model of time series with components, T, S, C and I is
    (a) $Y = T \times S \times C \times I$ (b) $Y = T + S + C + I$ (c) $Y = T \times S + C \times I$ (d) $Y = T \times S \times C + I$
15. Periodic changes in a business time series are called ____
    (a) secular trend   (b) seasonal   (c) irregular   (d) cyclic

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Write the advantages and disadvantages of random sampling.
17. Define parameter and statistic.
18. Explain the term 'Degrees of freedom' and Level of Significance.
19. State all the assumptions involved in analysis of variance technique.
20. Discuss irregular variation in the context of time series.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain the probability and non-probability sampling?

(Or)

(b) Discuss the procedure of stratified random sampling. Give examples.

22. (a) Write the test procedure for testing significance difference between two proportions.

(Or)

(b) An examination was given to two classes consisting of 40 and 50 students respectively. In the first class the mean mark was 74 with a standard deviation of 8, while in the second class the mean

mark was 78 with a standard deviation of 7. Is there a significant difference between the performances of the two classes at a level of significance of 0.05?

23. (a) A group of 5 patients treated with medicine 'A' weigh 42, 39, 48, 60 and 41 kgs, second group of 7 patients from the same hospital treated with medicine 'B' weigh 38, 42, 56, 64, 68, 69 and 62 kgs. Do you agree with the claim that medicine 'B' increases the weight significantly?

(Or)

(b) Out of 800 persons, 25% were literates and 300 had travelled beyond the limits of their district 40% of the literates were among those who had not travelled. Test whether there is any relation between travelling and literacy at 5% level.

24. (a) Distinguish between one - way classification and two-way classification.

(Or)

(c) The following table gives the number of refrigerators sold by 4 salesmen in three months May, June and July. Carry out analysis of variance.

Months	Salesman			
	A	B	C	D
May	50	40	48	39
June	46	48	50	45
July	39	44	40	39

25. (a) Calculate three yearly moving average of the following data:

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Sales (in lakhs)	15	18	17	20	23	25	29	33	36	40

(Or)

(d) Obtain seasonal fluctuations from the following Quarterly output of coal for four years.

Year	2000	2001	2002	2003
I	65	58	56	61
II	58	63	63	67
III	70	59	56	52
IV	60	55	51	58

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Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The application of statistical methods in biology is called
(a) statistics in biology   (b) statistics in science   (c) biostatistics   (d) all the above

2. Number of fruits in a tree is
   (a) discrete variable   (b) continuous variables   (c) quantitative variable   (d) none
3. Pie diagram is a_____dimensional diagram.
   (a) one   (b) two   (c) three   (d) four
4. _____is that value of the variate which divides the group into two equal parts.
   (a) mean   (b) median   (c) mode   (d) range
5. Mode for 1, 2, 3, 4, 5, 6, 7 is
   (a) 6   (b) 0   (c) No mode   (d) 2
6. Geometric mean for two numbers (1/16) and (4/25) is
   (a) 1/10   (b) 1/100   (c) 10   (d) 100
7. Range is calculated by using
   (a) L-S   (b) L+S   (c) L-S/L+S   (d) L+S/L-S
8. The variate values which divide a series into four equal parts are called
   (a) quartiles   (b) deciles   (c) percentiles   (d) median
9. The mean of squared deviations about the mean is called
   (a) standard deviation   (b) mean deviation   (c) coefficient variation   (d) range
10. Limits for correlation coefficient is
    (a) $-1 \leq r \leq 1$ (b) $0 \leq r \leq 1$ (c) $-1 \leq r \leq 0$ (d) $-1 \leq r \leq 2$
11. Rank correlation was found by
    (a) Pearson   (b) Spearman   (c) Galton   (d) Fisher
12. If the two regression coefficients are negative then the correlation coefficients is
    (a) positive   (b) negative   (c) zero   (d) one
13. When the difference is_____, the null hypothesis is rejected.
    (a) not significant   (b) significant   (c) proportion   (d) ratio
14. Student's t- test is applicable in case of
    (a) large samples   (b) more samples   (c) small samples   (d) none
15. The value of χ^2 varies from _____
    (a) 0 to 1   (b) 0 to -1   (c) 0 to - ∞ (d) 0 to ∞

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. What are the main objectives of classification?
17. What are the characteristics for an ideal average?
18. What are the merits and demerits of geometric mean?
19. What are the uses of spearman's coefficient of rank correlation?
20. Explain large and small sample tests.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Define tabulation and write the uses of tables.

(Or)

(b) The following table provides the relative frequencies of blood lead concentrations for two groups of workers in Canada, one examined in 1979 and the other in 1987. Plot the histogram and frequency polygon for each year on separate graphs.

Blood Lead (mg/dL)	Relative frequency (%)	
	1979	1987
0-19	11.5	37.8
20-29	12.1	14.7

30-39	13.9	13.1
40-49	15.4	15.3
50-59	16.5	10.5
60-69	12.8	6.8
70-79	8.4	1.4
80-89	9.4	0.4

22. (a) Calculate the mean, median and mode for the data given below:

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	3	8	12	17	6	4

(Or)

(b) Find the G.M and H.M for the following data:

X	11	12	13	14	15
F	3	7	8	5	2

23. (a) Write short notes on (i) Range (ii) Quartile deviation and (iii) Mean deviation

(Or)

(b) Calculate the standard deviation for the following data:

Class interval	10-20	20-30	30-40	40-50	50-60
Frequency	8	10	12	8	4

24. (a) Calculate coefficient of correlation between price and supply

Price	8	10	15	17	20	22	24	25
Supply	25	30	32	35	37	40	42	45

(Or)

(b) Compute the two regression equations from the following data.

X	1	2	3	4	5	6
Y	4	8	12	20	32	52

25. (a) The mean lifetime of 100 fluorescent light bulbs produced by a company is computed to be 1570 hours with a standard deviation of 120 hours. If μ is the mean lifetime of all the bulbs produced by the company, test the hypothesis $\mu = 1600$ hours against the alternative hypothesis $\mu \neq 1600$ hours using a 5% level of significance.

(Or)

(b) Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their contents are found to weigh (in kg) as follows: 50, 49, 52, 44, 45, 48, 46, 45, 49, and 45. Test if the average packing can be taken to be 50 kg.

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(For the candidates admitted from 2021 –2022 onwards)
B.Com DEGREE EXAMINATION
Third Semester
Allied: Business Statistics – I
(Common for B.Com, B.Com (CA), B.Com (CS))

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Raw data means
   (a) primary data   (b) secondary data   (c) well classified data   (d) information

2. The headings of the row given in the first column of a table are called
   (a) stubs   (b) captions   (c) titles   (d) foot note
3. Find the mode: 7, 10, 15, 12, 7, 14, 24, 10, 7, 20, 10
   (a) 7   (b) 10   (c) 7 & 10   (d) 20
4. If the minimum value in a set is 9 and its range is 57, the maximum value of the set is
   (a) 33   (b) 66   (c) 48   (d) 24
5. The variate values which divide a series into four equal parts are called
   (a) quartiles   (b) deciles   (c) percentiles   (d) median
6. The mean of absolute deviations from an average is called
   (a) mean deviation   (b) standard deviation   (c) quartile deviation   (d) mean
7. If r = 0, the Cov(x,y) is
   (a) 0   (b) 1   (c) -1   (d) 0.5
8. Rank correlation was found by
   (a) Pearson   (b) Spearman   (c) Galton   (d) Fisher
9. Regression coefficient is independent of
   (a) scale   (b) origin   (c) both scale and origin   (d) none
10. Index numbers are_____averages.
    (a) specified   (b) positional   (c) weighted   (d) special
11. The condition for the time reversal test to hold good with usual notations is
    (a) $P_{01} \times P_{10} = 1$ (b) $P_{10} \times P_{01} = 0$ (c) $P_{01} / P_{10} = 1$ (d) $P_{01} + P_{10} = 1$
12. Find Laspeyre's index if Passche's index is 130 and Bowley's index is 142.5
    (a) 155   (b) 136.25   (c) 272.5   (d) 138.42
13. A time series in a set of values arranged in_____order
    (a) chronological   (b) geographical   (c) qualitative   (d) all the above
14. Irregular variation in a time series can be due to
    (a) trend variations   (b) seasonal variations   (c) unpredictable causes   (d) cyclic variation
15. Seasonal indices may be found out by using
    (a) graphic method   (b) moving average method   (c) simple average method   (d) none

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Write an essay on different types of classification.
17. Mention the characteristics of good measures of dispersion.
18. What are the types of correlation? Explain.
19. Explain index numbers and its types.
20. Write a short note on irregular variation.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Calculate Arithmetic Mean, Geometric Mean and Harmonic Mean for the following data.

C.I	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
F	3	7	13	17	12	10	8	8	6	6

(Or)

(b) Calculate the Mode for the following data.

Values	10-20	20-30	30-40	40-50	50-60
Frequency	3	2	1	7	3

22. (a) Find coefficient of Quartile Deviation for the following data:

X	250	300	325	350	375	400	600
F	20	14	6	26	9	13	4

(Or)

(b) From the following table calculate the Karl-Pearson's Coefficient of Skewness.

Profit (in Lakhs)	10-20	20-30	30-40	40-50	50-60
No. of Companies	18	20	30	22	10

23. (a) Calculate Spearman's Rank Correlation Coefficient for the following data:

X	15	20	28	12	40	60	20	80
Y	40	30	50	30	20	10	30	60

(Or)

(b) Compute the two regression equations from the following data.

X	10	12	13	12	16	15
Y	40	38	43	45	37	43

24. (a) Explain Time reversal and Factor reversal test.

(Or)

(b) Construct price index number from the following data by applying, (i) Laspeyre's Method (ii) Paasche's Method and (iii) Fisher's Method

Commodities	1999		1998	
	Price	Quantity	Price	Quantity
A	4	6	2	8
B	6	5	5	10
C	5	10	4	14
D	2	13	2	19

25. (a) Calculate 3 yearly moving averages of the following data.

Year	2001	2002	2003	2004	2005	2006	2007
Sales (Units)	21	22	23	25	24	22	25

(Or)

(b) Fit a straight line trend by the method of least square to the following data and also estimate the trend value of the year 1985.

Year	1979	1980	1981	1982	1983
Production	100	120	140	160	180

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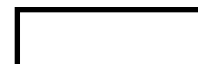
Time: Three Hours **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. If the number of rows and number of columns of a matrix are equal then it is called a _____
   (a) unit matrix   (b) scalar matrix   (c) square matrix   (d) row matrix

2. A Square matrix A is said to be singular, if $|A|$ =
   (a) 0   (b) 1   (c) less than 0   (d) less than 1

3. The value of $\begin{vmatrix} 2 & -1 \\ 0 & 1 \end{vmatrix}$ is
   (a) 1   (b) 2   (c) 3   (d) -1

4. The common difference of the sequence 5, 8, 11, 14, … is
   (a) 3   (b) -3   (c) 5   (d) 0

5. Which of the function symbol is called backward difference?
   (a) Δ (b) A   (c) δ (d) $\in$

6. Lagrange's interpolation formula can be used for
   (a) equal intervals only   (b) unequal intervals only   (c) both (a) and (b)   (d) none of these

7. The sum of the probability of an event and non-event is
   (a) 0   (b) 1   (c) 0 to 1   (d) -1

8. If the outcome of one event does not influence another event then the two events are
   (a) mutually exclusive   (b) dependent   (c) independent   (d) not mutually

9. The probability of drawing a spade from a pack of card is
   (a) 1/52   (b) 1/13   (c) 4/13   (d) 1/4

10. Linear programming problems which involve only two variables can be solved by
    (a) graphic method   (b) simplex method   (c) Big-M method   (d) none of these

11. A solution which maximizes or minimizes the given LPP is called
    (a) a solution   (b) a feasible solution   (c) an optimal solution   (d) none of these

12. It should be noted that the optimal value of LPP occurs at the corner points of the feasible region
    (a) solution (b) optimal solution   (c) feasible solution   (d) no solution

13. North-West Corner refers to _____
    (a) top left corner   (b) top right corner
    (c) bottom right corner   (d) bottom left corner

14. Solution for transportation problem using_____method is mostly nearer to an optimal solution.
    (a) NWCM   (b) LCM   (c) VAM   (d) Row Minima

15. In an assignment problem involving four workers & three jobs, total number of assignments possible are
    (a) 4   (b) 3   (c) 7   (d) 12

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Define (i) Scalar Matrix and (ii) Determinant
17. Define Sequence and Series.
18. Define Mutually Exclusive Events and Independent Events.
19. State the characteristics of standard form of LPP.
20. Distinguish between Transportation Problem and Assignment Problem.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) If $A = \begin{pmatrix} 1 & 2 \\ 1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 0 & -1 \\ 1 & 2 \end{pmatrix}$, then show that $(AB)^{-1} = B^{-1} A^{-1}$.

    (Or)

    (b) Solve by using matrix inversion method: 3x-2y+3z = 8, 2x+y-z = 1, 4x-3y+2z = 4

22. (a) Find the sum of the series 7 + 77 + 777 + . . .

    (Or)

    (b) Use Lagrange's formula and estimate from the following data for the number of workers getting income not exceeding Rs. 26 per month.

Income not exceeding (Rs.)	15	25	30	35

| No. of Workers | 36 | 40 | 45 | 48 |

23. (a) State and prove the addition theorem on probability.

(Or)

(b) A problem in mathematics is given to three students Dayan and, Ramesh and Naresh whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively. What is the probability that the problem will be solved?

24. (a) Solve the following LPP by the graphical method

Maximize $Z = 3x_1 + 2x_2$

Subject to

$-2x_1 + x_2 \leq 1$

$x_1 \leq 2$

$X_1 + x_2 \leq 3$ and $x_1, x_2 \geq 0$

(Or)

(b) Solve the following LPP by simplex method

Maximize $Z = 6x_1 + 2x_2$

Subject to

$x_1 + x_2 \leq 4$

$x_1 - x_2 \leq 2$ and $x_1, x_2 \geq 0$

25. (a) Explain Vogel's approximation method by obtaining initial feasible solution of the following T.P.

	D1	D2	D3	D4	Supply
O1	2	3	11	7	6
O2	1	0	6	1	1
O3	5	8	15	9	10
Demand	7	5	3	2	

(Or)

(b) Solve the following assignment problem for the Cell values represent cost of assigning job A, B, C and D to the machines I, II, III and IV are given below.

Machines

		I	II	III	IV
Jobs	A	10	12	19	11
	B	5	10	7	8
	C	12	14	13	11
	D	8	15	11	9

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(For the candidates admitted from 2021 –2022 onwards)

B.A DEGREE EXAMINATION

Third Semester

Allied: Statistical Methods for Economics
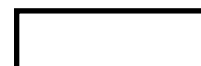
Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)

Answer ALL Questions

1. The origin of statistics can be traced to
   (a) commerce   (b) economics   (c) statehood   (d) econometrics

2. Data which are not originally collected

(a) secondary data   (b) primary data   (c) numerical data   (d) all the above

3. Classification and tabulation are the two methods used to
   (a) present the data   (b) condense the data   (c) study the data   (d) prepare the data

4. The class interval of the continuous group data is 0-9, 10-19, 20-29, 30-39
   (a) 10   (b) 9   (c) 4.5   (d) 14.5

5. Which of the following is one dimensional diagram?
   (a) bar diagram   (b) pie diagram   (c) cylinder   (d) histogram

6. Which is the three dimensional diagram?
   (a) cube   (b) cylinder   (c) sphere   (d) all the above

7. With the help of histogram we can draw
   (a) frequency polygon   (b) frequency curve   (c) frequency distribution   (d) all the above

8. More than and less than type Ogives are intersect at a point of
   (a) mean   (b) median   (c) mode   (d) all the above

9. _____curve is graphical method of studying dispersion.
   (a) lorenz   (b) frequency   (c) Ogives   (d) histogram

10. Mean for 2, 4, 6, 8, 10 is
    (a) 4   (b) 6   (c) 8   (d) 10

11. Shoe size of most of the people in India is No. 7 which measure of central value does is represented?
    (a) mean   (b) median   (c) mode   (d) all the above

12. Find the mode 13, 23, 33, 43, 41, 31, 23, 11
    (a) 13   (b) 23   (c) 33   (d) 31

13. Coefficient of range is
    (a) L-S/L+S   (b) L-S   (c) L+S   (d) L+S/L-S

14. _____deviation is also called Root-Mean Square Deviation.
    (a) Quartile   (b) mean   (c) standard   (d) all the above

15. If Variance is 36, then the value of standard deviation is
    (a) 8   (b) 9   (c) 6   (d) 4

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Write down the rules for tabulation.
17. What are the significance of diagrams?
18. What is Lorenz Curve?
19. Give merits and demerits of mode.
20. Define quartile deviation and coefficient of quartile deviation.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Explain the scope of statistics in economics.
            (Or)
    (b) What are the points that are to be considered in the use of primary data?

22. (a) Represent the following data by a percentage bar diagram.

Particulars	Factory A	Factory B
Selling price	400	650
Quantity sold	240	365
Wages	3500	5000
Materials	2100	3500

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Miscellaneous	1400	2100

(Or)

(b) Draw a Pie diagram for the following data of sugar in quintals of various countries.

Country	Production of Sugar (in quintals)
Cuba	62
Australia	47
India	35
Japan	16
Egypt	6

23. (a) For the following data, draw a histogram.

Class interval	21-30	31-40	41-50	51-60	61-70	71-80
Frequency	6	15	22	31	17	9

(Or)

(b) Draw an Ogive curve from the following data:

Classes	90-100	100-110	110-120	120-130	130-140	140-150	150-160
Frequency	16	22	45	60	50	24	10

24. (a) Find the median for the following data:

Mid values	5	15	25	35	45	55	65	75
Frequency	7	10	15	17	8	4	6	7

(Or)

(b) Calculate the geometric mean and harmonic mean of the following series of monthly income of a batch for families 180, 250, 490, 1400, 1050.

25. (a) Calculate the coefficient of mean deviation for the following data:

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	10	25	30	20	15

(Or)

(b) Find the standard deviation for the following data:

Variable	1	2	3	4	5
Frequency	5	2	5	4	4

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(For the candidates admitted from 2021 –2022 onwards)
B.A DEGREE EXAMINATION
Fourth Semester
Allied: Applied Statistics for Economics

Time: Three Hours   Maximum: 75 Marks

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. Correlation coefficient is independent of change of
   (a) origin   (b) scale   (c) origin and scale   (d) units

2. The nature of correlation for shoe size and I.Q is
   (a) positive correlation   (b) negative correlation   (c) no correlation   (d) linear

3. Rank correlation coefficient is given by

(a) $1 + \frac{6\sum d^2}{n^3 - n}$ (b) $1 - \frac{6\sum d^2}{n^3 - n}$ (c) $1 + \frac{6\sum d^3}{n^3 - n}$ (d) $1 + \frac{6\sum d^2}{n^3 + n}$

4. The regression analysis measures the ------------- between X and Y

(a) independency (b) dependency (c) both (a) & (b) (d) none of the above

5. The geometric men of two regression coefficients b_{xy} and b_{yx} is equal to

(a) r (b) r^2 (c) 1 (d) 0

6. If $b_{xy} = -3/2$ and $b_{yx} = -3/2$ then the correlation coefficient 'r' is,

(a) 3/2 (b) -3/2 (c) 9/4 (d) -9/4

7. A time series consists of_____components.

(a) two (b) three (c) four (d) five

8. Irregular variations are

(a) regular (b) cyclic (c) episodic (d) seasonal

9. Simple average method is used to calculate

(a) trend Values (b) cyclic Variations (c) seasonal indices (d) secular trend

10. Index numbers are barometers of

(a) the planning (b) the science (c) an economy (d) the models

11. Index numbers help in framing of

(a) polices (b) data (c) planning (d) all the above

12. The best average in the construction of index numbers is _____

(a) mean (b) geometric mean (c) harmonic mean (d) none

13. Data collected from each and every unit of the population is called

(a) census method (b) sampling method (c) primary data (d) secondary data

14. A sample is a study of_____of the population

(a) simple (b) parts (c) both (a) & (b) (d) none of the above

15. Which one of the following method is in Probability sampling?

(a) quota sampling (b) snowball sampling (c) systematic sampling (d) none

PART – B (2×5 = 10 Marks)

Answer any TWO Questions

16. Mention the important properties of correlation coefficient.

17. Explain the concept of regression and state their numerical measures.

18. What is cyclical variation?

19. What is meant by consumer price index number? What are its uses?

20. Explain systematic sampling.

PART – C (5×10= 50 Marks)

Answer ALL Questions

21. (a) Calculate the Karl Pearson's correlation coefficient between the marks (out of 10) in statistics and mathematics of 6 students.

Statistics	7	4	6	9	3	8
Mathematics	8	5	4	8	3	6

(Or)

(b) The following are the ranks obtained by 10 students in Tamil and English. Calculate the Spearman's rank correlation coefficient.

Tamil	1	2	3	4	5	6	7	8	9	10
English	1	4	2	5	3	9	7	10	6	8

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22. (a) Compute the two regression equations from the following data. Estimate the value of X = 3.5 what will be the value of Y.

X	1	2	3	4	5
Y	3	4	5	6	7

(Or)

(b) Given the following data, estimate the marks in statistics obtained by a student who has scored 60 marks in English. Mean of marks in Statistics = 80, Mean of marks in English = 50, S.D of marks in Statistics = 15, S.D of marks in English = 10 and Coefficient of correlation = 0.4.

23. (a) Find the trend for the following data by the method of 3 yearly moving average.

Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Production	15	21	30	36	42	46	50	56	63	70	74	82

(Or)

(b) Fit a straight line trend by the method of least squares to the following data and calculate trend values. Estimate the sales for the year 2005.

Year	1993	1994	1995	1996	1997
Sales (in lakhs)	4	6	7	8	10

24. (a) Construct price index number from the following data by applying, (i) Laspeyre's Method (ii) Paasche's Method and (iii) Fisher's Method and (iv) Bowley's Method

Commodities	1999		1998	
	Price	Quantity	Price	Quantity
A	4	6	2	8
B	6	5	5	10
C	5	10	4	14
D	2	13	2	19

(Or)

(b) Calculate index numbers from the following data taking prices of 1995 as base:

Commodities	Weight	Price (1995)	Price (1998)
A	40	16	20
B	25	40	60
C	5	2	3
D	20	5	7
E	10	2	4

25. (a) What is sampling? Write the merits and demerits of sampling.

(Or)

(b) Explain the probability sampling methods.

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(For the candidates admitted from 2021 –2022 onwards)
B.B.A DEGREE EXAMINATION
First Semester
Allied : Business Mathematics and Statistics - I
(Common for B.B.A / B.B.A (Retail Management) /B.B.A (CA) /B.B.A (International Business))

Time: Three Hours

Maximum: 75 Marks

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. A sequence is said to be in_____if its terms continuously increase or decrease by a fixed number.
   (a) A.P   (b) G.P   (c) H.P   (d) series

2. In a sequence if every term bear to the preceeding term a constant ratio then it is called-------- --.

(a) A.P   (b) G.P   (c) H.P   (d) series

3. The reciprocals of the terms of an _____ form an H.P.

    (a) A.P   (b) G.P   (c) H.P   (d) series

4. [0 0 0] is a

    (a) Unit matrix   (b) Scalar matrix   (c) Null matrix   (d) square matrix

5. [6 2 -3] is a matrix of order

    (a) 3 × 3   (b) 3 × 1   (c) 1 × 3   (d) 1 × 1

6. The value of $\begin{vmatrix} 1 & -1 \\ 0 & 0 \end{vmatrix}$ is

    (a) 1   (b) 0   (c) -1   (d) 2

7. The word statistics is derived from the latin word

    (a) statistic   (b) status   (c) statista   (d) statistik

8. Data which are originally collected is

    (a) secondary data   (b) primary data   (c) numerical data   (d) all the above

9. A table which contains data on two characteristics is called

    (a) one way table   (b) two way table   (c) manifold table   (d) simple table

10. Which of the following is a measure of central value?

    (a) Median   (b) Deciles   (c) Quartiles   (d) Percentiles

11. Mode is that value in a frequency distribution which possesses

    (a) minimum frequency (b) maximum frequency   (c) frequency one   (d) all the above

12. Find the combined mean for the data given below $n_1=20$, $\bar{X_1}=4$, $n_2=30$, $\bar{X_2}=3$

    (a) 3   (b) 3.4   (c) 3.6   (d) 3.8

13. Coefficient of range is

    (a) L-S/L+S   (b) L-S   (c) L+S   (d) L+S/L-S

14. The standard deviation is commonly denoted by the Greek letter is

    (a) m   (b) φ (c) σ (d) p

15. If the Standard deviation is 6, then the variance is

    (a) 6   (b) 36   (c) 12   (d) 4

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Define Sequence and Series.
17. Explain difference between Matrix and Determinant.
18. What are the functions of statistics?
19. What do you meant by measures of central tendency?
20. What is a coefficient of variation?

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a)   (i) Find three numbers in A.P whose sum is 12 and the sum of whose cubes is 408.

          (ii) Find four integers in A.P whose sum is 16 and product is 105.

(Or)

(b) Find the 4th and 7th terms of the H.P. 1/2, 4/13, 2/9, . . .

22. (a) Find the Adjoint of A=$\begin{bmatrix} 3 & 1 & 2 \\ 2 & 2 & 5 \\ 4 & 1 & 0 \end{bmatrix}$

(Or)

(b) Solve by Cramer method:

          2X+3Y+3Z = 22

$$X-Y+Z = 4$$
$$4X+2Y-Z = 9$$

23. (a) Explain the method of collecting primary data.

    (Or)

    (b) Draw a histogram and frequency curve from the following data:

Class Interval	90-100	100-110	110-120	120-130	130-140	140-150	150-160
Frequency	16	22	45	60	50	24	10

24. (a) Find the Mean and Median for the following data:

Class interval	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16
Frequency	45	50	65	70	30	25	20	18

    (Or)

    (b) Calculate the geometric and harmonic mean of the following series of monthly expenditure of a batch of students. 125, 130, 75, 10, 45, 0.5, 0.40, 500, 150, 5.

25. (a) Calculate the coefficient of range for the following data:

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	10	25	30	20	15

    (Or)

    (b) Find the standard deviation for the following data:

Variable	1	2	3	4	5
Frequency	5	2	5	4	4

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(For the candidates admitted from 2021 –2022 onwards)
B.B.A DEGREE EXAMINATION
Second Semester
Allied: Business Mathematics and Statistics – II
(Common for B.B.A / B.B.A (Retail Management) /B.B.A (CA) /B.B.A (International Business))

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The money paid for the use of money borrowed is called
   (a) amount   (b) loan   (c) principal   (d) interest

2. Compound interest formula is

(a) $p\left[\left(1 + \frac{r^2}{100}\right)^2 - 1\right]$
(b) $p\left[\left(r + \frac{r^2}{100}\right)^2 - 1\right]$
(c) $p*\left(1 + \frac{r}{100}\right)^{»} - 1+$
(d) $p*\frac{r^2}{100} + -1$

3. Rs. 800 at 5% p.a. C.I. will amount to Rs. 882 in
    (a) 1 year   (b) 2 years   (c) 3 years   (d) 4

4. The process of finding the values inside the interval (X_0, X_n) is called
    (a) interpolation   (b) extrapolation   (c) polynomial equation   (d) iterative

5. Newton's forward interpolation formula is used for_____intervals.
    (a) open   (b) unequal   (c) equal   (d) closed

6. Which of the following symbol is called backward difference operator?
    (a) Δ (b) A (c) δ (d) $\in$

7. Coefficient of correlation lies between
    (a) +1 and 0   (b) -1 and -1   (c) +1 and +1   (d) -1 and +1

8. If $\sum d^2 = 0$, the rank correlation is
    (a) -1   (b) 0.5   (c) 0   (d) 1

9. Regression means----------between variables
    (a) average relationship   (b) relationship   (c) no relationship   (d) total relation

10. Components of times series are of
    (a) two types   (b) three types   (c) four types   (d) six types

11. Identify Irregular variations is
    (a) earth quakes   (b) temperature   (c) sales   (d) festival

12. Simple average method is
    (a) biggest method   (b) easiest method   (c) secular trend method   (d) straight line

13. Index numbers are expressed in_____
    (a) percentage   (b) numbers   (c) values   (d) both (a)and (b)

14. _____is known as ideal index number.
    (a) Fisher's   (b) Kelly's   (c) Bowley's   (d) Passche's

15. Circular test is an extension of
    (a) Unit test   (b) Time reversal test   (c) Factor reversal test   (d) both (a) and

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Define simple interest and compound interest.
17. Explain Newton's forward difference method.
18. Explain scatter diagram.
19. What are the merits and demerits of the semi-average method?
20. What do meant by index numbers? Write its uses.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) At what rate percent p.a. C.I. will Rs. 2,000 amount to Rs. 3,000 in 3 years if the interest is reckoned half yearly?

(Or)

(b) An equipment is purchased on an installment basis such that Rs. 5000 is to be paid on the signing of the contract and four yearly installments of Rs. 3,000 each payable at the end of first, second, third and fourth year. If the interest is charged at 5% p.a. Find the cash down price.

22. (a) Solve the following by using Newton's forward interpolation formula.

X	0	1	2	3
f(x)	1	2	1	1

(Or)

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(b) Using Lagrange's interpolation formula find Y(10) from the following table:

X	5	6	9	11
Y	12	13	14	16

23. (a) The following data gives the heights (in inches) of father and his eldest son. Compute the correlation coefficient between the heights of fathers and sons using Karl Pearson's method.

Height of father	65	66	67	67	68	69	70	72
Height of son	67	68	65	68	72	72	69	71

(Or)

(b) Find the linear regression equation of percentage worms (Y) on size of the crop (X) based on the following seven observations.

Size of the crops (X)	16	15	11	27	39	22	20
Percentage worms (Y)	24	25	34	40	35	20	23

24. (a) Draw a trend line by the method semi average:

Year	1992	1993	1994	1995	1996	1997
Sales (in '000 tonnes)	21	23	25	23	26	25

(Or)

(b) Estimate the value of production for the year 1995 by using the method of least square from the following data.

Year	1991	1992	1993	1994	1995
Production ('000 tonnes)	70	72	88	90	92

25. a) Construct the price indices from the following data by applying (i) Laspeyre's method (ii) Paasche's method and (iii) Fisher ideal number by taking 2010 as the base year.

Commodity	2010		2011	
	Price	Quantity	Price	Quantity
A	15	15	22	12
B	20	5	27	4
C	4	10	7	5

(Or)

(b) Compute price index for the following data by applying weighted average of price relative method using (i) arithmetic mean and (ii) geometric mean.

Item	Price (Rs.) in 2006	Price (Rs.) in 2007	Quantity (Rs.) in 2006
A	2	2.5	40
B	3	3.25	20
C	1.5	1.75	10

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(For the candidates admitted from 2021 –2022 onwards)
B.SC STATISTICS DEGREE EXAMINATION

21USTA15

Semester - III
APPLIED NUMERICAL METHODS

Time: Three Hours **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. The order of convergence in Newton Rapson method is
   (a) 0 (b) 1 (c) 2 (d) 3
2. The Newton Raphson method is also called as_____method.
   (a) Tangent (b) Secant (c) Chord (d) Diameter

3. The equation $f(x)$ is given as $x^2- 4=0$. Keeping the approximation at x=6, then the value of x_1 is given as

(a) 10/3   (b) 4/3   (c) 7/3   (d) 13/3

4. Which one of the following symbol is called as forward difference operator?

(a) Δ   (b) δ   (c) A   (d) E

5. The r th forward difference operatorΔ^r is

(a) $\Delta^r f(x) = \Delta^{r-1} f(x +h) - \Delta^{r-1} f(x)$, r = 1,2,…..   (b) $A^r f(x) = A^{r-1} f(x +h) - A^{r-1} f(x)$, r = 1,2,…..

(c) $E^r f(x) = E^{r-1} f(x +h) - E^{r-1} f(x)$, r = 1,2,…..   (d) $\delta f(x) = \delta^{r-1} f(x +h) - \delta^{r-1} f(x)$, r = 1,2,…..

6. The forward difference operator Δ is denoted by

(a) Δ f(x)=f(x+h)-f(x)   (b) A f(x)=f(x+h)-f(x)

(c) E f(x)=f(x+h)-f(x)   (d)δf(x)=f(x+h)-f(x)

7. Interpolation formula is based on the fundamental assumption that the data can be expressed as

(a) a linear function   (b) a quadratic function

(c) a polynomial function   (d) none of the above

8. Interpolation is helpful in estimating

(a) missing value of a series   (b) an intermediary value for a given argument

(c) the argument for a given entry   (d) all the above

9. The Lagrange's formula for (n + 1) pairs of arguments and entries are

(a) a polynomial of degree n in x   (b) a polynomial of degree n in y

(c) a polynomial in x in which each term has degree n   (d) all the above

10. The process of finding the derivative of a function at value some particular of the independent variable is

(a) numerical value   (b) numerical differentiation

(c) numerical integration   (d) quadrature

11. In the Newton's backward difference formula the value of v is

(a) $v = (x - x_n) / h$ (b) $v = (x - x_0)/ h$

(c) $v = (x - x_n)$ (d) $v = (x + x_n)$

12. In the Newton's forward difference formula the value of u is

(a) $u = (x - x_0) / h$ (b) $u = (x + x_0)/ h$

(c) $u = (x - x_0)$ (d) $u = (x + x_0)$

13. While evaluating the definite integral by Trapezoidal rule, the accuracy can be increased by taking

(a) large number of sub intervals   (b) even number of sub intervals

(c) h = 4   (d) has a multiple of 3

14. While applying Simpsons 3/8 rule, the number of sub intervals should be

(a) odd   (b) even   (c) 4   (d) 3

15. Taylor series method will be very useful to give some_____for powerful numerical methods.

(a) initial value   (b) final value

(c) middle value   (d) quartile value

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Find the real root of the equation $f(x) = x^3 - x - 1$ by Bisection method.
17. Write the difference between the operators E and Δ.
18. Use Lagrange's interpolation formula to find y = 7.

X	1	3	4
Y	4	12	19

19. Explain Errors in Numerical differentiation.
20. Evaluate $\int_1^3 (\frac{1}{x}) \, dx$, by Simpsons rule with 4 strips.

21. (a) Find the real root of the equation f(x) = x³ + x²– 1 by Regula- Falsi method.

(Or)

(b) Find the real root of the equation f(x) = sin x + x -1, by Secant Method.

22. (a) Define the operators Δ, δ, A and E and show that

(i) Δ ≡ A E   (ii) A ≡ E⁻¹ Δ   (iii) A ≡ 1 − E⁻¹   (iv) E≡ (1 + Δ)

(Or)

(b) Show that E =≡ 1 + Δ and Δ ≡ A (1- A)⁻¹. Also deduce that 1 + Δ ≡ (E -1) A⁻¹

23. (a) Use Newton's method to find the value of y when x =4.

X	3	5	7	9	11	13
Y	7	11	15	19	23	27

(Or)

(b) Use Lagrange's interpolation formula and find y = 5.

X	1	3	4	6	10	12
Y	3	5	8	11	15	18

24. (a) From the following table, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x = 1.2.

X	1.0	1.2	1.4	1.6	1.8	2.0	2.2
Y	2.7183	3.3201	4.0552	4.9530	6.0496	7. 3891	9.0250

(Or)

(b) From the following table, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x = 1.6, choosing x_0 = 1.6.

X	1.0	1.2	1.4	1.6	1.8	2.0	2.2
Y	2.7183	3.3201	4.0552	4.9530	6.0496	7. 3891	9.0250

25. (a) Evaluate $\int_0^1 (\frac{1}{1+x}) dx$ by (i) Trapezoidal rule (ii) Simpsons (3/8) rule.

(Or)

(b) Determine the value of y when x = 0.1 given that y(0) = 1 and y' = x² + y by using modified Euler's method

****

Part – A (15×1 = 15 Marks)
Answer ALL Questions

1. All keywords in C are in _____
   (a) Lower Case letters   (b) Upper Case letters   (c) Camel Case letters   (d) All the above
2. Which of the following is not a valid variable name declaration?
   (a) int _a3;   (b) int _3a;   (c) int _A3;   (d) int _A33;
3. The format identifier '%i' is also used for_____data type.

(a) char   (b) int   (c) float   (d) double

4. Which for loop has range of similar indexes of 'i' used in for (i = 0;i < n; i++)?
   (a) for (i = n; i>0; i–)   (b) for (i = n; i >= 0; i–)
   (c) for (i = n-1; i>0; i–)   (d) for (i = n-1; i>-1; i–)

5. Which keyword can be used for coming out of recursion?
   (a) break   (b) return   (c) exit   (d) both (a) and (b)

6. Which keyword is used to come out of a loop only for that iteration?
   (a) break   (b) continue   (c) return   (d) if

7. Comment on the following pointer declaration, nt *ptr, p;
   (a) ptr is a pointer to integer, p is not   (b) ptr and p, both are pointers to integer
   (c) ptr is a pointer to integer, p may or may not be   (d) ptr and p both are not pointers to integer

8. What is a pointer?
   (a) a keyword used to create variables
   (b) a variable used to store address of an instruction
   (c) a variable used to store address of other variable
   (d) a variable used to store address of a structure

9. How many main() function we can have in our project?
   (a) 1   (b) 2   (c) depends on complier   (d) no limit

10. How will you free the allocated memory?
    (a) remove(var-name);   (b) free(var-name);
    (c) delete(var-name);   (d) dalloc(var-name);

11. What is the similarity between a structure, union and enumeration?
    (a) All of them let you define new values   (b) all of them let you define new data types
    (c) All of them let you define new pointers   (d) All of them let you define new structures

12. What is stderr?
    (a) standard error   (b) standard error type
    (c) standard error streams   (d) standard error definition

13. A file opened in w+ mode can be
    (a) read / write   (b) only read   (c) only write   (d) none

14. The EOF is equivalent to
    (a) -1   (b) 0   (c) 1   (d) 2

15. What will the function randomize() do in Turbo C under DOS?
    (a) returns a random number.
    (b) returns a random number generator in the specified range.
    (c) returns a random number generator with a random value based on time.
    (d) return a random number with a given seed value.

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain the importance of C language.
17. Write a general structure of 'if ' statement with example.
18. Describe the features of pointers.
19. What are the Different ways of representing Structures and Functions?
20. Explain random access to files.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Write detailed notes on C data types.

(Or)

(b) Write a C program for finding an area of a circle.

22. (a) Explain various branching statements in C with examples.

(Or)

(b) Write a program to print the following outputs using for loops.

```
1
2    2
3    3    3
4    4    4    4
5    5    5    5
```

23. (a) Explain the concept of two-dimensional array.

(Or)

(b) Explain string handling functions with example.

24. (a) Compare functions and structures.

(Or)

(b) Explain nested structure with diagram.

25. (a) Explain the following functions:

(i) scanf( ) and fscanf( )

(ii) getc( ) and getchar( )

(Or)

(b) Write a program for find a mean, median and mode for the given data.

Time: Three Hours   **Maximum: 75 Marks**

Part – A (15×1 = 15 Marks)

Answer ALL Questions

1. The origin of statistics can be traced to
   (a) state   (b) commerce   (c) economics   (d) industry

2. A sample is a study_____of the population
   (a) simple   (b) parts   (c) limit   (d) survey

3. A study based on complete enumeration is known as
   (a) sample survey   (b) census survey   (c) complete survey   (d) pilot survey

4. A Data which are collected first hand by the investigator is called
   (a) secondary data   (b) primary data   (c) sample   (d) census

5. The data collected from published report is known as
   (a) secondary data   (b) primary data
   (c) collection of data   (d) raw data

6. A suitable method of collecting data in cases where the informants are illiterate is
   (a) schedules   (b) questionnaire
   (b) (c) experiment   (d) table

7. Classification is the process of arranging data in
   (a) different columns   (b) different rows
   (c) different rows and columns   (d) grouping of related facts in different columns.

8. Geographical classification means classification of data according to
   (a) time   (b) location
   (c) attributes   (d) quantity

9. A table in which the data are classified according to more characteristics is called
   (a) Simple table   (b) manifold table
   (c) two-way table   (d) simple table

10. One dimensional diagrams are drawn on the basis of
    (a) length   (b) width   (c) height   (d) breadth

11. Squares are_____dimensional diagrams
    (a) one   (b) two   (c) three   (d) four

12. Pie chart represents the components of a factor by
    (a) percentages   (b) angles   (c) sectors   (d) circles

13. A_____is a visual form of presentation of statistical data.
    (a) graph   (b) diagram   (c) both (a) & (b)   (d) none

14. Histogram is a graph of
    (a) frequency distribution   (b) frequency curve
    (c) class interval   (d) mid points

15. When cumulative frequencies are plotted on a graph, then the frequency curve obtained is called
    (a) ogive curve   (b) linear curve
    (c) non-linear curve   (d) frequency curve.

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. Explain the limitations of statistics.
17. Distinguish between primary and secondary data.
18. What is discrete and continuous frequency distribution?
19. How diagrams are useful in representing statistical data.
20. What is a graph? List various types of graphs.

PART – C (5×10= 50 Marks)
Answer any TWO Questions

21. (a) Explain the functions of statistics.

(Or)

(b) Explain the two methods of selecting a simple random sampling.

22. (a) Define primary data. Explain the methods of collecting primary data.

(Or)

(b) State the characteristics of a good questionnaire.

23. (a) Write a detail note on the types of classification.

(Or)

(b) What are the main parts of an ideal table? Explain.

24. (a) Explain the various types of diagrams with suitable examples.

(Or)

(b) Draw a Pie diagram for the following data of production of sugar in quintals of various countries.

Country	Production of Sugar (in quintals)
Cuba	62
Australia	47
India	35
Japan	16
Egypt	6

25. (a) Write short notes on
   i. Histogram
   ii. Frequency Polygon
   iii. Frequency curve
   iv. Ogive.

(Or)

(b) Draw Histogram , frequency polygon and frequency curve from the data given below:

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of students	20	32	40	45	50	48	36	22	15

****

Part – A (15×1 = 15 Marks)

Answer ALL Questions

1. Which one of the following is a measure of central value?
   (a) Mean   (b) Deciles   (c) Quartiles   (d) Percentiles

2. The median of the variate values 11, 7, 6, 9, 12, 15, 19 is
   (a) 9   (b) 12   (c) 15   (d) 11

3. Mode is that value in a frequency distribution which possesses

(a) minimum frequency　　　　　　　　　　(b) maximum frequency
(c) frequency one　　　　　　　　　　　　(d) none of the above

4. Which one of the given measure of dispersion is considered best?
   (a) standard deviation　　　　　　　　　(b) range
   (c) quartile deviation　　　　　　　　　(d) coefficient of variation

5. The range of 6, 10, 4, 15, 8, 24 is
   (a) 9　　　　　　(b) 10　　　　　　(c) 11　　　　　　(d) 12

6. The square root of the variance of a distribution is
   (a) Standard deviation　(b) Mean　　　(c) Range　　　　　(d) Mode

7. The Limits of correlation coefficient is
   (a) $-1 \leq r \leq 1$　　(b) $0 \leq r \leq 1$　　(c) $-1 \leq r \leq 0$　　(d) $1 \leq r \leq 2$

8. When $r = +1$, the correlation is
   (a) positive correlation　　　　　　　　(b) perfect positive correlation
   (c) negative correlation　　　　　　　　(d) perfect negative correlation

9. Rank correlation coefficient is obtained by using the formula
   (a) $1 + \frac{6 \sum d^2}{n^3 - n}$　　(b) $1 - \frac{6 \sum d^2}{n^3 - n}$　　(c) $1 + \frac{6 \sum d^3}{n^3 - n}$　　(d) $1 + \frac{6 \sum d^2}{n^3 + n}$

10. A time series consists of＿＿＿＿＿components.
    (a) two　　　　(b) three　　　　(c) four　　　　(d) five

11. The variations caused by war, earthquakes, strikes flood, revolution etc., is called
    (a) seasonal variation　(b) cyclical variation　(c) irregular variation　(d) secular trend

12. The most widely used method of measuring Seasonal variations is
    (a) simple average method　　　　　　(b) ratio to moving average method
    (c) ratio to trend method　　　　　　(d) link relative method

13. Index numbers are barometers of an
    (a) planning　　　(b) science　　　(c) economy　　　(d) models

14. The best average in the construction of index number is
    (a) median　　　(b) mode　　　(c) Geometric mean　　　(d) AM

15. Family budget method is a method to calculate ＿＿＿＿＿
    (a) consumer price index.　(b) price index.　(c) quantity index.　(d) all

PART – B (2×5 = 10 Marks)
Answer any TWO Questions

16. What are the characteristics of a good measure of central tendency?
17. What do you understand by dispersion? State the different methods of measuring it. .
18. What is a scatter diagram? How does it help us in studying correlation?
19. What is a time series and explain the components of time series?
20. What is an index number and write its uses.

PART – C (5×10= 50 Marks)
Answer ALL Questions

21. (a) Calculate Mean, Median and Mode for the following data:

Wages (Rs.)	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70
No. of workers	12	18	22	27	17	23	29	8

(Or)

(b) Calculate median and mode for the given data:

Mid-point	59	61	63	65	67	69	71	73
Frequency	1	2	9	48	131	102	40	17

22. (a) Find range, Q.D and S.D and its co-efficient from the data given below:

Size of items	6	7	8	9	10	11	12

Frequency	3	6	9	13	8	5	4

(Or)

(b) Find S.D and co-efficient of variation for the following data taking 37.5 as assumed mean.

Age	20-25	25-30	30-35	35-40	40-45	45-50
No. of persons	170	110	80	45	40	35

23. (a) Calculate Karl Pearson's correlation co-efficient for the following data.

Price(X)	45	55	56	58	60	65	68	70	75	80	85
Price(Y)	56	50	48	60	62	64	65	70	74	82	90

(Or)

(b) From the following data calculate Spearman's rank correlation co-efficient:

X	48	33	40	9	16	16	65	24	16	57
Y	13	13	24	6	15	4	20	9	6	19

24. (a) Draw a trend line by the method of least square.

Year	2001	2002	2003	2004	2005	2006
Sales (in Lakhs)	60	75	81	110	106	117

(Or)

(b) Draw a trend line by the method of three yearly moving average.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
No. of students	15	18	17	20	23	25	29	33	36	40

25. (a) Construct price index number from the following data by applying Laspeyere' s Method, Paasche' s Method and Fisher' s ideal Method:

Commodity	2005		2006	
	Price	Quantity	Price	Quantity
A	20	8	40	6
B	50	10	60	5
C	40	15	50	15
D	20	20	20	25

(Or)

(b) What is meant by cost of living index number? How to construct it?

****

Answer any THREE Questions (3x20=60 Marks)
All questions carry equal marks

1. The following are the marks obtained by the students in statistics. Form a frequency table and draw histogram, frequency polygon and frequency curves.

35	10	55	22	5	48	30	20	30	23
50	32	7	18	15	55	37	29	25	42

33 45 37   26   29   32   38   24   30   10
8   7 15   45   48   50   27   29   30   15

2. Two cricketers scored the following runs in the several innings. Find who is a better run-getter and who more consistent player is.

A	42	17	83	59	72	76	64	45	40	32
B	28	70	31	0	59	108	82	14	3	95

3. Find the Karl Pearson's co-efficient of skewness from the following data.

Variable	0-5	5-10	10-15	15-20	20-25	25-30	30-35-	35-40
Frequency	2	5	7	13	21	16	8	3

4. Form the two regression equations of X on Y and Y on X from the data given below and find correlation co-efficient.

Price	10	12	13	12	16	15
Supply	40	38	43	45	37	43

5. Given the following bivariate probability distribution, obtain
   (i) Marginal distributions of X and Y
   (ii) The Conditional distribution of X given Y = 2

x \ y	-1	0	1
0	1/15	2/15	1/15
1	3/15	2/15	1/15
2	2/15	1/15	2/15

****

Time: Three Hours   **Maximum: 60 Marks**

Answer any THREE Questions (3x20=60 Marks)
All questions carry equal marks

1. Fit a Poisson distribution to the following data, and test the goodness of fit.

No. of mistakes per page	0	1	2	3	4
No. of pages	211	90	19	5	0

2. Fit a Normal distribution to the following data by the method of ordinates and also test the goodness of fit.

C.I	10-20	20-30	30-40	40-50	50-60	60-70	70-80
F	8	12	30	24	12	10	4

3. Consider a population of 6 units with values are 8, 3, 1, 11, 4 and 7, calculate the sample mean for all possible simple random samples of size 2. Verify that the sample mean is an unbiased estimate of population mean. Also calculate its variance and verify that.
    (i) It agrees with the formula for the variance of the sample mean.
    (ii) This variance is less than the variance obtained from sampling with replacement.

4. The following data show the stratification of all the farms in a country by farm size and the average acres of corn per farm in each stratum. For a sample of 100 farms, compute the sizes in each stratum under (a) proportional allocation and (b) optimum allocation. Compare the precisions of these methods with that of simple random sampling.

Farm size (acres)	No. of farms N_h	Average acres Y_h	Standard deviation Y_h
0-40	394	5.4	8.3
41-80	461	16.3	13.3
81-120	391	24.3	15.1
121-160	334	34.5	19.8
161-200	169	42.1	24.5
201-240	113	50.1	50.1
241-280	148	63.8	35.2

5. The data given below are for small population which exhibits a fairly study to rising trend, each column represent a systematic sample and row represent the strata. Compare the precision of systematic sampling, simple random sampling and stratified random sampling for 10 systematic sample with n=4, k =10 and N =40

Strata	1	2	3	4	5	6	7	8	9	10
I	0	1	1	2	5	4	7	7	8	6
II	6	8	9	10	3	12	15	16	16	17
III	18	19	20	20	24	23	25	25	29	27
IV	26	30	31	31	33	32	35	31	38	38

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(For the candidates admitted from 2021 –2022 onwards)
B.SC STATISTICS DEGREE EXAMINATION
Sixth Semester
MAJOR PRACTICAL - III

21USTP03

Time: Three Hours   **Maximum: 60 Marks**

Answer any THREE Questions (3x20=60 Marks)
All questions carry equal marks

1. (i) A sample of size 400 was drawn and the sample mean was found to be 99. Test whether this sample could have come from a normal population with mean 100 and variance 64 at 5% level of significance.

(ii) Before an increase in excise duty on tea, 400 people out of a sample of 500 persons were found to be tea drinkers. After an increase in duty, 400 people were tea drinkers in a sample of 600 people. Do you think that there is a significant decrease to the consumption of tea after the increase in the excise duty?

2. Two random samples were drawn from two normal populations and their values are:
   A: 66 67 75 76 82 84 88 90 92
   B: 64 66 74 78 82 85 87 92 93 95 97
   Test whether the two populations have the same variance at the 5% level of significance.

3. Given the following data obtained from a completely randomized design with four treatments, analyze the given data and draw conclusions about the equality of treatment effects.

Treatments			
T_1	T_2	T_3	T_4
20.9	23.7	13.2	5.8
12.4	14.4	10.2	6.1
10.3	9.0	5.1	4.8
4.2	-	-	1.5

4. A Company wants to purchase cars for its own use. He has to select the make of the car out of the four makes A, B, C and D available in the market. For this he tries four cars of each make by assigning the cars to four drivers to run on four different routes. For this, he chooses a Latin square design. The efficiency of cars is measured in terms of time in hours. The layout and time consumed is as given below. Analyze the experimental data and draw your conclusions.

Routes	Drivers			
	1	2	3	4
1	18(C)	12(D)	16(A)	20(B)
2	26(D)	34(A)	25(B)	---(C)
3	15(B)	22(C)	10(D)	28(A)
4	30(A)	20(B)	15(C)	9(D)

5. An experiment was planned to study the effect of sulphate of potash and super phosphate on the yield of potatoes. All the combinations of 2 levels of super phosphate (0 cent (p_0) and 5 cent (p_1) acre and two levels of sulphate of potash (0 cent (k_0) and 5 cent(k_1 acre) were studied in a randomized block design with 4 replications for each. The (1/70) yields (lb.per plot = (1/70) acre obtained are given in the following table. Analyze the data and give your conclusions.

Block	Yields (lbs per plot)			
I	(1) 23	k 25	P 22	Kp 38
II	p 40	(1) 26	K 36	Kp 38
III	(1) 29	k 20	Pk 30	P 20
IV	kp 34	k 31	P 24	(1) 28

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(For the candidates admitted from 2021 –2022 onwards)
B.SC STATISTICS DEGREE EXAMINATION
Sixth Semester
MAJOR PRACTICAL - IV

21USTP04

Time: Three Hours   **Maximum: 60 Marks**

Answer any THREE Questions (3x20=60 Marks)
All questions carry equal marks

1. A machine is set to deliver the packets of a given weight. Ten samples of size five each were examined and the following results were obtained:

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

2. From a lot consisting of 2,200 items, a sample of size 225 is taken. If it contains 14 or less defectives, the lot is accepted otherwise rejected. Plot the OC, ATI and AOQ curves. Also obtain the value of AOQL.

3. From the following production data, fit a parabolic curve of second degree to a given time series data and also find the estimate of production in 2008.

Year	2002	2003	2004	2005	2006
Production ('000 tonnes)	1	2.8	6.3	12.5	26.5

4. Calculate seasonal indices by the method of link relatives.

Quarters	1	2	3	4	5
1	30	35	31	31	34
2	26	28	29	31	36
3	22	22	28	25	26
4	31	36	32	35	33

5. Using the following data, construct Fisher's ideal index and show that it satisfies Factor Reversal and Time reversal test.

Commodities	Price (in Rs)		Quantity(in Kg)	
A	6	10	50	56
B	2	2	100	120
C	4	6	6	60
D	10	12	30	24
E	8	12	40	36

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(For the candidates admitted from 2021 –2022 onwards)
B.SC DEGREE PRACTICAL EXAMINATION
(Common for B.Sc Mathematics and B.Sc Mathematics CA)
Second and Fourth Semester
Allied Statistics Practical

Time: Three Hours   **Maximum: 60 Marks**

Answer any THREE questions (3 X 20 = 60)
All questions carry equal Marks

1. Calculate the Mean, Median and Q.D for the given data:

Mid-Point	15	20	25	30	35	40	45
Frequency	15	33	56	103	40	32	10

2. Two Fit a Poisson distribution for the following data and test the goodness of fit.

X	0	1	2	3	4
F	122	122	60	15	2

3. Fit a non-liner trend of the form $y = a + bX + cX^2$ for the following data:

X	2.0	2.5	3.0	3.5
Y	1.1	1.6	2.7	4.1

4. From the data given below, find the two regression equations and estimate the value of X when Y = 50 and the value of Y when X = 45.

X	12	15	21	20	22	35	30	28	26	30
Y	25	32	42	45	39	72	68	47	55	65

5. An examination was given to two classes consisting of 40 and 50 students respectively. In the first class the mean mark was 74 with a standard deviation of 8, while in the second class the mean mark was 78 with a standard deviation of 7. Is there a significant difference between the performances of the two classes at a level of significance of 0.05?

****

Time: Three Hours   **Maximum: 60 Marks**

Answer any THREE questions (3 X 20 = 60)
All questions carry equal Marks

1. Following are the marks obtained by 50 students in statistics, prepare continuous frequency distribution and also draw a Frequency Curve.

$$
\begin{array}{cccccccccc}
78 & 25 & 25 & 50 & 30 & 29 & 55 & 52 & 43 & 43 \\
44 & 20 & 48 & 44 & 43 & 58 & 36 & 46 & 48 & 47 \\
56 & 60 & 31 & 47 & 53 & 65 & 68 & 73 & 59 & 12 \\
34 & 74 & 79 & 20 & 16 & 70 & 65 & 39 & 60 & 45 \\
60 & 20 & 47 & 49 & 51 & 38 & 49 & 35 & 52 & 61
\end{array}
$$

2. Calculate Mean, Median and Mode for the given data:

Mid - Weights (in kg)	4.5	5.5	6.5	7.5	8.5	9.5	10.5
No. of Children's	11	24	29	29	18	12	4

3. (i) Find Spearman's Rank Correlation Coefficient for the following data:

X	48	33	40	9	16	16	65	24	16	57
Y	13	13	24	6	15	4	20	9	16	19

(ii) Find the two regression lines for the given data:

X	1	3	2	5	8	7	6
Y	6	4	5	2	1	9	8

4. Fit a Poisson distribution for the following data and test the goodness of fit.

X	0	1	2	3	4	5	6	7	8
F	210	180	160	93	40	21	8	5	3

5. A company producing light bulbs finds that mean life span of the population of bulbs is 1200 hours with a standard deviation of 125 hours. A sample of 100 bulbs produced in a lot is found to have a mean life span of 1150 hours. Test whether the difference between the population and sample means is statistically significant at 5% level of significance.

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(For the candidates admitted from 2021 –2022 onwards)
B.Sc GEOGRAPHY PRACTICAL EXAMINATION
Second and Fourth Semester
Allied Statistics Practical

Time: Three Hours   **Maximum: 60 Marks**

Answer any THREE questions (3 X 20 = 60)
All questions carry equal Marks

1. (i) Form a frequency distribution from the following data by inclusive method taking 4 as the magnitude of class intervals:

10	17	15	22	11	16	19	24	29	18
25	26	32	14	17	20	23	27	30	12
15	18	24	36	18	15	21	28	33	38
34	13	10	16	20	22	29	19	23	31

(ii) The sales proceeds, cost and the profit or loss per wooden chair of a firm, represent this data by Percentage bar diagram.

Particulars	Amount in (Rupees)		
	2001	2002	2003
Sales proceeds	190	220	250
Cost per chair materials	100	110	130
Wages	40	75	90
Other costs	30	50	60
Total cost	170	235	280

2. Calculate the Mean, Median and Mode for the given data:

Values	0-9	10-19	20-29	30-39	40-49	50-59	60-69
Frequency	678	720	664	598	524	378	244

3. Calculate the regression equations and correlation coefficient for the following data:

X	0	1	2	3	4	5
Y	1	4	8	12	6	8

4. In a college 1000 students were categorized on the basis of their family economic status and their intelligence level. Test if there is any significant association between economic status and intelligence level using 3^2 – test.

Economic Status	Intelligence Level		Total
	High	Low	
Rich	460	140	600
Poor	240	160	400
Total	700	300	1000

5. Three processes A, B and C are tested to see whether their outputs are equivalent. The following observations of outputs are made:

A   10   12   13   11   10   14   15   13

B   9   11   10   12   13

C   11   10   15   14   12   13

Carry out the analysis of variance and state your conclusion.

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1. (a) Write a Generalized C program for solving the following transcendental equation by Regula - Falsi method. Cos x = 3x - 1

    (Or)

    (b) Write a C program for estimating the population (in crores) for the year 2014 from the following data by Newton's Forward Interpolation method.

Year	2013	2015	2017	2019	2021
Population	46	66	81	93	101

2. (a) Write a C program for estimating the value of $\sqrt{155}$ by Lagrange's Interpolation method from the data below.

X	150	152	154	156
Y - $\sqrt{x}$	12.247	12.329	12.410	12.490

    (Or)

    (b) Write a C program for evaluating the following integral by Simpson's 3/8 Rule.

    $$I = \int_0^1 \frac{1}{(1+x)} \, dx \text{ (correct five decimal places)}$$

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