MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

Affiliated to Periyar University

Accredited by NAAC with 'A++' Grade & Recognized u/s 2(f) and 12(B) of the UGC Act 1956

Kalippatti-637501, Namakkal (Dt), Tamil Nadu, India.

BACHELOR OF SCIENCE

SYLLABUS FOR B.Sc. STATISTICS

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS ADMITTED FROM

THE ACADEMIC YEAR 2023 – 2024 ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE
(Autonomous)
(Affiliated to Periyar University)

Department of Statistics

REGULATIONS FOR B.Sc. STATISTICS PROGRAMME
OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM
(Effective from the academic year 2023-2024)

I. PREAMBLE

Statistics is a discipline that is fundamental in decision making and policy formulation. It's descriptive and inferential roles not only formulate the basis of growth for almost all disciplines of the contemporary world, but also provide an array of non-traditional employment avenues ranging from that of sport-analysts to business analysts. The B.Sc. Statistics Programme focuses on statistical science and its application to real problems. The thrust of this programme is to prepare students to enter into a promising professional life even after graduation, as also provide to them a platform for pursuing higher studies leading to post-graduate or doctoral degrees. During the programme, Statistical packages will be used to reinforce students' theoretical and practical skills. Graduates may apply the knowledge gained in production industry, financial, medical and agriculture sectors.

II. GRADUATES ATTRIBUTES

- **In-depth knowledge and understanding of major concepts:** Understanding of theoretical principles and experimental findings in different sub-areas available in respective disciplines

- **Creative and Critical thinking:** The capability of using creative and critical thinking in respective areas

- **Analytical ability:** The ability to analyze issues and problems in all the disciplines

- **Problem-solving skills:** The capability towards solving problems

- **Entrepreneur skills:** The inclusion of leadership, business management, time management skills.

- **Communication skills:** The ability to transfer complicated/technical information in a precise manner
- **Mutual and multidisciplinary competence:** The ability of teamwork in interdisciplinary fields
- **Digital literacy:** The capability of utilizing modern digital tools to carry out the simulation process
- **Moral and ethical awareness:** Ability to adopt moral ethics

Social responsibility: Creating socially responsible citizens

III. PROGRAMME EDUCATIONAL OBJECTIVES

- ❖ Undergraduate students are to be passionately engaged in initial learning with an aim to think differently as agents of new knowledge, understanding and applying new ideas in order to acquire employability/ self- employment.
- ❖ Undergraduate students are trained to take up higher learning programmes.
- ❖ Undergraduate students are made to be competent and socially responsible citizen of India.
- ❖ Undergraduate students are to be exposed to technical, analytical and creative skills.
- ❖ Undergraduate students are to be imparted with a broad conceptual background in the Biological sciences / Computing sciences / Languages and culture / Management studies / Physical sciences.

IV. PROGRAMME OUTCOMES

- ❖ Acquire scientific knowledge leading to creative thinking and research motivations.
- ❖ Internalize the learned concepts and that will enable them to become skilled professionals.
- ❖ Develop a sense of an interdisciplinary approach to identify and resolve issues through the project, seminars, fieldwork, internships, and industrial visits.
- ❖ Become empowered individuals who will emerge as entrepreneurs or be employed in industry, academia, and Government sectors.

❖ Establish a self-sustained environment for a healthy society.

V. PROGRAMME SPECIFIC 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 experiment studies and to demonstrate data analysis together with proper and effective interpretations.

- ❖ Able to handle statistical packages for practical utility and also to develop new software programs in accordance with the requirement for solving a problem.
- ❖ Apply the critical thinking ability to carry out extended investigation and innovation of mathematical formulations.
- ❖ Induce the interest to communicate Mathematics effectively and precisely using technology.

This course 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 Statistical Aptitude and Statistical Data Analysis Using R.

VI. REGULATIONS

These regulations shall take effect from the academic year 2023-2024, i.e, for students who are to be admitted to the first year of the course during the academic year 2023-24 and thereafter.

1. Eligibility for Admission:

A Pass in the Higher Secondary Examinations with Statistics / Mathematics / Business mathematics (Academic or Vocational Stream) as one

of the subject conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereto.

2. Duration of the Course:

The candidates shall complete all the courses of the programme in 3 years from the date of admission. The programme of study shall consist of six semesters and a total period of three years with a minimum of **140** credits. The programme of study will comprise the course according to the syllabus.

3. Programme of Study:

The course of study for the UG degree has been divided into the following five categories:

Part I : Tamil / Other Languages.

Part II: English Language.

Part III: Core Courses, Generic Elective Courses, Discipline Specific Elective Courses.

Part IV: Skill Enhancement Courses, Foundation Course and Enhancement Compulsory Courses

Part V: Extension Activity.

Extension Activity:

Every student shall participate compulsorily for period of not less than three years (6 semesters) in any one of the following programmes. NSS/ Sports/YRC/Other Extra-curricular and Co-curricular activities (Club/IIC/EDC). The student's performance shall be examined by the staff in-charge of extension activities along with the Head of the respective department and a senior member of the Department on the following parameters.

The marks shall be sent to the Controller of Examinations before the commencement of the final semester examinations.

20% of marks for Regularity of attendance.

60% of marks for Active Participation in classes/ camps/ games/ special Camps/ programmes in the college/ District/ State/ University activities.

10% of marks for Exemplary awards/ Certificates/ Prizes.

10% of marks for Other Social components such as Blood Donations, Fine Arts, etc.

The above activities shall be conducted outside the regular working hours of the college. The mark sheet shall carry the gradation relevant to the marks awarded to the candidates.

A - Exemplary - 80 and above

B - Very good - 70-79

C - Good - 60-69

D - Fair - 50-59

 E - Satisfactory - 40 – 49

This grading shall be incorporated in the mark sheet to be issued at the end of the semester. (Handicapped students who are unable to participate in any of the above activities shall be required to take a test in the theoretical aspects of any one of the above fields and be graded and certified accordingly).

4. Examinations:

The programme of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment - CIA) and External (End Semester) theory examinations. The theory examinations shall be conducted for three hours duration at the end of each semester. The candidates failing in any subjects(s) will be permitted to reappear for the same in the subsequent semester examinations.

VII. STRUCTURE OF THE PROGRAMME

SEMESTER: I

Part	Course Category	Title of the Course	Course Code	Hrs/Week		No. of Credits	Max. Mark		
				L	P		Int.	Ext.	Total
I	LANGUAGE COURSE-I	TAMIL – I	M23UFTA01	6	-	3	25	75	100
		HINDI – I	M23UFHI01						
		FRENCH – I	M23UFFR01						
II	LANGUAGE COURSE-II	ENGLISH – I	M23UFEN01	6	-	3	25	75	100
III	CORE COURSE-I	DESCRIPTIVE STATISTICS	M23UST01	5	-	5	25	75	100
	CORE COURSE- II	PROBABILITY THEORY	M23UST02	5		5	25	75	100
	GENERIC ELECTIVE COURSE-I	MATHEMATICS FOR STATISTICS	M23UMAGE8	4		3	25	75	100
	SEC-I	SEC-I- (NME-I)	M23UMAN01	2	-	2	25	75	100
IV	FOUNDATION COURSE	STATISTICAL APTITUDE FOR COMPETITIVE EXAMINATION	M23USTFC1	2	-	2	25	75	100
		Total		**30**	**-**	**23**	**175**	**525**	**700**

SEMESTER: II

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credits	Max. Mark Int.	Max. Mark Ext.	Max. Mark Total
I	LANGUAGE COURSE-I	TAMIL - II	M23UFTA02	6	-	3	25	75	100
		HINDI – II	M23UFHI02						
		FRENCH – II	M23UFFR02						
II	LANGUAGE COURSE-II	ENGLISH - II	M23UFEN02	6	-	3	25	75	100
III	CORE COURSE-III	MATRIX AND LINEAR ALGEBRA	M23UST03	5	-	5	25	75	100
	CORE COURSE-IV	DISTRIBUTION THEORY	M23UST04	5	-	5	25	75	100
	GENERIC ELECTIVE COURSE-II	REAL ANALYSIS	M23UMAGE9	4		4	25	75	100
IV	SEC-II	SEC-II –(NME-II)	M23UMAN03	2	-	2	25	75	100
	SEC-III	CORE PRACTICAL - I DESCRIPTIVE STATISTICS AND PROBABILITY THEORY	M23USTS01	-	2	2	40	60	100
		Total		**28**	**2**	**24**	**190**	**510**	**700**

SEMESTER: III

Part	Course Category	Title of the Course	Course Code	Hrs/ Week		No. of Credits	Max. Mark		
				L	P		Int.	Ext.	Total
I	LANGUAGE COURSE-I	TAMIL – III	M23UFTA03	6	-	3	25	75	100
		HINDI – III	M23UFHI03						
		FRENCH – III	M23UFFR03						
II	LANGUAGE COURSE-II	ENGLISH – III	M23UFEN03	6	-	3	25	75	100
III	CORE COURSE-V	ESTIMATION THEORY	M23UST05	5	-	5	25	75	100
	CORE COURSE-VI	SAMPLING TECHNIQUES	M23UST06	6	-	5	25	75	100
	DISCIPLINE SPECIFIC ELECTIVE - I	DSE-I-NUMERICAL METHODS	M23USTDSE1	5	-	3	25	75	100
IV	SEC-IV	CORE PRACTICAL-II ESTIMATION THEORY & SAMPLING TECHNIQUES	M23USTS02		2	2	40	60	100
		Total		**28**	**2**	**21**	**165**	**435**	**600**

SEMESTER: IV

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	P	No. of Credits	Max. Mark Int.	Ext.	Total
I	LANGUAGE COURSE-I	TAMIL - IV	M23UFTA04	6	-	3	25	75	100
		HINDI – IV	M23UFHI04						
		FRENCH – IV	M23UFFR04						
II	LANGUAGE COURSE-II	ENGLISH - IV	M23UFEN04	6	-	3	25	75	100
III	CORE COURSE-VII	TESTING OF STATISTICAL HYPOTHESIS	M23UST07	5	-	5	25	75	100
	CORE COURSE-VIII	ACTUARIAL STATISTICS	M23UST08	4		4	25	75	100
	DISCIPLINE SPECIFIC ELECTIVE-II	DSE-II-OFFICIAL STATISTICS	M23USTDSE2	3	-	3	25	75	100
IV	SEC-V	CORE PRACTICAL–III TESTING OF HYPOTHESIS & ACTUARIAL STATISTICS	M23USTS03		2	2	40	60	100
	SEC-VI	BIO STATISTICS	M23USTS04	2		2	25	75	100
	ENHANCEMENT COMPULSORY COURSE – I	ENVIRONMENTAL STUDIES	M23UES01	2	-	2	25	75	100
		Total		**28**	**2**	**24**	**215**	**585**	**800**

SEMESTER: V

Part	Course Category	Title of the Course	Course Code	Hrs/Week		No. of Credits	Max. Mark		
				L	P		Int.	Ext.	Total
III	CORE COURSE-IX	STOCHASTIC PROCESS	M23UST09	6	-	5	25	75	100
	CORE COURSE-X	REGRESSION ANALYSIS	M23UST10	6	-	4	25	75	100
	CORE PRACTICAL-IV	PRACTICAL –IV STOCHASTIC PROCESS & REGRESSION ANALYSIS	M23USTP01		5	4	40	60	100
	DISCIPLINE SPECIFIC ELECTIVE –III	DSE-III OPERATIONS RESEARCH	M23USTDSE3	6	-	3	25	75	100
		DSE-IV ECONOMETRICS	M23USTDSE4	5	-	3	25	75	100
IV	ENHANCEMENT COMPULSORY COURSE – II	YOGA	M23UVE01	2	-	2	25	75	100
	INTERNSHIP / INDUSTRIAL VISIT / FIELD VISIT	INTERNSHIP	M23USTIS01	-	-	2	40	60	100
	Total			**25**	**5**	**23**	**205**	**495**	**700**

SEMESTER: VI

Part	Course Category	Title of the Course	Course Code	Hrs/ Week L	Hrs/ Week P	No. of Credits	Max. Mark Int.	Max. Mark Ext.	Max. Mark Total
III	CORE COURSE-XI	DESIGN OF EXPERIMENTS	M23UST11	5	-	4	25	75	100
	CORE COURSE-XII	DEMOGRAPHY	M23UST12	5	-	4	25	75	100
	CORE PRACTICAL -V	DESIGN OF EXPERIMENTS & DEMOGRAPHY	M23USTP02		4	4	40	60	100
	CORE PROJECT	PROJECT	M23USTPR1	5	-	4	25	75	100
	DISCIPLINE SPECIFIC ELECTIVE	DSE-V STATISTICAL QUALITY CONTROL	M23USTDSE5	4	-	3	25	75	100
		DSE-VI APPLIED STATISTICS	M23USTDSE6	**5**		3	25	75	100
IV	PROFESSIONAL COMPETENCY SKILL	INTRODUCTION TO R LANGUAGE	M23USTPCS1	2		2	25	75	100
	EXTENSION ACTIVITIES	EXTENSION ACTIVITIES	M23UEX01	-	-	1	-	-	-
	Additional Credit for online courses (SWAYAM/MOOC)/Value-Added**			-	-	-	-	-	-
	Total			**26**	**4**	**25**	**190**	**510**	**700**
	Over all Total			**165**	**15**	**140**	**1140**	**3060**	**4200**

Summary of Credits, Hours and mark distribution

Part	Course Name	No. of Credits						Total Credits	Total Hours	No. of Courses	Max. Marks
		I	II	III	IV	V	VI				
I	Language – I	3	3	3	3	-	-	12	24	4	400
II	Language – II	3	3	3	3	-	-	12	24	4	400
III	Core Course	10	10	10	10	8	8	54	62	12	1200
	Core practical	-	-	-	-	4	4	8	9	2	200
	Discipline Elective Course	-		3	3	6	6	18	28	6	600
	Generic Elective Course	3	4	-	-			07	8	2	200
	Project	-	-	-	-	-	4	4	5	1	100
IV	Skill Enhanced course	2	2	-	2		2	8	08	4	400
	SEC – Core Practical	-	2	2	2	-	-	6	6	3	300
	Enhancement Compulsory Course	-	-	1	1	2	-	4	4	2	200
	Foundation course	2	-	-	-	-	-	2	2	1	100
	Internship	-	-	-	-	2	-	2	-	1	100
V	Extension Activities	-	-	-	-	-	1	1	-	-	-
	Online Courses **	-	-	-	-	-	-	-	-	-	-
Total		23	24	22	24	22	25	140	180	42	4200

* Equal credits will be transferred by completing online courses such as MOOC/SWAYAM/NPTEL.

* On successful completion of Value Added course, the students will gain one extra credit.

DISCIPLINE SPECIFIC ELECTIVE SUBJECTS FOR B.Sc., STATISTICS STUDENTS

Semester	Subject	Course Code
III	DSE-I NUMERICAL METHODS	M23USTDSE1
IV	DSE-II OFFICIAL STATISTICS	M23USTDSE2
V	DSE-III OPERATION RESEARCH	M23USTDSE3
V	DSE –IV ECONOMETRICS	M23USTDSE4
VI	DSE –V STATISTICAL QUALITY CONTROL	M23USTDSE5
	DSE –VI APPLIED STATITICS	M23USTDSE6

GENERIC ELECTIVE COURSE FOR B.Sc STATISTICS STUDENTS

Semester	Subject	Course Code
I	GEC-I MATHEMATICS FOR STATISTICS	M23UMAGE8
II	GEC-II REAL ANALYSIS	M23UMAGE9

GENERIC ELECTIVE COURSE OFFERED FOR OTHER MAJOR STUDENTS

Semester	Subject	Course Code
I	GEC-I - MATHEMATICAL STATISTICS	M23USTGE1
II	GEC-II STATISTICAL INFERENCE	M23USTGE2
	GEP - I STATISTICS PRACTICAL	M23USTGEP1
III	GEC-III - MATHEMATICAL STATISTICS – I	M23USTGE4
	GEC-III BUSINESS MATHEMATICS AND STATISTICS	M23UCC08
	GEC-III BUSINESS STATISTICS	M23USTGE5
IV	GEC-IV OPERATION RESEARCH – BBA	M23USTGE7
	GEC-IV OPERATION RESEARCH – B.Com	M23USTGE8
	GEC-IV - MATHEMATICAL STATISTICS – II	M23USTGE6

SEC – (NME-) FOR OTHER DEPARTMENTS

Semester	Course Title	Course Code
I	SEC-I-(NME) - I – BASICS OF STATISTICS-I	M23USTN01
	SEC-I-(NME) - I -GENETICAL STATISTICS	M23USTN02
II	SEC-II-(NME) - II- BASICS OF STATISTICS-II	M23USTN03
	SEC-II-(NME) - II - INDIAN OFFICIAL STATISTICS	M23USTN04

ENTREPRENEURSHIP BASED COURSES

ENTREPRENEURSHIP	
SEMESTER	**COURSE TITLE**
I	DESCRIPTIVE STATISTICS
	PROBABILITY THEORY
II	MATRIX AND LINEAR ALGEBRA
	DISTRIBUTION THEORY
III	ESTIMATION THEORY
	SAMPLING TECHNIQUES
IV	TESTING OF STATISTICAL HYPOTHESIS
	ACTUARIAL STATISTICS
V	STOCHASTIC PROCESS
	REGRESSION ANALYSIS
VI	DESIGN OF EXPERIMENTS
	DEMOGRAPHY

SKILL ENHANCEMENT COURSES:

Semester	Course Title	Course Code
I	SEC-I-(NME-I)	M23UMAN01
II	SEC-II-(NME-II)	M23UMAN02
	SEC-III PRACTICAL - I - DESCRIPTIVE STATISTICS AND PROBABILITY THEORY	M23USTS01
III	SEC-IV PRACTICAL-II ESTIMATION THEORY & SAMPLING TECHNIQUES	M23USTS02
IV	SEC-V PRACTICAL–III TESTING OF HYPOTHESIS & ACTUARIAL STATISTICS	M23USTS03
	SEC-VI BIO STATISTICS	M23USTS04
VI	SEC-VII INTRODUCTION TO R LANGUAGE	M23USTPCS1

VIII. SCHEME OF EXAMINATION:

1. Question Paper Pattern for Theory Examination

Time: Three Hours   Maximum Marks: 75

Knowledge Level	Sections		Marks	Total Marks	Meaning of K's
K1	**Part - A** 10 Questions - Objectives type *1 Marks (No Choice)	Two Questions from each unit	**10**	**75**	K1- Memory Level K2 - Understanding Level K3 - Application Level K4 - Analytical Level
K1, K2	**Part - B** 5 Questions *2 Marks (No Choice)	One Question from each unit	**10**		
K2, K3	**Part - C** 5 Questions (either or type) * 5 Marks	One Question from each unit	**25**		
K2, K3, K4	**Part - D** 3 out of 5 Questions *10 Marks	One Question from each unit	**30**		

2. Question Paper Pattern for Practical Examination

Time: 3 hrs   Maximum Marks: 60

Questions from each Unit

Answer any three Questions out of 5 Questions (3x20 = 60)

3. Distribution of Marks:

   The following are the distribution of marks for external and internal for End Semester Examinations and continuous internal assessment and passing minimum marks for Theory / Practical / Project / Internship papers of B.Sc. Statistics programme.

ESE	CIA Total	EA Total	Total Marks Allotted	Passing Minimum for EA	Passing Minimum (ESE)
Theory	25	75	100	30	40
Practical	40	60	100	24	40
Project	40	60	100	24	40
Internship	40	60	100	24	40

The following are the Distribution of marks for the Continuous Internal Assessment in Theory / Practical / Project / Internship papers of B.Sc. Statistics programme.

THEORY

EVALUATION OF INTERNAL ASSESSMENT
       Test   : 15 Marks
       Assignment : 05 Marks
       Attendance : 05 Marks

         Total : 25 Marks

PRACTICAL

EVALUATION OF INTERNAL ASSESSMENT
       Test   : 20 Marks
       Attendance : 10 Marks
       Observation: 10 Marks

       Total   : 40 Marks

PROJECT

EVALUATION OF INTERNAL ASSESSMENT
       Review 1 : 10 Marks
       Review 2 : 10 Marks
       Review 3 : 10 Marks
       Pre-Viva : 10 Marks

       Total   : 40 Marks
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4. Passing Minimum:

The Candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Theory Exam mark) with minimum of 30 marks (out of 75 marks) in the End Semester Theory Examinations.

The Candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Practical Exam mark) with minimum of 24 marks (out of 60 marks) in the End Semester Practical Examinations.

5. Submission of Record Note Books for Practical Examinations

Candidates appearing for practical examinations should submit a bonafide record note books prescribed for practical examinations. The candidates failed to submit the record book shall not be permitted to appear for the practical examinations.

6. Internship/Project:

The following guidelines to be followed for the Project with Viva-voce:
1. The project should be valued for 60 marks by an external examiner; however the Viva-Voce examination should be conducted by both the external examiner appointed by the College and the internal examiner/supervisor/faculty concerned.
2. The Project Report may consist of minimum of 40 pages.
3. The candidate has to submit the Project Report 10 days before the commencement of the V Semester Examinations.
4. A candidate who fails in the Project/Dissertation or is absent may resubmit the report, on the same topic, with necessary modification / correction / improvements in the subsequent Even Semester Examinations for evaluation and shall undergo viva-voce Examination.

Internship:

Internship training (Minimum two weeks period) is mandatory for all the UG programmes during Second year vacation period.

The Internship training should be valued for 60 marks by an external examiner; however the Viva-Voce examination should be conducted by the internal examiner / faculty concerned.
1. The Internship training Report may consist of minimum of 30 pages.
2. The candidate has to submit the Internship training Report 20 days before the commencement of the V Semester Examinations.

7. NOTE

a) SWAYAM / MOOC – Free Online Course

SWAYAM / MOOC is an instrument for self-actualization providing opportunities for a life-long learning. Here the student can choose from hundreds of courses, virtually every course taught at the college level, offered by the best teachers in India and elsewhere.

The students can choose an online SWAYAM / MOOC course during their period of study which will earn an extra credit and it will be transferred to the academic records of the students.

b) Value Added Courses

Students are provided with additional courses during their course of study. Students are free to choose the courses. On successful completion of each course, the students will gain one extra credit.

CORE- I	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST01	DESCRIPTIVE STATISTICS	Contact Hour Per Week: 5

OBJECTIVES:

1. To explains the important concepts of statistics and statistical data.
2. To provides formulate the visualization of frequency distribution.
3. To measure the averages, dispersions, lack of symmetry, moments, and relationship among variables.
4. To Estimate and predict the unknown and future values.
5. To Study of non-linear and consistency of the data.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To describe the scope, functions, applications and limitations of Statistics.	K1
CO2	To also to explain the statistical survey, collection of data, sampling and presentation of data.	K2
CO3	To discuss the importance and uses of central values and dispersions for the various types of data.	K3
CO4	To measure the various measures of averages and scattered of the mass of data in a series.	K3
CO5	To explain about the lack of symmetry, rth moments and peakedness of the frequency distributions.	K4

Unit- I **(15 hours)**

Statistics: Introduction - Definition – Functions - Applications - Limitations. Organising a Statistical Survey: Planning the survey - Executing the survey-Collection of Data: Primary and secondary data - Methods of collecting primary data - Sources of secondary data. Sampling: Census and Sample methods. Classification-Types - Formation of frequency distribution-Tabulation - parts of a Table - Types. Diagrammatic representation – Types.

Graphical representation - Graphs of frequency distributions. Merits and Limitations of diagrams and graphs.

Unit -II   **(15 hours)**

Measures of Central tendency: Introduction-Definitions-Types - Mean-Median-Mode-Geometric mean-Harmonic Mean-Weighted mean - Merits and Demerits-Measures of Dispersion: Introduction – Definition – Types – Range - Quartile deviation - Mean deviation - Standard deviation - Co-efficient of variation – Lorenz curve - Merits and Demerits.

Unit –III   **(15 hours)**

Skewness: Introduction-Definition-Types-Karl Pearson's – Bowley's - Kelly's methods – Their merits and demerits. Kurtosis: Introduction-Definition-Types-Its merits and demerits. Moments: Introduction - Definition-Types - Raw, Central moments and their relations.

Unit- IV   **(15 hours)**

Correlation analysis: Introduction - Definition - Types – Ungrouped and Grouped data – Probable error – properties - Rank correlation – Partial and Multiple correlations - Regression analysis: Introduction - Definition – Regression Equations -Multiple regression - Principle of least squares for first degree, Second degree, Exponential and Power curves.

Unit- V   **(15 hours)**

Theory of Attributes: Introduction – Definition-Classes and Class frequencies-Consistency of data-Independence of attributes-Association of attributes-Yule's coefficient and -Coefficient of Colligation.

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistical Methods	Gupta, S.P.	Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition.	2017
2.	Fundamental of mathematical statistics	S.C.Gupta and V.K. Kapoor	Sultan Chand & sons, New Delhi	2002

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of Statistics	Sancheti.D.C and Kapoor.V.K(2005)	vol.2 World Press Pvt. Ltd., Kolkatta	1987
2.	An introduction to the theory of Statistics	G.U.Yule and M.G. Kendall	Facsimile Publisher	1956
3.	FUNDAMENTALS OF STATISTICS	Elhance D.N	Kitab mahal	2018
4.	An introduction to statistical analysis of data	Anderson, T.W. and Sclove SL.	Houghton Miffin&co.	1978
5.	Statistics	Pillai, R.S., and Bagavathi	Chand and Company Ltd., New Delhi.	2003

NOTE: Problem-80% & Theory -20%.

Mapping with Programme Specific Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	M	S	S	S	S
CO5	S	S	S	S	M

S- Strong; **M**-Medium.

CORE- II	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST02	PROBABILITY THEORY	Contact Hour Per Week: 5

OBJECTIVES:

1. To describe the importance and scope of probability theory and to predict the chance of an experimental outcomes.
2. To provides the study of random variable, distribution function, mathematical expectation,
3. To generating function and law of large numbers.
4. To describe two-dimensional variables and its distributions

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To learn the concepts of probability and Identify the different approaches of probability theory	K1
CO2	To define the random variable and its respective probability values and to compare a discrete and continuous random variable.	K2
CO3	To Calculate the expected value of a random variable variance, covariance, moments and find the conditional expectation and variance of bi-variate random variable.	K3
CO4	To Estimate the measures of central values, Dispersions, Skewness and Kurtosis through the generating function	K4
CO5	To Calculate the mean and variance through some law of large numbers.	K3

Unit – I   **(15 hours)**

Theory of Probability: Introduction-Basic terminology- Definition - Axiomatic approach – Types of Events - Conditional Probability - Addition and Multiplication theorems of Probability for 'two' and 'n' events (Statement and Proof) - Boole's inequality (Statement and Proof)- Bayes' theorem of Probability (Statement and Proof with numerical illustration -very simple problems)

Unit - II   **(15 hours)**

Random variables and Distribution functions: Introduction - Discrete random variable: Probability mass function- Discrete distribution function, Properties. Continuous random variable : Probability density function and properties, measures of central tendency, dispersion, Skewness and kurtosis for continuous Probability distribution.

Unit – III   **(15 hours)**

Two dimensional random variables - Joint probability mass function- Marginal probability function, Conditional probability function. Two dimensional distribution functions-Marginal distribution functions - Joint density function-Marginal density function - Conditional distribution function - Conditional probability density function. Transformation of One - Dimensional and Two Dimensional random variable (concept only).

Unit - IV   **(15 hours)**

Mathematical Expectations: Introduction- Expected value of a random variable (Discrete and Continuous)-Expected value of function of a random variable - Properties of Expectation-Properties of variance- Covariance. Inequalities involving expectation: Cauchy Schwartz and Markov inequalities.

Unit – V   **(15 hours)**

Generating functions: M.G.F-Properties-Uniqueness theorem - C.G.F-Properties- P.G.F-Properties. Characteristic Function: Properties–Inversion theorems (Statement only)- Uniqueness theorem (Statement only). Chebychev's Inequality (Statement and Proof). Law of Large Numbers (L.L.N): Convergence in probability - Properties: Weak L.L.N - properties-Bernoulli's L.L.N (Statement and Proof) - Khinchin's theorems (Statement only).

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of mathematical statistics	S.C.Gupta and V.K. Kapoor	Sultan Chand & sons, New Delhi	2002

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	An introduction to probability theory and mathematical statistics.	Gupta S.C. and Kapoor V.K	Sultan Chand & Sons	1984
2.	Introduction to Mathematical Statistics,	Hogg. R.V. and Craig. A.T.	McGraw Hill Publishing Co. Inc. New York.	1978
3.	Introduction to the theory of Statistics,	Mood A.M. Graybill, F.A. and Bose. D.C.	I.McGraw Hill Publishing Co. Inc. New York.	1974
4.	New Mathematical Statistics	Sanjay Arora and Bansilal	Satyaprakashan, New Delhi	1989

NOTE: Problem-40% & Theory -60%
Mapping with Programme Specific Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	S	S	M

S- Strong; **M**-Medium.

GEC – I	B.Sc. STATISTICS	Credits: 3
Course Code: M23UMAGE8	**MATHEMATICS FOR STATISTICS**	**Contact Hour Per Week: 4**

OBJECTIVES:

1. To create deep interest in learning mathematics which develop broad and balance knowledge and understanding definitions, concepts, principles and theorems.

2. To helps the students to enhance the ability of learners to apply the knowledge and skill acquired by them to solve specific theoretical and applied problems in mathematics.

3. To also encourages the students to develop a range of generic skill helpful in employment, internships in social activities.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Distinguish between proper and improper fractions. Express an algebraic fraction as the sum of its partial fractions	K1
CO2	To Demonstrate the knowledge to determine the sums, expansion and approximation of series including binomial, exponential, logarithmic and fourier.	K2
CO3	To Solve problems about polynomials with real coefficients, imaginary and irrational roots. Explain the relationship between the derivative of a function as a function and the notion of the derivative.	K3
CO4	To Calculate limits of a function	K4
CO5	To Obtain the nth derivative in successive differentiation. Apply Euler's theorem on homogenous function	K3

Unit-I (12 hours)

Rational fractions: Proper and improper rational fractions. Partial fractions: Forms of partial fractions.

Unit-II (12 hours)

Series: Summation and approximations related to Binomial, Exponential and Logarithmic series -Taylor's series, Fourier series for even and odd functions.

Unit-III (12 hours)

Theory of equations: Polynomial equations with real coefficients-imaginary and irrational roots-solving equations with related roots-equation with given numbers as roots-equation whose roots are symmetric functions of roots.

Unit-IV (12 hours)

Differential calculus: Functions – Different types – simple valued and many valued – Implicit and Explicit functions, Odd and even functions, periodic functions, algebraic and transcendental functions. Inverse functions, Limit of a function – Some standard limit (without proof) Differentiation of standard functions- standard rules of differentiation-Addition, subtraction, multiplication and quotient rules – function of function rule.

Unit-V (12 hours)

Successive differentiation: Leibnitz's theorem, nth derivatives of standard functions – simple problems. Partial differentiation: Successive partial differentiation. Maxima and Minima for two variable functions. Homogenous function – Euler's theorem on homogenous function.

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Allied Mathematics, Vol. – I&II	Duraipandian, P. and Udaya Baskaran, S.	Margham Publications	2014
2.	Allied Mathematics	Vittal, P.R	Sultan Chand & sons, New Delhi	2012
3.	Ancillary Mathematics, Book II : (Containing Differential Calculus)	Narayanan,S ManickavachagamPillai	S. Viswanathan Pvt, Ltd .	1993

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Ancillary Mathematics (Vol. II,Part I) : (Containing Trignometry)	Narayanan,S and Manickavachaga mPillai	S. ViswanathanPvt. Ltd .	1993
2.	ELHANCE .D N	FUNDAMENTALS OF STATISTICS	KITAB MAHAL	1993
3.	Algebra	S.J.Venkatesan	Sri Krishna Publications, Chennai-77 skhengg1999@gmail.com	(2019

NOTE: Problem-40% & Theory -60%

Mapping with Programme Specific Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium

FOUNDATION COURSE	B.Sc. STATISTICS	Credits: 2
Course Code: M23USTFC1	STATISTICAL APTITUDE FOR COMPETITIVE EXAMINATION	Contact Hour Per Week: 2

OBJECTIVES:

1. To introduces statistical aptitude so that the students of statistics could accumulate sufficient knowledge about the subject matter in a short span of time, and may also abreast themselves with the nature of questions and their exact answers.

2. To brevity and clarity "fill in the banks" and "multiple choices" type questions have been setup.

3.To covers concepts such as it provides technical skills to understand and develop various department examinations like Group Exams, TNPSC, SSC & UPSC.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To understand the univariate and bivariate data.	K1
CO2	To compute the measures of central tendencies.	K3
CO3	To understand the Axioms of probability and expectation.	K2
CO4	To obtain the statistical inference in based on sample.	K4
CO5	To obtain the role of rank correlation in some contests	K4

Unit – I (6 hours)

Statistics – Classification, Tabulation and Frequency Distribution.

Unit – II (6 hours)

Diagrammatic and Graphical Representation of data.

Unit – III (6 hours)

Elementary Probability

Unit – IV (6 hours)

Correlation –types of correlation-simple problems only.

Unit – V (6 hours)

Regression-simple problems only.

TEXT BOOK :-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Programmed Statistics	B.L.Agarwal	New age International publishers.	2013

NOTE: Problem-60% & Theory -40%

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	S
CO2	S	M	M	S	S
CO3	M	S	M	S	S
CO4	S	M	S	M	S
CO5	S	M	S	S	S

S- Strong; **M**-Medium.

Core-III	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST03	MATRIX AND LINEAR ALGEBRA	Contact Hour Per Week: 5

OBJECTIVES:

- To study the basic operations of transpose and inverse of matrices
- To know the structure of orthogonal and unitary matrices
- To learn the invariance properties of ranks
- To know and to apply the concepts of vector space and matrix polynomials.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To the basic operations of matrices	K1
CO2	To understand various transactions of matrices and its applications	K3
CO3	To understand various properties of matrices	K2
CO4	To able to understand vector space and its applications	K4
CO5	To able to understand Eigen vector and its applications	K4

Unit- I   **(15 hours)**

Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Adjoint of a matrix, Inverse of a matrix.

Unit II   **(15 hours)**

Reversal law for the inverse of product of two matrices. Commutativity of inverse and transopose of matrix, Commutativity of inverse and conjugate transopose of matrix,Orthogonal and Unitary Matrices.

Unit III   **(15 hours)**

Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.

Unit-IV   **(15 hours)**

Vector space – Linear Dependence - Basis of a vector space –Sub-space - Properties of Linearly Independent and Dependent systems, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices

Unit-V   **(15 hours)**

Matrix polynomials, Characteristic roots and vectors,Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Nature of characteristic roots in case of special matrices, Cayley-Hamilton theorem.

TEXT BOOK :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Matrices	Vasishtha.A.R	KrishnaprakashanMandir, Meerut	1972

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	A Text Book of Matrices	Shanthinarayan	S.Chand& Co New Delhi ,	2012
2.	Matrices	M.L.Khanna	Jai PrakashNath& Co	2009

NOTE: Problem-80% & Theory -20%

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium.

Core-III	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST04	DISTRIBUTION THEORY	Contact Hour Per Week: 5

OBJECTIVES:

1. To learn discrete distributions
2. To learn continuous distributions
3. To understand Distributions generated from mathematical functions
4. To learn normal distribution and its properties
5. To understand about sampling distributions

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Identify discrete distributions appeared in real life situations	K2
CO2	To understand some continuous distributions and its applications	K1
CO3	To Connection between some of the real values mathematical functions and its application in distribution theory	K3
CO4	To Understand normal distribution and its properties	K2
CO5	To Understand sampling distributions and its applications in real life	K4

Unit – I   **(15 hours)**

Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants. Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants. Fitting of Poisson distribution. Negative binomial distribution – m.g.f., cumulants. Fitting of Negative binomial distribution.

Unit – II   **(15 hours)**

Geometric distribution – lack of memory, moments, m.g.f.- Hypergeometric distribution – mean, variance, approximation to Binomial, recurrence relation – Multinomial distribution – m.g.f., mean and variance.

Unit – III   **(15 hours)**

Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f. characteristic function, moments, points of inflexion, mean deviation, Area property – Rectangular distribution – moments, m.g.f., characteristic function, mean deviation about mean.

Unit – IV   **(15 hours)**

Exponential distribution – m.g.f., characteristic function, memory less property – Gamma distribution – m.g.f., cumulants and central moments, reproductive property – Beta distribution – First kind and second kind – constants

Unit – V   **(15 hours)**

Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations, properties and interrelationships).

NOTE: Theory -100%

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Allied Mathematics, Vol. – I&II	Duraipandian, P. and Udaya Baskaran, S.	Margham Publications	2014
2.	Allied Mathematics	Vittal, P.R	Sultan Chand & sons, New Delhi	2012
3.	Introduction to Mathematical Statistics	Hogg, R.V. and Graig, A.T.	A/e, Mc.Graw Hill Publishing Co.Inc., New York.	1978

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Introduction to the Theory of Statistics	Mood, A.D. Graybill, F.A. and Boes, D.C	3/e, Mc.Graw Hill, New York.	1974
2.	Fundamentals of Mathematical Statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & sons, New Delhi	1970

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	M	M	M	M

S- Strong; **M**-Medium.

GENERIC ELECTIVE COURSE –II

GEC –II	B.Sc. STATISTICS	Credits: 4
Course Code: M23UMAGE9	**REAL ANALYSIS**	**Contact Hour Per Week: 4**

OBJECTIVES:

1. To study the basic operations of sets and functions
2. To know the structure of the real sequence and its convergence
3. To learn series and its convergence
4. To learn the limits, continuity and derivative of real valued functions
5. To know and apply the Riemann integration

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Do basic operations of sets and understand set functions	K1
CO2	To Understand sequence and its convergence	K2
CO3	To Understand series and its convergence	K4
CO4	To identify real valued functions and its discontinuity	K2
CO5	To Understand integration concepts	K3

Unit – I   **(12 hours)**

Operations on sets, Functions, Real valued functions, Equivalence, Countability, Real Numbers, Cantor set, Least Upper Bounds, Greatest Lower Bound.

Unit – II   **(12 hours)**

Definition of Sequence, Subsequence,Limit of a sequence, Convergent and Divergent sequences, Oscillating sequence, Bounded and Monotone sequences, Operations on convergent sequences, Limit Infimum, Limit Supremum, Cauchy sequences, Summability of sequences.

Unit – III   **(12 hours)**

Definition of Series, Convergent and Divergent series, series with nonnegative terms, alternating series, conditional convergence, absolute convergences and test for absolute convergence.

Unit-IV   **(12 hours)**

Limit of a function on the real line, Increasing and Decreasing functions, Continuous function, Operations on continuous functions, Composition of continuous functions, Derivatives, Derivative and continuity, Rolle's Theorem, Mean value theorem, Taylor's theorem.

Unit – V   **(12 hours)**

Concept of Riemann Integral, Refinement of partition, Upper and Lower sums, Upper integral and Lower Integral Riemann integrability, Necessary and Sufficient condition for Riemann integrable, Properties of Riemann integrals, Fundamental theorem.

TEXT BOOK :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Methods of Real Analysis	Goldberg .R R	Oxford &IBH	1976

REFERENCE BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Real Analysis	Shanthinarayan,	S.Chand& Co,New Delhi	2012
2.	Principles of Mathematical Analysis	Walter Rudin	3rd Edition, McGraw-Hill	2017

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

NOTE: Theory -100%

S- Strong; **M**-Medium.

SEMESTER – II
SKILL ENHANCEMENT COURSE – III

SEC-III Core Practical – I	B.Sc. STATISTICS	Credits: 2
Course Code: M23USTS01	SEC-III- PRACTICAL – I DESCRIPTIVE STATISTICS & PROBABILITY THEORY	Contact Hour Per Week: 4

OBJECTIVES:

To introduce fundamental concepts such as practical based Probability Theory. It cover Mathematical Expectation and Conditional Expectations. It provides technical skills to understand and develop various applications for Probability Theory. This course introduces fundamental concepts such as practical based Descriptive Statistics. It covers concepts such as Measures of Central Tendencies, Measures of Dispersion, and Correlation Analysis. It provides technical skills to understand and develop various applications for descriptive statistics.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To apply the Solution of Measures of central tendency and Measures of variability in practical life data.	K3
CO2	To apply the Correlation and Regression Analyses in practical situation.	K4
CO3	To apply Probabilities of discrete and continuous random variables	K3
CO4	To examine the Bayes Theorem.	K4
CO5	To apply Joint and marginal distribution function and Joint and marginal density function.	K4

Unit – I   **(6 hours)**

Graphic representation of data – Histogram, frequency polygon, and O'Give curve. Measures of Central Tendencies and Measures of Dispersion .

Unit – II   **(6 hours)**

Correlation and Regression Equations X on Y and Y on X

Unit – III   **(6 hours)**

Discrete and continuous random variables - Distribution functions and moments. Addition theorem - Multiplication theorem - Problems.

Unit - IV   **(6 hours)**

Conditional probability - Bayes Theorem Problems. Joint, marginal and conditional density function – Joint, marginal and conditional distribution function – Simple Problems

Unit – V   **(6 hours)**

Bivariate distribution - Discrete and Continuous Random Variable - Mathematical Expectation – Conditional Expectations

CORE – VI	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST06	SAMPLING TECHNIQUES	Contact Hour Per Week: 5

OBJECTIVES:

   1. To know the basic operations of sampling

   2. To study the theory and applications of SRS

   3. To learn practical uses of Stratification

   4. To apply Systematic and PPS Sampling in real time problems

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To Know the difference between census and sampling.	K1
CO2	To Understand basic operations and advantages of sampling	K2
CO3	To Understand widely used sampling techniques	K2
CO4	To Know to estimate population information using sampling	K3
CO5	To Apply sampling techniques in real time problems	K4

Unit – I   (15 hours)

Basic concepts of sample surveys – Advantages of Sampling – Principal steps in Sample survey, Sampling unit – Sampling frame – Census – Probability Sampling, Alternatives to probability sampling, Mean Square Error.

Unit – II   (15 hours)

Simple random sampling, Methods of selection, Sampling with and without replacement – Properties of estimates, Finite population correction, Estimation of Standard error, Confidence limits – Simple random sampling for

Qualitative characteristics, Sample size determination for proportions and continuous data. Design effect..

Unit – III   (15 hours)

Stratified random sampling, principles of stratification, Notations – Estimation of population mean and its variance – Estimated variance and confidence limits,   Allocation techniques -equal allocation, proportional allocation, Neyman allocation and optimum allocation, Estimation of gain due to stratification.Estimation of sample size for continuous data.

Unit – IV   (15 hours)

Systematic sampling –Relation to cluster sampling, Estimation of population mean and its sampling variance – Comparison of systematic sampling with stratified random samples.Systematic sampling in two dimensions.

Unit – V   (15 hours)

Varying Probability sampling, Selection of one unit with PPS, PPS Sampling with replacement, Estimator for population total and its variance, Selection procedures, Cumulative total method, Lahiri's method, Split method.

TEXT BOOKS :-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Sampling Techniques	Cochran, W.G.	John Wiley Eastern	1978
2.	Sampling Theory and Methods	Murthy M.N.	Statistical Publishing Society, Calcutta	1967

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Theory and Analysis of Sample Surveys Design	Singh. D. and ChaudryF.S.	Wiley Eastern Ltd.	1986
2.	Sampling Theory and Methods	Sampath.S,	CRC Press.	2001

NOTE: Theory 100%

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium.

SEMESTER – III

DISCIPLINE SPECIFIC ELECTIVE-III

DSE -III	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTDSE1	**NUMERICAL METHODS**	**Contact Hour Per Week: 5**

OBJECTIVES:

1. To introduce the study of algorithms that used numerical approximation for the problems of Mathematical analysis.
2. To solve mathematical problems numerically

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To Solve numerically equations that cannot have direct solution	K1
CO2	To Solve system of linear equations	K2
CO3	To Understand the need of interpolation	K2
CO4	To Handle numerical differentiation	K3
CO5	Do integration numerically	K4

Unit – I   (15 hours)

The Solution of Numerical Algebraic and Transcedental Equations: Bisection Method, Iteration Method, Regula Falsi Method, Newton – Raphson Method. Hornor's Method.

Unit – II   (15 hours)

Solution of Simultaneous Linear Algebraic Equations:Guass – Elimination Method, Guass–Jordan Method, Guass – Jacobi Method, Guass –Seidel Method.

Finite Differences: Operators. Interpolation for Equal intervals: Newton's Forward Interpolation Formula and Newton's Backward Interpolation Formula, Evaluation of missing terms.

Unit – III   (15 hours)

Central Difference Interpolation Formula For Equal Intervals: Guass Forward Interpolation Formula, Gauss Backward Interpolation Formula, Sterlings Formula, Bessel's Formula, Laplace- Everett's Formula.

Unit – IV   (15 hours)

Interpolation with Unequal Intervals: Divided Differences, Newton's Divided Differences Interpolation Formula, Lagrange's Interpolation Formula and Inverse Lagrange's Interpolation, Method of reversal of series.

Unit – V   (15 hours)

Numerical Differentiation: Numerical Differentiation based on Newton's Forward and Backward Interpolation Formula – Computation of Second order derivatives.

Numerical Integration:General Quadrature formula for equidistant ordinates, Trapezoidal Rule,Simpson's $1/3^{rd}$ Rule, Simpson's $3/8^{th}$ Rule and Weddle's Rule.

Numerical Solution of Ordinary Differential Equations:Taylor Series Method, Picard's Method and Runge – Kutta Method. (Simple Problems Only Without Derivation)

TEXT BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Calculus of Finite Differences and Numerical Analysis	Kandasamy, P., Thilagavathy, K.	S.Chand Publications.	2003
2	Numerical mathematics part I and II	Balasubramaniam and Venkatraman	by Rochouse and Sons	1972

REFERENCE BOOKS:

S. N o	Title of the Book	Author	Publisher	Year of Publicatio n
1.	Numerical Methods	Kalavathy, S., and Thomson.	Vijay Nicole Publications.	2004
2	Numerical Analysis	Gupta, B.D.	Konark Publications .	2004
3	Calculus of Finite Differences and Numerical Analysis	Venkatachalapathy , S.G.	Margam Publications.	2004

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

NOTE: Problem-80% & Theory -20%

S- Strong; **M**-Medium.

SEC – IV Core Practical- II	**B.Sc. STATISTICS**	**Credits: 2**
Course Code: M23USTS02	**MAJOR PRACTICAL – II ESTIMATION THEORY & SAMPLING TECHNIQUES**	**Contact Hour Per Week: 2**

OBJECTIVES:

To introduces practical based Estimation theory and Sampling techniques. It covers concepts such as Simple random sampling, Stratified random sampling and Systematic Sampling. Estimation theory on the estimators of various method and method of least square. It provides technical skills to understand and develop various applications for sampling techniques.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand about problems in estimators	K1
CO2	To handle data and can estimate least square method.	K2
CO3	To Conduct random experiments in real life data in simple random sampling.	K3
CO4	To Conduct random experiments in real life data in stratified random sampling and proportional & optimum allocations	K3
CO5	To Comparison of practical life simple random sampling and stratified random sampling.	K4

Unit-I   **(6 hours)**

Estimator – Consistency, Unbiasedness,Efficiency and sufficient statistics.

Unit-II   **(6 hours)**

Method of Minimum Chi-Square-Method of Minimum Variance -Methods of Least squares.

Unit – III   **(6 hours)**

Simple random sampling – Drawing sample from the population with and without replacement – Estimation of population mean, total, variance and its S.E.

Unit – IV   **(6 hours)**

Stratified random sampling - Estimation of mean and variance of the population mean - Variance of the estimator of mean under proportional and optimum allocations.

Unit – V   **(6 hours)**

Systematic sampling: Estimation of mean and its variance.

CORE- VII	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST07	TESTING OF STATISTICAL HYPOTHESIS	Contact Hour Per Week: 5

OBJECTIVES:

1. To make familiar with testing concepts
2. To understand the concept of Most Powerful test
3. To understand the Likelihood ratio tests and their uses
4. To apply tests for samples from unknown distributions

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To frame hypotheses about population in real life research	K1
CO2	To identify suitable testing procedure for given hypotheses	K3
CO3	To compare two populations using samples taken from them	K3
CO4	To Compare populations in its means and variances separately	K2
CO5	To identify situations to apply parametric and nonparametric tests	K4

Unit – I   **(15 hours)**

Statistical Hypothesis – Null and Alternative Hypothesis – Simple and Composite hypothesis – Critical region – Type-I and Type-II error – Most Powerful test – Uniformly Most powerful test – Neyman Pearson Lemma – Simple problems.

Unit – II (15 hours)

Likelihood ratio test – Tests of mean of a normal population – Equality of two means of normal populations – test for variance of a normal population – Equality of variances of two normal populations

Unit – III (15 hours)

Chi-square tests, Distribution of quadratic forms, Test of equality of several means, Analysis of Variance. Correlation and Regression testing.

Unit – IV (15 hours)

Exact tests based on t distribution – One sample tests - one sided and two sided tests – Variance known and Variance unknown – Two sample tests – One sided and two sided - Variance known and Variance unknown.

Unit – V (15 hours)

Nonparametric methods – Confidence interval for distribution quintiles' – Tolerance limits for distributions. Sign test, Wilcoxon test.

TEXT BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Introduction to Mathematical Statistics, 4th edition,	Robert V. Hogg and Allen T.Craig	Macmillan Publishing Co., Inc. New York	1978
2.	An Introduction to Probability and Statistics	Rohatgi.V.K, and A.K.Md.EhsanesSaleh	John Wiley & Sons	2001

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamentals of Mathematical Statistics	GuptaS.C. and Kapoor V.K.	Sultan Chand & Sons	1991
2.	An outline of Statistical Theory	Goon A.M. Gupta M.K. and Das Gupta B	Vol.II World Press Calcutta	1980
3.	Introduction to the Theory of Statistics	Mood A.M. Graybill F.A. and Boes D.C.B	3/e, McGraw Hill, New York	1980

NOTE: Problem – 60% & Theory – 40%

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium.

CORE- VIII	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST08	ACTUARIAL STATISTICS	Contact Hour Per Week: 4

OBJECTIVES:

1. To develops a greater understanding of statistical principles and their application in actuarial statistics.
2. To Describe the core areas of actuarial practice and relate to those areas actuarial principles, theories and models.
3. It gives the understanding of the application knowledge of the life insurance environment.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To explain the utility theory and insurance terminologies.	K1
CO2	To articulate the insurance and annuity benefits through multiple life functions	K2
CO3	To evaluation for special mortality laws.	K3
CO4	To describe the various types of premium and their numerical evaluations.	K3
CO5	To explain implementation of the Life insurance policies.	K4

Unit - I   **(12 hours)**

Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest.

Unit – II   **(12 hours)**

Mortality : Gompertz - Makeham laws of mortality - life tables. Annuities: Endowments, Annuities, Accumulations, Assurances, Family income benefits.

Unit – III (12 hours)

Policy Values : Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.

Unit – IV (12 hours)

Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capital sums on retirement and death, widow's pensions, benefits dependent on marriage.

Unit – V (12 hours)

Principles of insurance, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance.

TEXT BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Life and other contingencies	Hooker,P.F., Longley, L.H.-	Cook Cambridge.	1957
2.	Life contingencies,	Alistair Neill	Heinemann professional publishing.	1977
3.	Fundamentals of Applied Statistics	Gupta and Kapoor	Sultan Chand & Sons	2001

REFERENCE BOOK:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Introductory statistics with applications in general Insurance	Hosack,I.B., Pollard, J.H. and Zehnwirth, B	Cambridge University	1999

Note: Problem – 30% & Theory – 70%

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium

SEMESTER – IV

Discipline Specific Elective - IV

DSE - IV	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTDSE2	OFFICIAL STATISTICS	Contact Hour Per Week: 3

OBJECTIVES:

1. To understand Indian official statistical system and data collection
2. To know Indian economic and agricultural surveys
3. To know index numbers and consumer price index
4. To know time series analysis

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand Indian official statistics and offices related to it	K2
CO2	To understand Indian surveys for collecting official statistics	K2
CO3	To know uses of index numbers	K3
CO4	To know demand analysis and its need	K4
CO5	To understand economic India by knowing agricultural and economic surveys	K2

Unit-I **(9 hours)**

Indian Statistical System: Data Collection for Governance – NSSO and its role in national data collection. NSSO reports and publications

Unit-II **(9 hours)**

Economic Statistics: Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data

Unit-III (9 hours)

Index numbers: Basic problems in construction of index numbers. Methods- Simple and Weighted aggregate-Average of price relatives-Chain base method. Criteria of goodness-Unit test , Time Reversal Factor Reversal and Circular tests. Base Shifting, Splicing and deflating index numbers. Wholesale and Consumer price index numbers. Index of industrial production.

Unit-IV (9 hours)

Series: Measurement of Trend : Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second degree parabola, Exponential curve, Modified Exponential curve, Gompertz curve and Logistic curve. Time Measurement of Seasonal variation by Ratio-to-Moving average method. Exponential smoothing , Holt Winter's method and Box-Jenkinson's method(only algorithm).

Unit-V (9 hours)

Demand Analysis: Introduction-Demand and Supply, Price elasticity of demand and supply, partial and cross elasticities of demand. Types of data required for estimating elasticity. Methods of estimating demand functions: Leontief 's and Pigou's methods. Engel's law and Engel's curves. Pareto's law of law of income distribution. Utility function.

TEXT BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamentals of Applied Statistics,4th edition	Gupta S.C. and Kapoor V.K.	Sultan Chand &Sons Publishers, New Delhi.	2007
2.	Statistical Methods	Gupta S.P.	Sultan Chand &Sons Publishers, NewDelhi.	2011

S. No	Title of the Book	Author	Publisher	Year of Publication
3.	Forecasting Methods and Applications , 3rd Edition	Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman,	John Wiley and Sons Inc.	1998

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Forecasting Methods and Applications , 3rd Edition	Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman	John Wiley and Sons Inc. .	2003
2.	Applied Statistical Methods,	Irving W. Burr	Academic Press	1974

Note: Theory – 100%

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium.

SEC – V Core Practical- III	**B.Sc. STATISTICS**	Credits: 2
Course Code: M23USTS03	**MAJOR PRACTICAL – III TESTING OF HYPOTHESIS & ACTUARIAL STATISTICS**	**Contact Hour Per Week: 2**

OBJECTIVES:

1. To introduces practical based on testing of hypothesis and Actuarial statistics.

2. To covers concepts such as Testing of hypothesis on the parameters of various distributions and Test of significance t, F distribution.

3. To provides technical skills to understand and develop various applications for statistical inference.

4. To Describe the core areas of actuarial practice and relate to those areas actuarial principles.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To obtain the Single mean – difference of two means	K1
CO2	To test of significance paired t test. F test for equality of two variances	K2
CO3	To test of significance of F test for equality of two variances	K3
CO4	To test the simple and compound interest	K3
CO5	To test the principles of insurance.	K4

Unit –I **(6 hours)**

Test of significance: Large sample - Single proportion- difference of proportions – Single mean – difference of two means.

Unit – II **(6 hours)**

Test of significance: Small sample test – t test for single mean – difference of two means – paired t test.

Unit – III **(6 hours)**

F test for equality of two variances and Chi square test for independence of attributes.

Unit – IV **(6 hours)**

Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest.

Unit – V **(6 hours)**

Principles of insurance, pure endowment, whole life assurance, Net premium for assurance

SEC -VI-(NME-VI)	B.Sc. STATISTICS	Credits: 2
Course Code: M23USTS04	BIO STATISTICS	Contact Hour Per Week: 2

OBJECTIVES:

1. To Understand and apply the statistical methods like measures of location, dispersion and the relationship between two variables in bio-statistics.
2. To understand large and small samples in laboratory study to apply it in real life problems.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand collection and classification of data.	K1
CO2	To test for measures of central tendancy	K4
CO3	To obtain measures of dispersion	K3
CO4	To understand correlation in real life situation	K2
CO5	To apply the testing of hypothesis	K4

Unit – I   **(6 hours)**

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   **(6 hours)**

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

Unit – III   **(6 hours)**

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

Unit – IV   **(6 hours)**

Correlation and Regression Definitions – Types and Methods of Correlation –Karl Pearson's coefficient of correlation – Spearman's Rank correlation coefficient –

of Proportions - Small sample test based on Mean, Difference of Means, Paired 't' Regression: Simple regression equations (two variables) – Simple Problems.

Unit – V   **(6 hours)**

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 test -   F-test -   Chi-square test.

NOTE: PROBLEM 80% & THEORY 30%

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistical Methods,	Gupta S. P.	Sultan Chand & Sons, New Delhi	2001
2	Statistics	Pillai R. S. N. And Bagavathi. V.	S. Chand & Company Ltd.,New Delhi.	2005
3.	Introduction to Bio-Statistics and Research methods	P.S.S. Sundar Rao, J. Richard	Prentice Hall of India Pvt Ltd, New Delhi.	2012
4.	An introduction to Bio-Statistics	Gurumani. N	2nd Revised Edition, MJP Publishers.	2005
5.	Bio-Statistics	Daniel. W. W	John Wiley and Sons, New York.	1987

REFERENCE BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Basic and Clinical Biostatistics,	Beth Daw Robert G Trapp son,	McGraw Hill, New Delhi.	2004
2	Bio Statistical Analysis,	Zar J	Prentice Hall, India	2014
3.	Fundamentals of Biostatistics, (8th edition)	Bernard Rosner,	Cengage Learning, USA.	2015

4.	Applied Biostatistics for Health Science	Rossi R. J	John Wiley, New York.	2010
5.	Bio-Statistics	Daniel. W. W	John Wiley and Sons, New York.	1987
6.	Statistics	Pillai.R.S.N. and Bagavathi.V	S.Chand & Company Ltd., New Delhi.	2005

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M
CO2	S	M	S	S	S
CO3	M	S	M	S	S
CO4	S	S	S	S	S
CO5	S	M	S	M	S

S- Strong; **M**-Medium.

CORE-IX	B.Sc. STATISTICS	Credits: 5
Course Code: M23UST09	STOCHASTIC PROCESS	Contact Hour Per Week: 5

OBJECTIVES :

1. To study the basic concepts of theory of Stochastic Processes, the most important types of Stochastic Processes, various properties and characteristics (Poisson, Markov and others).
2. To learn the notions of periodicity, stationarity and applications

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Understand stochastic nature of random variable and different stochastic process	K1
CO2	To know about transition matrix and its calculations	K2
CO3	To understand Markov chain and its applications	K3
CO4	To understand Markov process and its applications	K4
CO5	To understand renewal process and its applications	K3

Unit – I   (15 hours)

Notion and specification of Stochastic Processes – Stationary Process – Markov Chains – Definition and examples – Higher transition probabilities: Chapman – Kolmogorov equations. Classification of States and Chains

Unit – II   (15 hours)

Markov Chains – Determination of Stability of a Markov System – Limiting Behaviour – Ergodic theorem. One dimensional random walk

Unit – III **(15 hours)**

Markov Processes with discrete state space: Poisson Process – Postulates of Poisson process Properties of Poisson Process – Poisson process and related distributions. Pure Birth process – Yule-Furry process.Pure Death Process – Simple Birth and Death Process.

Unit – IV **(15 hours)**

Renewal Process – Definition, related concepts and examples – Renewal equation – Elementary Renewal Theorem – Basic Renewal Theorem.

Unit – V **(15 hours)**

Applications in Stochastic Models: Queuing Systems and Models: Simple queuing models M/M/1, M/M/s queuing systems (finite and infinite) steady state solution-simple problems with finite and infinite capacities.   .

TEXT BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Stochastic Processes	Medhi, J.	New Age International Publishers.	2019
2	Operations Research	KantiSwarup, Gupra.P.K. Man Mohan	Sultan Chand & Sons	2010

REFERENCE BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	A first Course in Stochastic Processes	Karlin ,S. and Taylor, H.M	Karlin ,S. and Taylor, H.M.(1975): A Academic Press, New York.	1975
2	Stochastic Processes	Ross, S.M.	John Wiley Eastern Ltd., New York.	1983

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium

CORE-X	B.Sc. STATISTICS	Credits: 4
Course Code: M23UST10	REGRESSION ANALYSIS	Contact Hour Per Week: 5

OBJECTIVES:

1. To understand linear and nonlinear relationships between variables and training the students in applications oriented.
2. To teach Linear Regression models, its assumptions and its properties.
3. To perform model adequacy check before using Linear Regression models

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To Estimating model parameters and testing it	K2
CO2	To understand linear and nonlinear models assumptions	K3
CO3	To check model adequacy	K1
CO4	To know about variable selection	K4
CO5	To know about nonlinear regression model**s**	K2

Unit – I **(15 hours)**

Simple linear regression-Assumptions, estimation of model parameters, standard error of estimators, testing of hypotheses on slope and intercept (β's), interval estimation of model parameters, prediction interval of a new observation, coefficient of determination, regression through origin.

Unit – II **(15 hours)**

Standard Gauss Markov setup, least square estimation of model parameters, variance covariance of least squares estimators, estimation of error variance

Tests of hypotheses – significance of regression (ANOVA, R^2 and adjusted R^2), individual regression coefficients, subset of regressor variables, general linear hypotheses- Confidence intervals and regions, prediction intervals, detecting hidden interpolation.

Unit – III   (15 hours)

Model adequacy checking - residual plots for checking normality homoscedasticity and detection of outliers. Test for Lack of fit of the model. Durbin – Watson test for autocorrelation. Analytical methods for selecting a transformation generalized and weighted least squares- Detection of influential observations – Cooks statistic, DFFITS, DFBETAS.

Variance stabilizing transforms and transforms to linearize the model, analytical methods for selecting a transform, generalized and weighted least squares.Dummy (or indicator variables) – general concepts and their use.

Unit – IV   (15 hours)

Multicollinearity – sources, effects, diagnostics, Methods of dealing with multi collinearity (collection of additional data, model respecification, Ridge regression).

Selection of Variables – forward selection, backward elimination and stepwise regression (algorithms only)

Unit – V   (15 hours)

Nonlinear regression – transformation to a linear model, their use nd limitations, initial estimates (starting values), parameter estimation using iterative procedures – Gauss-Newton, steepest Descent, Marquardt's compromise.   Count data- Poisson Regression – variables selection- Non – parametric regression.

TEXT BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Introduction to Linear regression analysis, third edition	Montgomery, D. C., Peck, E. A. and Vining, G. G.	John Wiley and Sons, Inc.	2003
2.	Biostatistical Analysis, fourth edition,	Zar, J.H	Pearson education.	2006
3.	Applied regression Modeling, second edition	Iain Pardoe	Wiley	2012

REFERENCE BOOKS :-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Applied Regression Analysis, third edition	Draper, N.R. and Smith, H.	John Wiley and Sons, Inc.	2003
2	Econometric methods, third edition	Johnston, J.	McGraw Hill International	1984
3.	Regression Analysis— Theory, Methods, and Applications,	A. Sen, M. Srivastava	Springer	2011

MAPPING WITH PROGRAMME OUTCOMES

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium.

CORE PRACTICAL-IV	B.Sc. STATISTICS	Credits: 4
Course Code: M23USTP01	STOCHASTIC PROCESS AND REGRESSION ANALYSIS	Contact Hour Per Week: 5

OBJECTIVES:

1. To study the basic problems of Stochastic Processes, the most important types of Stochastic Process (Poisson, Markov and others).
2. To learn the Estimating model parameters and testing it.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Understand stochastic nature of random variable	K1
CO2	To know about Poisson process	K2
CO3	To understand birth and death process	K3
CO4	To Estimating model parameters and testing it	K4
CO5	To know about nonlinear regression model**s**	K3

Unit – I (12 hours)

Higher transition probabilities: Chapman – Kolmogorov equations.

Unit – II (12 hours)

Poisson Process – Postulates of Poisson process.

Unit – III (12hours)

Poisson Process-Pure Birth process – Yule-Furry process. Pure Death Process – Simple Birth and Death Process.

Unit – IV   **(12 hours)**

Simple linear regression- Estimation of model parameters, standard error of estimators, testing of hypotheses on slope and intercept.

Unit – V   **(12 hours)**

Non linear regression- transformation to a linear model..   .

TEXT BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	A first Course in Stochastic Processes	Medhi, J.	New Age International Publishers	2019
2.	Operations Research,	KantiSwarup, Gupra.P.K. Man Mohan.,	Sultan Chand & Sons.	2010
3.	Introduction to Linear regression analysis, third edition,	Montgomery, D. C., Peck, E. A. and Vining, G. G	John Wiley and Sons, Inc	2003
4.	Biostatistical Analysis, fourth edition	Zar, J.H	Pearson College Div	2006

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	A first Course in Stochastic Processes	Karlin ,S. and Taylor, H.M.	Academic Press, New York	1975
2.	Stochastic Processes	SRINIVASAN S.K	Narosa publishing house	2003
3.	Applied Regression Analysis	Draper, N.R. and Smith, H	John Wiley and Sons, Inc	2003

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	M	M	S	S	M
CO3	S	S	S	S	S
CO4	S	S	M	M	S
CO5	M	S	S	M	M

S- Strong; **M**-Medium.

ELECTIVE – VI	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTDSE4	**ECONOMETRICS**	**Contact Hour Per Week: 5**

OBJECTIVES:

To successful completion of the course the students should have understood econometric Model, estimation and testing of parameters, forecasting and verification of economic theory and application of models in planning.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Know the objectives of Econometrics	K1
CO2	To Learn the method of estimation and testing of parameters.	K2
CO3	To Understand the General linear model.	K2
CO4	To Apply the detecting multi co linearity.	K4
CO5	To Obtain the Econometric models.	K3

Unit I: **(15 hours)**

Definition-Scope-objectives of Econometrics-Limitations-Divisions of Econometrics.

Unit II: **(15 hours)**

Single equation model two variable case-Reasons for introducing error term in the model-least square method of estimation and testing of parameters of the model-Estimation of error variance –Simple problems.

Unit III: (15 hours)

To General linear model-Assumptions –Least square method of estimation and testing of the parameters of the models –problems under failure of assumptions.

Unit IV: (15 hours)

Multicollinearity- Effects of multicollinearity – detecting multi collinearity – Remedies –Autocorrelation-sources of autocorrelation- Dubin-watson test-Dummy variables (concept only)-Specification errors.

Unit V: (15 hours)

Econometric models in planning: Mahalanobis four sector model-criticism of the model- problems-problems relating to three variable linear model and test for auto correlation.

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Econometrics Basic and applied	Aaron C Johnson Jr,Marvin B Johnson and Rueben C Buse	Maxwell Maxmillan Intl editions	1987

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Econometric methods	Johnston. J	McGraw Hill Intl students' editions	1996
2	Theory of Econometrics	Koutsoyannis. A	Palgrave publications Ltd	2001
3	Econometrics and mathematical Economics	S.P Singh ,Anil K.Parashar and H P Singh	S.Chand & Co.)	1980

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	S	M
CO2	S	M	S	M	S
CO3	M	S	M	S	S
CO4	M	M	S	S	M
CO5	S	M	S	S	S

S- Strong; **M**-Medium

SEMESTER- V

DISCIPLINE SPECIFIC ELECTIVE – V

DSE – V	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTDSE3	**OPERATIONS RESEARCH**	**Contact Hour Per Week: 4**

OBJECTIVES:

1. To purpose of this course is provides a quantitative analysis of the problem from which management can make an objective decision.

2. To Operation Research has drawn upon skills from mathematics, engineering, business, computer science, economics, and statistics to contribute to a wide variety of applications in business, industry, government, and military.

3. To Operations Research and Management Science methodologies and their applications continue to grow and flourish in a number of decision-making fields.

4. To impart basic knowledge of various optimization techniques.

5. To find the optimal solution for real life situation with help of Operations Research Techniques.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand optimization techniques and solving set of equations with constraints	K1
CO2	To solve problems of linear programming	K2
CO3	To understand transportation problems and its applications	K2
CO4	To solve problems using games theory	K4
CO5	To do replacement problems and solve it	K3

Unit I   **(12 hours)**

Formulation of Linear programming models – Graphical solution of LPP in two variables – LPP in standard form – Principles of Simplex method – Algorithm – Need for artificial variables – Charne's M-Technique – Concept of degeneracy.

Unit II   **(12 hours)**

Transportation problem(TP) – TP formulation- North-West Corner, Least cost, Vogel's Approximation method – UV-method – Assignment problem and algorithm.

Unit III   **(12 hours)**

Theory of Games – Basic definition – Maximin and Minimax criterion – Solution of Games with saddle points – Two–by–Two (2x2) Games without saddle point – principle of dominance – problems based on dominance rule – Graphical method for (2xn) and (mx2) games.

Unit-IV   **(12 hours)**

Replacement problems – Replacement policy for items whose maintenance cost increases with time and the value of money remains constant – Replacement policy for 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-V   **(12 hours)**

Network analysis by CPM/PERT : Basic Concept – Constraints in Network – Construction of the Network – Time calculations – Concept of slack and float in Network Analysis – Network crashing – Finding optimum project duration and minimum project cost.

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Operations Research	Kanti Swarup, P.K. Gupta and Manmohan Johnston. J	Sultan Chand Sons, New Delhi.	2007
2.	Operations Research	S.D. Sharma	Kedarnath and amnath, Meerut.	2002
3.	Operations Research: Theory and application	J.K. Sharma	Macmillan, India Ltd.	2002

REFERENCE BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Operations Research	Taha	PHI	2007
2.	Operations Research	Prem k. Gupta, Hira r.s	S.chand & company	1991
3.	Operations Research: Theory and application	J.K. Sharma	Macmillan, India Ltd.	2002

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium.

CORE – XII	B.Sc. STATISTICS	Credits: 4
Course Code: M23UST11	DESIGN OF EXPERIMENTS	Contact Hour Per Week: 6

OBJECTIVES:

1. To get theoretical knowledge in Statistical Design of Experiments and analysis of variance
2. To build strong theoretical foundation in Orthogonal Latin squares, Hyper Graeco Latin squares, factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance, Response surface methodology
3. To develop analytical thinking in problem solving skills

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand analysis of variance and experimental designs	K1
CO2	To have strong theoretical knowledge in Orthogonal Latin squares, Hyper Graeco Latin squares	K2
CO3	To Know factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance	K2
CO4	To understand clinical trial concepts and Response surface methodology	K4
CO5	To do numerical problems and able to get critical thinking to solve problems	K3

Unit -I **(18 hours)**

Fundamental Principles of Experiments – Replication, Randomization and Local Control techniques – Size of experimental unit – Methods of determination of experimental units – (Maximum curvature method – Fairfield Smith's variance law).

Unit -II **(18 hours)**

Analysis of variance – One way, Two way, classification (without interaction) – Multiple range test; Newman-Keul's test – Duncan's multiple range test – Tukey's test – Transformation – Square root, angular and log transformations.

Unit- III **(18 hours)**

Completely Randomized Design (CRD) and its analysis – Randomized block design (RBD) abd uts abaktysus – RBD – More than one but equal number of observations per cell – Latin Square Design (LSD) and its analysis.

Unit-IV **(18 hours)**

Missing plot techniques – Meaning – Least Square method of estimating one missing observation – RBD and LSD – Two observations missing in RBD and LSD – Analysis of covariance technique in CRD and RBD (without derivation).

Unit-V **(18 hours)**

Factorial experiment – Definition – 2^2, 2^3 and 3^2 factorial experiments and their analysis – Principles of confounding – Partial and complete confounding in 2^3 – Split plot design and its analysis.

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Design and Analysis of Experiments,	Das, M.N. and Giri N.C	Wiley Eastern, New Delhi.	1979
2.	Fundamentals of Applied Statistics	Gupta S.C. and Kapoor V.K	Sultan Chand and Sons, New Delhi	2007

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Design and Analysis of Experiments,	Kempthorne	John Wiley, New York.	1956
2.	Design of Experiments	Montgomery. D.	John Wiley and Sons	1985

Mapping with Programme Specific Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S
CO2	S	M	S	S	M
CO3	M	S	S	S	S
CO4	S	M	S	S	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium.

CORE – XIII	B.Sc. STATISTICS	Credits: 4
Course Code: M23UST12	**DEMOGRAPHY**	**Contact Hour Per Week: 6**

OBJECTIVES:

1. To Learn population and demographic registration
2. To learn fertility and mortality measurements
3. To understand Life table uses
4. To learn migration effect

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand need of population study and its registration system	K1
CO2	To understand fertility and mortality effect on population	K2
CO3	To understand life table and its usage to real problems	K2
CO4	To get effect of migration in population	K4
CO5	To understand population growth and its effect	K3

Unit I   **(18 hours**)

Sources of demographic data – civil registration – population census registers – errors in demographic data – methods of improvements

Unit II   **(18 hours)**

Fertility and mortality measurements – general and specific rates – standardized rates – age pyramid of sex composition gross and net reproduction rates.

Unit III   **(18 hours)**

Life table – structure – construction – relationship between the function of a life table – abridged life table – population estimation – growth rates – gross and net reproduction rates component method of population projection – forces of mortality – Gompertz and Makeham's law – logistic curve fitting and its use.

Unit-IV   **(18 hours)**

Spatial distribution of population –migration – kinds of migration – factors important in migration analysis – migration defining period and boundary – migration data by vital statistics and survival ratio and National Growth rate methods

Unit-V   **(18 hours)**

Components of population growth and change – Demographic transition theory – Methods of population projection – component method of projection, Leslie matrix, Logistic curve and its graduation.

TEXT BOOKS :-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Techniques of Population Analysis	Berclay G.W	John Wiley & Sons Inc	1959
2.	Health and Vital Statistics	Allen & Unwin Srivastava, Benjamin,B		1968
3.	A text book of Demography	O.S	Vikas Publishing	1983
4.	Principles of Demography	Bogue , Donald J	John Willey, New York	1976

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Techniques of Demography	Pathak. K.B. and Ram. F	Wiley Eastern	1992
2	Technical Demography,	Ram Kumar R	Wiley Eastern	1986

Mapping with Programme Specific Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium.

SEMESTER-VI

CORE PRACTICAL-V	B.Sc. STATISTICS	Credits: 4
Course Code: M23USTP02	DESIGN OF EXPERIMENTS & DEMOGRAPHY	Contact Hour Per Week: 5

OBJECTIVES:

1. To get theoretical knowledge in Statistical Design of Experiments and analysis of variance
2. To build strong theoretical foundation in Orthogonal Latin squares, Hyper Graeco Latin squares, factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance, Response surface methodology
3. To develop analytical thinking in problem solving skills
4. To learn fertility and mortality measurements
5. To understand Life table uses

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand analysis of variance and experimental designs	K1
CO2	To have strong problematic knowledge in Latin squares, Randomized block design	K2
CO3	To Know factorial and fractional factorial experiment.	K2
CO4	To understand the fertility and mortality measurements	K4
CO5	To know the force of mortality	K3

Unit-I   **(15 hours)**

Statistical Analysis of One Way - Two Way Classification - Multiple Comparison methods

Unit – II   **(15 hours)**

Analysis of CRD, RBD and LSD - Missing plot techniques in RBD and LSD with one missing observation.   .

Unit – III   **(15 hours)**

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

Unit-IV   **(15 hours)**

Fertility and mortality measurements – general and specific rates – standardized rates – age pyramid of sex composition gross reproduction rates.

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Unit-V   **(15 hours)**

Forces of mortality – Gompertz and Makeham's law – logistic curve fitting.

ELECTIVE – VII	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTDSE5	STATISTICAL QUALITY CONTROL	Contact Hour Per Week: 5

OBJECTIVES:

1. To impart basic theoretical knowledge about terminologies, need of control charts for quality control, construct control limits of variables and attributes.

2. To educate the learner to be able to construct control charts for defects, number of defects (c- chart); and control chart for number of defects per unit (u-chart).

3. To educate acceptance sampling plan and discuss the procedure of its implementation, compute the probability of accepting or rejecting a lot.

4. To define acceptance quality level (AQL) and lot tolerance percent defective (LTPD) of the lot; and compute the producer's risk and consumer's risk for an acceptance sampling plan.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To understand Industrial applications of Statistics	K1
CO2	To understand statistical process control and methods for it	K4
CO3	To understand attribute and variable control chart and interpret process based on it	K2
CO4	To understand the situations using special purpose control charts	K3
CO5	To know various product control techniques	K4

Unit I   **(15 hours)**

Importance and need for Statistical Quality Control techniques in Industry – Causes of variations in Quality – Uses of Shewart's Control charts – Terminologies: Specification limits, Tolerance limits, 3σ limits and Warning limits – Theory of runs and its applications in Quality control. Basis of sub grouping – Advantages and Limitations of SQC -Control charts variables: Chart for Mean (Xbar- Chart) ,Range Chart (R-Chart) , Standard Deviation Chart (S-Chart) - Process Capability Analysis.

Unit II   **(15 hours)**

Control Charts for Attributes: Control Chart for Fraction Defective (p-Chart), p-Chart for Variable Sample Size, Control Chart for Number of Defectives (np-Chart). Control Charts for Defects: Control Chart for Number Of Defects (C-Chart) and Control Chart for Number Of Defects Per Unit (U-Chart).

Unit III   **(15 hours)**

Acceptance sampling plans for attributes –Types of Acceptance Sampling plans, Methods of Inspection: 100% Inspection and Sampling Inspection, Advantages and Limitations of Acceptance Sampling. Terms used in acceptance sampling plans: Lot, Lot Size, Sample Size, Lot Quality, Acceptance Number , Probability of accepting a lot (Pa) , Acceptance Quality Level (AQL), Lot Tolerance Percent Defective (LTPD), Producer's Risk, Consumer's Risk, AOQ, AOQL, ATI and ASN.

Unit-IV   **(15 hours)**

Rectifying Sampling Plans. Single and Double sampling plans. OC, AOQ, ATI and ASN curves for Single and Double sampling plans.

Unit-V   **(15 hours)**

Acceptance sampling for variables known and unknown sampling plans (one sided specification only) -Determination of n and k for one sided specification of OC curve.

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TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Introduction to Statistical Quality Control (Unit V: Chapter 16 (pages 670 to 680)	Douglas C. Montgomery	John Wiley & Sons, New York.	2005
2	Fundamentals of Applied Statistics	Gupta S.C and V.K.Kapoor	Sultan Chand Sons, New Delhi	2007
3.	Statistical Quality Control	DhanpatRao& Co	New Delhi	1998

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistical Quality Control.	Gupta, R.C.	Khanna Publishers	1974
2	Statistical basis of Acceptance sampling	Ekambaram, S K.	Asia Publishing House.	1963
3.	Statistical Quality Control	Grant, E,L. and Laven Worth, R.S.	McGraw Hill.	2000

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	S
CO2	S	M	S	M	S
CO3	M	S	M	S	S
CO4	S	M	S	S	S
CO5	S	S	S	M	S

S- Strong; **M**-Medium.

ELECTIVE- VIII	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTDSE6	APPLIED STATISTICS	Contact Hour Per Week: 5

OBJECTIVES:

1. To course we have aimed to discuss the ideas involved in applying statistical methods to advance knowledge and understanding.
2. To apply statistics in multi disciplinary sciences for making decisions. Statistical considerations arise in virtually all areas of science and technology and, beyond these, in issues of public and private policy and in everyday life.
3. To the detailed methods used vary greatly in the level of elaboration involved and often in the way they are described, there is a unity of ideas which gives statistics as a subject both its intellectual challenge and its importance.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To learn the concept of time series.	K1
CO2	To obtain the seasonal variation in real life data.	K3
CO3	To apply the Laspeyre's and Passche's and Fisher's index numbers in real life problems.	K4
CO4	To compute the different index numbers.	K3
CO5	To study the functions of NSSO – CSO.	K2

Unit – I   **(15 hours)**

Concept of time series – Source of time series data – Component of time series – Additive and Multiplicative models – Resolving the components of time series – Trend – Methods of measuring trend – Semi average method – Method of moving average – Method of least squares.

Unit – II   **(15 hours)**

Seasonal variation – Seasonal index – Methods of measuring seasonal index – Simple average method – Ratio to moving average - Ratio to trend method – Link relatives method – Cyclical variation – Measurement of cyclical variation – Method of periodogram analysis – Auto regression series of first order and second order .

Unit – III   **(15 hours)**

Basis of Index Numbers – Definition – uses - Problems in the construction – Different types of Index Numbers – Simple Index Numbers – Weighted Index Numbers – Laspeyre's Index Numbers – Paasche's Index Numbers – Fisher's Index Numbers – Marshall & Edge worth Index Numbers – Dorbish & Bowley's Index Numbers.

Unit – IV   **(15 hours)**

Optimum tests of Index Numbers – Time reversal test – Factor Reversal Test – Circular Test – Chain base Index Number – Conversion of FBI into CBI and Vice versa – Uses of Index Numbers - Cost of living Index Numbers.

Unit – V   **(15 hours)**

Statistical system in India – Official sources of statistics – Functions of NSSO – CSO – Importance of Census – Census and data collection.

TEXT BOOK:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamentals of Applied Statistics	Gupta, S.C. & Kapoor, V.K	Sultan Chand & Sons, New Delhi	2007

REFERENCE BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamentals of Applied Statistics	Gupta, S.C. & Kapoor, V.K	Sultan Chand & Sons, New Delhi	2007

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	M	M
CO2	S	M	S	M	S
CO3	M	S	M	S	S
CO4	S	M	S	S	S
CO5	S	S	S	M	S

S- Strong; **M**-Medium.

PROFESSIONAL COMPETENCY SKILL	B.Sc. STATISTICS	Credits: 2
Course Code: M23USTPCS1	INTRODUCTION TO R LANGUAGE	Contact Hour Per Week: 2

OBJECTIVES:

1. To course is designed to help students learn how to analyze and interpret research data with intermediate statistics.

2. To this reason, most of the practical statistical analyses is done with the help of an appropriate software package.

3. To manager/researcher is only required to prepare the input data and should be able to get the final result easily with the help of software packages, so that focused attention can be given to various other aspects of problem solving and decision making.

4. To this course is famous for graphical data analyses and big data analytics.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

Cos	Statement	Knowledge Level
CO1	To use the basic data structures in R programming.	K1
CO2	To data manipulation - acquiring skills in flexible matrix manipulation.	K3
CO3	To analyze univariate and Bivariate data	K4
CO4	To test the correlation and Regression lines and the Analysis of Variance using R	K2
CO5	To test the probability distributions for real life problems	K4

Unit – I   **(6 hours)**

Introduction to R – Using the help facility. R data types and objects, reading and writing data import and export. Data Structures: Vectors, Matrices, List and data frames. Basic tools in R and Build in data reading from other sources

Unit – II   **(6 hours)**

Vector matrix operations – matrix operations – addition , ubtraction, multiplication, matrix decomposition – lu, qr, and svd and inverse, basics of matrix, rank of matrix.

Unit - III   **(6 hours)**

Graphical procedures and packages - Measures of Central Tendency – Measures of dispersion

Unit –IV   **(6 hours)**

Correlation and Regression analysis – Fitting a linear model – Prediction & forecasting – Design of Experiments – ANOVA (One way & Two Way)

Unit –V   **(6 hours)**

Testing of Hypothesis: One and two sample t test, F test for equality of variances, Chi square test

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Handbook of Statistical Analysis Using R-Brain	Everitt and A. TorstenHothron.Chapman	Hall/ CRC-2nd Edition	2009.

REFERENCE BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Introductory Statistics with R - Peter Dalgaard	Springer	Verlag New York, Inc. 1st Edition	2005

Note: Theory 100%

Mapping with Programme Specific Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S
CO2	S	M	S	S	S
CO3	M	S	M	S	S
CO4	S	M	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium.

GENERIC ELECTIVE COURSE-I

GEC-I	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTGE1	**MATHEMATICAL STATISTICS**	**Contact Hour Per Week: 4**

OBJECTIVES:

1. To provide foundation as well as comprehensive background of „Mathematical statistics, Correlation and Regression to beginners in simple and interesting manner.

2. To covers concepts such as theoretical and sampling distribution, It is hoped to convey that this subject is both a fascinating and important one.

3. To study the basic concepts for promoting theoretical as well as applications of statistics.

4. To covers concepts such as Correlation and regression Analysis, curve fitting. It provides technical skills to understand and develop various applications for descriptive statistics.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To learn the basic concepts about the random variables and distribution functions	K1
CO2	To learn the Mathematical Expectation ,MGF and CF	K2
CO3	To learn the theoretical and sampling distributions	K3
CO4	To learn the applications of correlation and regression in real life Situations.	K4
CO5	To learn of curve fitting in real life situations	K4

Unit- I (12 Hours)

Random variable – Discrete and Continuous – Probability Density Function – Probability Mass Function – Distribution Function – Marginal and Conditional Distributions (Simple Problems).

Unit – II (12 Hours)

Mathematical Expectation – Properties – Moment Generating Function and Characteristic Function – Properties (Simple Problems) – Tchebychev‟s Inequality.

Unit – III (12 Hours)

Theoretical Standard Distributions – Binomial, Poisson and Normal Distributions – Derivations, Properties and Exact Sampling Distributions – t, F and Chi-Square distributions (Concepts only).

Unit – IV (12 Hours)

Correlation and Regression – Correlation Coefficient of Rank Correlation– Regression lines and regression Coefficients – Properties.

Unit – V (12 Hours)

Curve Fitting, Method of Least Squares – Fitting of First Degree and Second Degree Polynomials, Fitting of Power Curve and Exponential Curve – Simple.

NOTE: PROBLEM 50% & THEORY 50%

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of mathematical statistics (11th edition)	S.C.Gupta and V.K. Kapoor Springer	Sultan Chand & sons, New Delhi	2004

REFERENCE BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistics	Sancheti.D.C and Kapoor.V.K	Sultan Chand & Sons, New Delhi	2009

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	S	M
CO2	S	S	M	M	S
CO3	M	S	S	M	M
CO4	M	S	M	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

GEC –II	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTGE2	STATISTICAL INFERENCE	Contact Hour Per Week: 4

OBJECTIVES:

To introduce theory and practical based Estimation and Testing. It covers concepts such as Method of maximum likelihood, fitting of curves and testing of hypothesis on the parameters of various distributions and Test of significance t, F and chi square distribution. It provides technical skills to understand and develop various applications for statistical inference.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	To understand the types of estimation and Learn the properties of good estimator.	K1
CO2	To know the importance of maximum likely hood estimator and Obtain the importance of Cramer Rao rule.	K2`
CO3	To know about the two types of errors and Know the role of Neyman – Pearson Lemma in testing of hypothesis.	K2
CO4	To analyze the statistical data using single means and difference of mean	K4
CO5	To analyze data using the chi square test	K4

Unit – I   **(12 Hours)**

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

Unit – II   **(12 Hours)**

Methods of Estimation – Maximum Likelihood and Methods of Moments – Properties of these Estimators – Interval Estimation (Concepts only).

Unit – III   **(12 Hours)**

Test of Hypothesis – Simple and Composite Hypothesis – Type I and Type II errors – Power of a test – Neyman- Pearson Lemma – Simple Problems.

Unit – IV   **(12 Hours)**

Test of Significance – Standard error – Large Sample test with regard to mean, difference of means – Simple Problems.

Unit – V   **(12 Hours)**

Test of Significance – Exact sample test based on t and F distributions with regard to means, variance and correlation coefficients – Chi-Square test for single variance, Goodness of fit and Independence of Attributes.

NOTE: PROBLEM 40 % & THEORY 60%

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition)	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi	2002

REFERENCE BOOKS :-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition)	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi	2011
2	Statistics	Sancheti.D.C and Kapoor.V.K	Sultan Chand & Sons	2010

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M
CO2	S	M	S	M	S
CO3	M	S	M	S	S
CO4	S	M	S	M	M
CO5	S	M	S	M	S

S- Strong; **M**-Medium.

GEC- PRACTICAL-I	B.Sc. STATISTICS	Credits: 3
Course Code: M23USTGEP1	STATISTICS PRACTICAL	Contact Hour Per Week: 2

OBJECTIVES:

1. To Introduces fundamental concepts such as practical based Descriptive Statistics. It covers concepts such as Measures of Central Tendencies, Measures of Dispersion, and Correlation Analysis

2. To provides technical skills to understand and develop various applications for descriptive statistics. This course introduces practical based Distribution Theory.

3. To Fitting of curves and goodness of fit and Fitting of curves and Testing of hypothesis on the parameters of various distributions and Test of significance t,F distribution.

4. To provides technical skills to understand and develop various applications for statistical inference.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO3	To obtain the curve fitting using data	K3
CO4	Applications of correlation and regression	K3
CO5	To analyse the data using test for independence of attributes and paired t-test	K4

Unit – I **(6 Hours)**

Computation of Measures of Location and Dispersion – Coefficient of Skewness.

Unit – II **(6 Hours)**

Fitting of Binomial, Poisson and Normal distributions – Test of Goodness of Fit.

Unit – III **(6 Hours)**

Curve fitting – Fitting a Straight line (Y= a+bx), Second Degree Parabola (Y= a+bx+cx^2) – Exponential (Y= ae^{bx}) and Power curve (Y= ab^x and Y= ax^b).

Unit – IV **(6 Hours)**

Computation of Correlation coefficient – Rank correlation coefficient – Regression lines.

Unit – V **(6 Hours)**

Asymptotic and exact tests with regard to mean, variance and Paired t-test – Test for independence of attributes.

GENERIC ELECTIVE-III	For other Departments (B.Sc. AIDS)	Credits: 3
Course Code: M23USTGE4	**Elective – III – Generic Elective - MATHEMATICAL STATISTICS – I**	**Contact Hour Per Week: 5**

OBJECTIVE:

This course is to provide foundation as well as comprehensive background of 'Mathematical statistics, Correlation and Regression to beginners in simple and interesting manner. It covers concepts such as theoretical and sampling distribution, It is hoped to convey that this subject is both a fascinating and important one. To study the basic concepts for promoting theoretical as well as applications of statistics. It covers concepts such as Correlation and regression Analysis, curve fitting. It provides technical skills to understand and develop various applications for descriptive statistics.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Learn the basic concepts about the random variables and distribution functions	K2
CO2	Learn the Mathematical Expectation ,MGF and CF	K2
CO3	Learn the theoretical and sampling distributions	K3
CO4	Applications of correlation and regression in real life situations.	K4
CO5	Applications of curve fitting in real life situations	K4

UNIT- I   **(15 Hours)**

Random variable – Discrete and Continuous – Probability Density Function – Probability Mass Function – Distribution Function – (Simple Problems).

UNIT – II   **(15 Hours)**

Mathematical Expectation – Properties – Moment Generating Function and Characteristic Function – Properties (Simple Problems) – T chebychev‟s Inequality.

UNIT – III   **(15 Hours)**

Theoretical Standard Distributions – Binomial, Poisson – Derivations, Properties – simple problems.

UNIT – IV   **(15 Hours)**

Correlation and Regression – Correlation Coefficient of Rank Correlation– Regression Coefficients – Properties.

UNIT – V   **(15 Hours)**

Curve Fitting, Method of Least Squares – Fitting of First Degree and Second Degree Polynomials, Fitting of Power Curve and Exponential Curve – Simple Problems only.

NOTE: PROBLEM 60% & THEORY 40%

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of mathematical statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & sons, New Delhi	2004

REFERENCE BOOK:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistics	Sancheti.D.C and Kapoor.V.K(2005)	Sultan Chand & sons, New Delhi	2009

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	M
CO2	S	S	M	M	S
CO3	M	S	S	M	M
CO4	M	S	M	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

GEC –III	B.COM CA	Credits: 3
Course Code: M23UCC08	BUSINESS MATHEMATICS AND STATISTICS	Contact Hour Per Week: 4

OBJECTIVES:

> ➢ To impart knowledge on the basics of ratio, proportion, indices and proportions
> ➢ To learn about simple and compound interest and arithmetic, geometric and harmonic progressions
> ➢ To familiarize with the measures of central tendency.
> ➢ To conceptualize with correlation co-efficient.
> ➢ To gain knowledge on time series analysis

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Learn the basics of ratio, proportion, indices and logarithm	K1
CO2	To Familiarise with calculations of simple and compound interest and arithmetic, geometric and harmonic progressions.	K2
CO3	To Determine the various measures of central tendency	K3
CO4	To Calculate the correlation and regression co-efficient.	K3
CO5	To Assess problems on time series analysis	K4

Unit – I   **(12 Hours)**

   Ratio: Ratio, Proportion and Variations

Unit - II.   **(12 Hours)**

   Interest and Annuity: Simple and Compound Interest – Annuity - Meaning - Types of Annuity Applications

Unit – III   **(12 Hours)**

   Business Statistics Measures of Central Tendency : Arithmetic Mean - Mode and Median . Measures of Variation – Range and Standard Deviation.

Unit – IV   **(12 Hours)**

   Correlation and Regression: Correlation - Karl Pearson's Coefficient of Correlation – Regression Lines and Coefficients

Unit – V   **(12 Hours)**

   Time Series Analysis and Index Numbers: Time Series Analysis : Secular Trend – Seasonal Variation – Cyclical variations - Index Numbers – Aggregative and Weighted Aggregative Index – Cost of Living Index

NOTE: PROBLEM 80 % & THEORY 20%

TEXT BOOKS:.

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Business Mathematics and Statistics	Dr. B.N. Gupta	Shashibhawan publishing house, Chennai.	2014
2.	Business Mathematics & Statistics	P.R. Vittal	Margham Publications, Chennai	2012

REFERENCE BOOKS:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamentals of business statistics	J.K. Sharma	Vikas publishing, Noida.	2014
2.	Business Mathematics & Statistics	Aggarwal B M	Ane Book Pvt. Ltd., New Delhi	2010

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	M
CO2	S	M	M	S	S
CO3	M	M	S	S	S
CO4	S	M	S	M	S
CO5	S	M	S	S	S

S- Strong; **M**-Medium.

GEC –III	B.B.A	Credits: 3
Course Code:M23USTGE5	BUSINESS STATISTICS	Contact Hour Per Week: 4

OBJECTIVES:

To course we have aimed to discuss the ideas involved in applying statistical methods to advance knowledge and understanding. This course is to provide foundation as well as comprehensive background of Descriptive Measure such as measures of central tendency and measures of dispersion to beginners in simple and interesting manner. It covers concepts such correlation and regression. This course introduces practical based applied statistics for learning the basic concepts which aims to resolve the real life problems

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To apply the Measures of Central Tendency in business	K1
CO2	To understanding the Measures of Variation	K2
CO3	To analyze of Time Series	K3
CO4	To understand Index Numbers and Statistical quality control	K3
CO5	To testing of hypothesis	K4

Unit-I   **(12 Hours)**

Introduction – Meaning and Definition of Statistics – Collection and Tabulation of Statistical Data – Diagrammatic Presentation of Statistical Data - Measures of Central Tendency – Arithmetic Mean, Median and Mode.

Unit-II   **(12 Hours)**

Measures of Variation – Standard Deviation – Quartile deviation –Simple Correlation – Scatter Diagram – Karl Pearson's Correlation.

Unit-III   **(12 Hours)**

Analysis of Time Series – Methods of Measuring Trend and Seasonal Variations

Unit –IV   **(12 Hours)**

Index Numbers – Consumer Price Index – And Cost of Living Indices.

Unit-V   **(12 Hours)**

Testing of hypothesis – Chi-Square test, T Test, F Test.

NOTE: PROBLEM 80 % & THEORY 20%

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Business Mathematics and Statistics	P.R. Vittal	Margham Publications, Chennai	2004
2.	Statistical Methods	S.P. Gupta	Sultan Chand &Sons, NewDelhi	2007
3.	. Elements of Business Statistics	S.P. Gupta	Sultan Chand &Sons, NewDelhi	2007

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Business Statistics	David M.Levine, David F.Stephanetal	A first Course, 7th edition	2017
2.	Statistics	Dina Nath Pandit	A Modern Approach , Hindustan Publishing Corporation	2022
3.	A textbook of Business Statistics	Hazarika Padmalochan	S.Chand Publications	2012

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S
CO2	S	S	M	M	M
CO3	S	S	M	M	S
CO4	S	S	M	M	M
CO5	S	S	M	S	S

S- Strong; **M**-Medium

GENERIC ELECTIVE-IV	For other Departments (B.Sc. AIDS)	Credits: 3
Course Code: M23USTGE6	**Elective – IV – Generic Elective - MATHEMATICAL STATISTICS – II**	**Contact Hour Per Week: 5**

Objective:

This course introduces theory and practical based Estimation and Testing. It covers concepts such as Method of maximum likelihood, fitting of curves and testing of hypothesis on the parameters of various distributions and Test of significance t, F and chi square distribution. It provides technical skills to understand and develop various applications for statistical inference.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Understand the types of estimation and Learn the properties of good estimator.	K1
CO2	Know the importance of maximum likely hood estimator and Obtain the importance of Cramer Rao rule.	K2`
CO3	Know about the two types of errors and Know the role of Neyman – Pearson Lemma in testing of hypothesis.	K2
CO4	Analyze the statistical data using single means and difference of mean	K4
CO5	Analyze data using the chi square test	K4

UNIT- I (15Hours)

Population and sample,parameter and statistic – point estimation-unbiasedness-consitency- efficiency (Cramer – Rao Inequality) and sufficiency.

UNIT – II (15 Hours)

Methods of estimation – maximum likelihood and methods of moments-properties and these estimators.

UNIT – III (15 Hours)

Test of hypothesis – simple and composite hypothesis – type I and type II Error – Neymann pearson lemma.

UNIT – IV (15 Hours)

Test of significance – standard error- large sample test with regard to mean, difference of mean (simple problems)

UNIT – V (15 Hours)

Test of significance – Exact sample test based on t and chi - square distribution – Goodness of fit and independence of attributes.

NOTE: PROBLEM 60% & THEORY 40%

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Fundamental of mathematical statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & sons, New Delhi	2004

REFERENCE BOOK:-

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistics	Sancheti.D.C and Kapoor.V.K(2005)	Sultan Chand & sons, New Delhi	2009

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	M	S
CO3	M	S	M	S	S
CO4	S	M	S	M	M
CO5	S	M	S	M	S

S- Strong; **M**-Medium.

GENERIC ELECTIVE COURSE-IV

GEC - IV	B.COM	Credits: 3
Course Code: M23USTGE8	**OPERATION RESEARCH**	**Contact Hour Per Week: 4**

OBJECTIVES:

1. To impart knowledge on the basics of ratio, proportion, indices and proportions
2. To learn about simple and compound interest and arithmetic, geometric and harmonic progressions.
3. To familiarise with the measures of central tendency
4. To conceptualise with correlation co-efficient
5. To gain knowledge on time series analysis

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To learn the basics of ratio, proportion, indices and logarithm	K1
CO2	To familiarise with calculations of simple and compound interest and arithmetic, geometric and harmonic progressions.	K2
CO3	To determine the various measures of central tendency	K3
CO4	To calculate the correlation and regression co-efficient.	K3
CO5	To assess problems on time series analysis	K4

Unit – I **(12 Hours)**

     Introduction to Operations research and Linear Programming Problem:
Operations research – Origin and development - Decision making - Linear
inventory systems, Inventory classification. Economic order quantity (EOQ)
model, Single period probabilistic inventory models with discrete and
continuous demand.

Unit – II **(12 Hours)**

     Transportation and Assignment problem: Transportation Problem –
methods - North West corner method - Least cost method - Vogel's
approximation method - Assignment problem- Hungarian method only.

Unit – III **(12 Hours)**

     Game Theory and Simulation: Game Theory- different strategies
followed by the players in a game - Optimal strategies of a game using maxi-
min criterion – Graphical method – Simulation.

Unit – IV **(12 Hours)**

     Inventory Management: Introduction to inventory systems, Inventory
classification. Economic order quantity (EOQ) model, Single period probabilistic
inventory models with discrete and continuous demand.

Unit – V **(12 Hours)**

     Network Analysis: Network models- CPM and PERT Determination of
Critical Path Method (CPM) - PERT - Application of PERT and CPM.

NOTE: PROBLEM 80 % & THEORY 20%

TEXT BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Operations Research	V.K. Kappor	Vikas Publications, Noida	2012
2.	Operations research principles & practice	Ravindran A	John wiley	1987
3.	Operation Research	Anand Sharma	Himalaya Publishing House, Mumbai	2014
4.	Elements of Operation Research	S. Gurusamy	Vijay Nicole Imprints Private Limited.	2016

REFERENCE BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Operations Research	S.Kalavathy	Vikas Publications, Noida	2000
2.	Operation Research,	P.R.Vittal	- Margham Publications, Chennai	2012
3.	Statistical Methods	S.P. Gupta	Sultan Chand & Sons, New Delhi.	2019

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M
CO2	S	M	S	S	M
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	S	S	S	M	S

S- Strong; **M**-Medium

GENERIC ELECTIVE COURSE-IV

GEC - IV	B.B.A	Credits: 3
Course Code: M23USTGE7	**OPERATION RESEARCH**	**Contact Hour Per Week: 4**

OBJECTIVES:

1. To Introduction Operations Research definition and concept Essential features of LPP.
2. Formulation of Transportation problem and finding an initial basic feasible solution.
3. Expressing Assignment problem, Hungarian method- Minimization and Maximization case and Sequencing Problem.
4. Analyses Network models and constructing network- critical path, various floats.
5. Analyses Game Theory and Decision Theory.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	To analyse Linear Programming	K1
CO2	To analyse Transportation problem	K2
CO3	To analyse Assignment problem	K3
CO4	To analyse Network models	K3
CO5	To analyse Game Theory and Decision Theory	K4

Unit – I   **(12 Hours)**

Linear Programming problem -Concept and scope of OR, general mathematical model of LPP, steps of L.P model formulation, Graphical method of the solution of LPP -simple problems.

Unit- II   **(12 Hours)**

Transportation problem- Basic definitions, finding an initial basic feasible solution- North -west corner rule, row minima method, column minima method, and least cost entry method Vogel's approximation method.

Unit- III   **(12 Hours)**

Assignment problem-Hungarian method- Minimization and Maximization case, unbalanced assignment problem. Sequencing Problem-Processing n jobs on 2 machines, processing n jobs on 3 machines.

Unit- IV   **(12 Hours)**

Network models-PERT and CPM — difference between PERT and CPM- constructing network- critical path, various floats, three-time estimates for PERT.

Unit- V .   **(12 Hours)**

Game Theory- Maximin-Minmax criterion, Saddle point, Dominance property, Graphical method for solving 2xn and mx2 game. Decision Theory- decision trees.

NOTE: PROBLEM 80 % & THEORY 20%

TEXT BOOK :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Operations Research	DR H. Premraj	Margham publications, Chennai	2019.

REFERENCE BOOKS :

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Operative Research	P.R. Vittal& V. Malini	Margham publications, Chennai	2014
2.	Problems in Operations Research	P.K. Gupta& Man Mohan,	Sultan Chand & sons – New Delhi	2022
3.	Introduction to operational Research	V.K. Kapoor	Sultan Chand & sons – New Delhi	2011

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	M	M	S
CO3	S	S	M	M	S
CO4	S	S	M	M	M
CO5	S	S	M	M	M

S- Strong; **M**-Medium

SEC – I (NME-I)	I B.COM/I B.SC CHEMISTRY	Credits: 2
Course Code: M23USTN01	BASIC OF STATISTICS-I	Contact Hour Per Week: 2

OBJECTIVES:

1. To enable the students to understand the basic concepts of statistics, collection of data, presentation of data and analysis of data.

2. To acquire knowledge of statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.,

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Learn the Basic concept of statistics	K2
CO2	To Learn the collection of data	K1
CO3	To Learn the classification of data	K2
CO4	To Learn the diagrammatic presentation of data	K3
CO5	To understand the graphical presentation	K4

Unit – I   **(6 Hours)**

Introduction of Statistics – Definition – Scope – Limitations – Population and Sample – Concepts of Random sampling – Basic concepts only.

Unit – II   **(6 Hours)**

Collection of Data: Primary and Secondary data – Methods of collecting primary and secondary data**.**   **.**

Unit – III (6 Hours)

Presentation of Data: Classification of data – Types – Frequency distributions for discrete and continuous data.

Unit – III (6 Hours)

Diagrammatic Representation of Data: Bar Diagrams: Types of one dimensional -simple and multiple bar diagram only - two dimensional diagram-Pie-diagram only.

Unit – V (6 Hours)

Graphical Representation of Statistical Data: Histogram – Frequency Polygon – Frequency curve and Cumulative frequency curve.

NOTE: PROBLEM 50% & THEORY 50%

TEXT BOOK:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Business Statistics	P.A. Navanithan	Jai Publications	2006

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	M

S- Strong; **M**-Medium.

SEC-II-(NME-II)	COMMON TO ALL UG PROGRAMMES	Credits: 2
Course Code: M23USTN03	BASIC OF STATISTICS-II	Contact Hour Per Week: 2

OBJECTIVES:

3. To enable the students understand and compute the measures of central tendency and dispersion.

4. To learn the concepts of time series, evaluation of trend and measurement of seasonal variations by using various methods.

5. Acquire knowledge about index numbers, cost of living index numbers and calculate an indices from real life problems.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Understand and compute various statistical measures of central tendency	K2
CO2	To Gain knowledge about the sources of measure dispersion	K1
CO3	To Understand and compute various statistical measures of correlation.	K2
CO4	To Understand the concepts of index numbers, optimum tests and its construction.	K3
CO5	To Understand and compute various statistical measures of time series.	K4

Unit – I   **(6 hours)**

Measures of Central Tendency: Definitions and concepts of Arithmetic mean Median and Mode – Merits and Demerits – Uses -Simple Problems**.**

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Unit – II   **(6 hours)**

Measures of Dispersion: Range, Quartile deviation and Standard deviation   -Simple Problems.

Unit – III   **(6 hours)**

Correlation: Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient – Simple Problems.

Unit – IV   **(6 hours)**

Regression: Linear Regression equation

Unit – V   **(6 hours)**

Time series: Measures of trend – Graphic method – Semi average method and Moving average method-Simple Problems.

NOTE: PROBLEM 80% & THEORY 20%

TEXT BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Business Statistics	P.A. Navanithan	Jai Publications	2007
2.	Statistics	Pillai. R. S. N. And Bagavathi. V.	S. Chand & Company Ltd., New Delhi.	2005

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Statistical methods	Gupta. S. P.	Sultan Chand & Company Ltd., New Delhi.	2001
2.	Statistics (7th Edition)	Sancheti. D. C. and Kapoor. V. K	Sultan Chand & Sons, New Delhi	2005
3.	Comprehensive Statistical Methods	Arora P. N	Sultan Chand & Sons, New Delhi	2010
4.	Basic Statistics	Agarwal B. L	Wiley Eastern Ltd., Publishers, New Delhi	1991
5.	Business Statistics	Vittal P. R	Margham Publications, Chennai	2012

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium.

SEC-II-(NME-II)	COMMON TO ALL UG PROGRAMMES	Credits: 2
Course Code: M23USTN04	**INDIAN OFFICIAL STATISTICS**	**Contact Hour Per Week: 2**

OBJECTIVES:

1. To know the population and agricultural statistics
2. To understand industrial statistics and price statistics
3. To know the National sample survey

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COs	Statement	Knowledge Level
CO1	To Understand the population statistics	K2
CO2	To gain knowledge about Industrial Statistics	K1
CO3	To Understand the concept of time series and estimate the trend values using various methods.	K2
CO4	To Understand and compute Financial and national Income statistics	K3
CO5	To Understand the concept of Sample Surveys	K4

Unit – I   **(6 hours)**

Population Statistics: Statistical organization – Population Statistics – Agricultural Statistics – Indices of Agricultural production – Miscellaneous Agricultural Statistics.

Unit – II   **(6 hours)**

Industrial statistics – ASI – Indices of Industrial Production and profits.

Unit – III   **(6 hours)**

Price statistics – Price index numbers – Labour Bureau; Index number of Retail prices – Indices of security price

Unit – IV (6 hours)

Wage statistics – trade statistics – Financial statistics – National income statistics.

Unit – V (6 hours)

National sample surveys – Activities and publications of CSO and the Department of Statistics, Government of Tamil Nadu. National Income compilation.

REFERENCE BOOKS:

S. No	Title of the Book	Author	Publisher	Year of Publication
1.	Central Statistical Organisation	P.A. Guide to Official Statistics	1. Department of Statistics, Ministry of Planning, India	1979

Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	M	M	M

S- Strong; **M**-Medium.