MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

Affiliated to Periyar University

[Accredited by NAAC "A" Grade & Recognized under u/s 2(f) and 12(B) of the UGC act 1956]

KALIPPATTI - 637501.

BACHELOR OF SCIENCE

SYLLABUS FOR B.Sc. STATISTICS

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR

2019 – 2020 ONWARDS

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.

I- 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.

II - PROGRAMME OUTCOMES:

- A student of three - year B.Sc. degree course will not be allowed to offer Statistics and Statistical Techniques simultaneously in any of the three years of the course.
- Students offering Statistics at the First year of the three-year B.Sc. course may be allowed to offer Statistical Techniques as one of their subjects in the second year of the three-year B.Sc. in place of Statistics.
- Students offering Statistical Techniques at the first year of the three-year B.Sc. course may be allowed to offer Statistics as one of their subjects in the second year of the three-year B.Sc. course in place of Statistical Techniques.
- Students must complete all the practical's to the satisfaction of the teacher concerned.
- Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

III REGULATIONS AND SYLLABUS (with effect from 2019-2020 onwards)

1. Objectives of the Course:

Statistics is a key to success in the field of science and technology. Today, the students need a thorough knowledge of fundamental basic principles, methods, results and a clear perception of the power of statistical ideas and tools to use them effectively in modeling, interpreting and solving the real life problems. Statistics plays an important role in the context of globalization of Indian economy, modern technology, and computer science and information technology.

The main objectives of the course is

- o To build the basis for promoting theoretical and application aspects of Statistics.
- o To underline the statistics as a science of decision making in the real life problems With the description of uncertainty.
- o To emphasize the relevance of statistical tools and techniques of analysis in the study of inter-disciplinary sciences.

This syllabus is aimed at preparing the students to hope with the latest developments and compete with students from other universities and put them on the right track.

2. Eligibility Condition for Admission:

A Pass in the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereto.

3. Duration of the Course:

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

The odd semesters will consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

4. Course of Study:

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

5. Examinations :

The theory examination shall be three hours duration to each paper at the end of each semester. The practical examination shall be three hours duration to each paper at the end of each academic year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

6. STRUCTURE OF THE PROGRAMME

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
			SEMESTER-I						
I	Language Course –I	Tamil - I/ French – I/ Hindi – I	M19UFTA01	5	-	3	25	75	100
II	Language Course – II	English – I	M19UFEN01	5	-	3	25	75	100
III	Core Course- I	Descriptive Statistics	M19UST01	7	-	5	25	75	100
	Allied Course-I	Allied – I Mathematics- I	M19UMAA01	5	-	4	25	75	100
	Core Practical – I	Practical –I Descriptive Statistics	M19USTP01	-	4	2	40	60	100
	Allied Practical – I	Allied Practical - I Mathematics *	M19UMAAP01	-	2	-	-	-	-
IV	Enhancement Compulsory Course-I	Value Education: Yoga	M19UVE01	2	-	2	25	75	100
	Total			**24**	**6**	**19**	**165**	**435**	**600**

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
			SEMESTER-II						
I	Language Course –I	Tamil - II/ French – II/ Hindi – II	M19UFTA02	5	-	3	25	75	100
II	Language Course – II	English – II	M19UFEN02	5	-	3	25	75	100
III	Core Course-II	Probability Theory	M19UST02	7	-	5	25	75	100
	Allied Course-II	Allied - II Mathematics- II	M19UMAA02	5	-	4	25	75	100
	Core Practical - II	Practical – II Probability Theory	M19USTP02	-	4	2	40	60	100
	Allied Practical - I	Allied Practical - I Mathematics	M19UMAAP01	-	2	2	40	60	100
IV	Enhancement Compulsory Course - II	Environmental Studies	M19UES01	2	-	2	25	75	100
	Total			**24**	**6**	**21**	**205**	**495**	**700**

4

		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/ French – III/ Hindi – III	M19UFTA03	5	-	3	25	75	100
II	Language Course-II	English – III	M19UFEN03	5	-	3	25	75	100
III	Core Course-III	Sampling Techniques	M19UST03	5	-	4	25	75	100
	Core Course-IV	Distribution Theory	M19UST04	5	-	4	25	75	100
	Allied Course-III	Allied - III Statistical Economics	M19UCMA03	4	-	4	25	75	100
	Core Practical – III	Practical – III Sampling & Distribution Theory	M19USTP03	-	2	2	40	60	100
IV	Non Major Elective Course –I	NMEC - I		2	-	2	25	75	100
	Skill Enhancement Course –I	SEC – I Quantitative Aptitude	M19USTS01	2	-	2	25	75	100
	Total			28	2	24	215	585	800

		SEMESTER –IV							
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 - IV/ French – IV/ Hindi – IV	M19UFTA04	5	-	3	25	75	100
II	Language Course-II	English – IV	M19UFEN04	5	-	3	25	75	100
III	Core Course-V	Estimation Theory	M19UST05	5	-	5	25	75	100
	Core Course-VI	Testing of hypothesis	M19UST06	5		4	25	75	100
	Allied Course-IV	Allied - IV Psychological Statistics	M19UCMA04	4	-	4	25	75	100
	Core Practical – IV	Practical – IV Estimation & Testing of Hypothesis	M19USTP04	-	2	2	40	60	100
IV	Skill Enhancement Course – II	SEC – II Statistical Aptitude	M19USTS02	2	-	2	25	75	100
	Non Major Elective Course –II	NMEC - II		2	-	2	25	75	100
V	Extension Activities		M19UEX01	-	-	1	-	-	-
	Total			28	2	26	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-VII	Official Statistics	M19UST07	5	-	5	25	75	100
	Core Course-VIII	Design of Experiments	M19UST08	5	-	5	25	75	100
	Core Course-IX	Linear Programming and its Applications	M19UST09	5	-	5	25	75	100
	Core Practical – V	Practical – V: Design & Linear Programming	M19USTP05	-	4	2	40	60	100
	Core Practical – VI	Practical – VI: Statistical Data Analysis (Lab Oriented)	M19USTP06	-	4	2	40	60	100
	Elective Course –I	Elective - I		5	-	4	25	75	100
IV	Skill Enhancement Course –III	SEC – III Statistical Software Packages	M19USTS03	2	-	2	25	75	100
		Total		**22**	**8**	**25**	**205**	**495**	**700**

		SEMESTER-VI							
Part	Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
				L	P		Int.	Ext.	Total
III	Core Course-X	Statistical Quality Control	M19UST10	5	-	5	25	75	100
	Core Course-XI	Applied Statistics	M19UST11	5	-	5	25	75	100
	Core Course-XII	Decision Theory and its applications	M19UST12	5	-	5	25	75	100
	Core Practical – VII	Practical – VII: Applied Statistics & Decision Theory	M19USTP07	-	4	2	40	60	100
	Elective Course -II	Elective - II		4	-	4	25	75	100
	Project Course	Project	M19USTPR1	5	-	5	40	60	100
IV	Skill Enhancement Course –IV	SEC – IV Statistical Forecasting	M19USTS04	2	-	2	25	75	100
		Total		**26**	**4**	**28**	**205**	**495**	**700**
		OVER ALL TOTAL		**152**	**28**	**143**	**1210**	**3090**	**4300**

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	20	4	400
II	Language – II	3	3	3	3	-	-	12	20	4	400
III	Core	5	5	8	9	15	15	57	64	12	1200
	Core Practical	2	2	2	2	4	2	14	24	7	700
	Elective	-	-	-	-	4	4	8	9	2	200
	Project	-	-	-	-	-	5	5	5	1	100
	Allied	4	4	4	4	-	-	16	18	4	400
	Allied Practical	-	2	-	-	-	-	2	4	1	100
IV	SEC	-	-	2	2	2	2	8	8	4	400
	NMEC	-	-	2	2	-	-	4	4	2	200
	Enhancement Compulsory Courses	2	2	-	-	-	-	4	4	2	200
V	Extension Activities	-	-	-	1	-	-	1	-	1	-
	Total	**19**	**21**	**24**	**26**	**25**	**28**	**143**	**180**	**44**	**4300**

ALLIED SUBJECTS FOR B.Sc. STATISTICS STUDENTS

Semester	Course Title	Course Code
I	Allied – I: Mathematics –I	
II	Allied – II: Mathematics –II	
	Allied Mathematics – Practical	
III	Allied – III: Statistical Economics	
IV	Allied – IV: Psychological Statistics	

ALLIED SUBJECTS OFFERED FOR OTHER MAJOR STUDENTS

Semester	Course Title	Course Code
I	Mathematical Statistics	
	Business Statistics	
	Business Mathematics & Statistics – I	
II	Statistical Inference	
	Business Statistical Decision Techniques	
	Business Mathematics & Statistics – II	
	Allied Practical – Mathematical Statistics	
III	Introduction to Operation Research - I	
IV	Introduction to Operation Research – II	

ELECTIVE COURSES

Semester	ELECTIVE – I		
	S.No	Name of the Course	Course Code
V	1.	Actuarial Statistics	
	2.	Non – Parametric Test	
	3.	Queuing Theory	
	ELECTIVE – II		
	S.No	Name of the Course	Course Code
VI	1.	Stochastic Processes	
	2.	Numerical Analysis	
	3.	Regression Analysis	

SKILL ENHANCEMENT COURSE:

Semester	Name of the Course	Course Code
III	Competitive Exam – I (Quantitative Aptitude)	
IV	Competitive Exam – II (Statistical Aptitude)	
V	Statistical Software Packages	
VI	Statistical Forecasting	

NON - MAJOR ELECTIVE COURSES OFFERED FOR OTHER MAJOR STUDENTS

Semester	Course Title	Course Code
III	Applied Statistics	
	Statistical Survey	
IV	Statistical Methods	
	Agricultural Statistics	

IV   SCHEME OF EXAMINATION:

1. Question Paper Pattern for Theory Papers

Time: Three Hours   Maximum Marks: 75

Part A: (10 x 1 = 10)
Answer ALL Questions
(Two Questions from Each Unit)

Part A: (10 x 2 = 20)

Answer ALL Questions
(Two Questions from Each Unit)

Part B: (5 x 5 = 25)

Answer ALL Questions
(One Question From Each Unit with internal choice)

Part C: (3 x 10 = 30)

Answer Any Three Questions out of Five Questions
(One Question from Each Unit)

2. Question Paper Pattern for Practical Papers

EXTERNAL MARK: 60
INTERNAL MARK: 40

QUESTION PATTERN

Answer any three Questions (3x20 =60)

Questions from each Unit

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 papers of UG programmes.

ESE	EA Total	Passing Minimum for EA	CIA Total	Passing Minimum for CIA	Total Marks Allotted	Passing Minimum (ESE)
Theory	75	30	25	10	100	40
Practical	60	24	40	16	100	40
Project	60	24	40	16	100	40

The following are the Distribution of marks for the Continuous Internal Assessment in Theory / Practical papers of UG programmes.

THEORY

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

   Total : 25 Marks

The Passing minimum shall be 40% out of 25 marks (10 marks)

PRACTICAL

EVALUATION OF INTERNAL ASSESSMENT
   Test 1 : 15 Marks
   Test 2 : 15 Marks
   Record : 10 Marks

   Total : 40 Marks

The Passing minimum shall be 40% out of 40 marks (16 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

The Passing minimum shall be 40% out of 40 marks (16 marks)

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 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 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. 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 / guide/teacher concerned.

2. The Project Report may consist a minimum of 60 pages.

3. The candidate has to submit the Project Report 20 days before the commencement of the VI 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.

7. Note

SWAYAM / MOOC – Free Online Education

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.

Core Course- I	B.Sc. STATISTICS	2019 - 2020
Code: M19UST01	DESCRIPTIVE STATISTICS	
Credits: 5		

Objective:

This course is to provide foundation as well as comprehensive background of 'Descriptive Measures', Correlation and Regression to beginners in simple and interesting manner. It covers concepts such as descriptive statistics and introduces common measures of central tendency, variability and frequently used graphs and charts, Moments, Skewness and Kurtosis and introduces the concept of association with graphics displaying different strengths of association between two variables. 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

CO	Statement	Knowledge Level
CO1	Know the uses of statistics in society and Understand the method of data collection, Learn the types of statistical diagrams.	K1
CO2	Learn the Measures of central tendency.	K2
CO3	Learn the Measures of variability in practical life data.	K2
CO4	Applications of moments, Skewness and Kurtosis in real life situations.	K3
CO5	Analyse the Bivariate data in real life problems working different strengths of association between two variables.	K4

Unit- I

Origin and meaning of statistics – Primary and Secondary data – Types of variables – Diagrammatic representation of data – Graphic representation of data – Histogram , frequency polygon, frequency curve and O'Give.

Unit -II

Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean – Inter relationship between A.M, G.M and H.M – Properties of a good average.

Unit –III

Measures of dispersion – Range, Quartile Deviation, Mean Deviation and Standard Deviation – Co-efficient of Variation – Lorenz curve.

Unit- IV

Moments – Raw moments – Central moments – Relationship between raw and central moments – Measures of Skewness – Karl Pearson's coefficient of Skewness – Bowley's Co-efficient of Skewness – Measures of Kurtosis.

Unit- V

Correlation – Types of correlation – Scatter diagram – Karl Pearson's coefficient of correlation – Properties – Spearman's Rank correlation coefficient – Regression – Least square method – Regression equations.

TEXT BOOK:

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Mathematical Statistics (11th - Edition)	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Statistics	Goon Gupta A.M and Das Gupta	The World Press Private Limited	1994
2.	Statistical Methods	Gupta, S.P	Sultan Chand & Sons, New Delhi.	2001

Mapping with Programme Outcomes

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

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

Core Practical- I	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP01	**MAJOR PRACTICAL – I** **Descriptive Statistics**	
Credits: 2		

Objective:

This course introduces fundamental concepts such as practical based Descriptive Statistics. It covers concepts such as Measures of Central Tendencies, Measures of Dispersion, 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

CO	Statement	Knowledge Level
CO1	Learn the Solution of Measures of central tendency.	K2
CO2	Learn the Solution of Measures of variability in practical life data.	K2
CO3	Application of moments, Skewness and Kurtosis in real life situations.	K3
CO4	Obtaining the Correlation and rank correlation in practical situation.	K4
CO5	Apply Regression Analyse for Bivariate data in real life problems.	K4

Unit - I

Diagrammatic representation of data – Graphic representation of data – Histogram , frequency polygon, frequency curve and O'Give.

Unit - II

Construction of Univariate and Bivariate frequency distribution – Computation of Measures of Central Tendencies.

Unit - III

Calculation of Measures of Dispersion – Skewness and Kurtosis.

Unit - IV

Calculation of Karl Person's coefficient of correlation and Spearman's Rank Correlation coefficient.

Unit - V

Finding the two Regression Equations X on Y and Y on X and estimating unknown values of X and Y.

Mapping with Programme Outcomes

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

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

மதிப்புக் கல்விப்பாடம்
(Value Education)

பாடநோக்கம்

இளம் வயது முதல், உடல், மனம் இரண்டையும் பக்குவமாக வைத்துக் கொள்ள வேண்டியதன் அவசியத்தை மாணவர்களுக்கு உணரச் செய்தல்.

அலகு 1

யோகமும் உடல்நலமும்

உடலமைப்பு – எளியமுறை உடற்பயிற்சி – மகராசனம் - யோகாசனங்கள்

அலகு 2

இளமைகாத்தல் - பாலுணர்வும் ஆன்மீகமும் - மனதின் 10 படிநிலைகள் - மன அலைச்சுழல்.

அலகு 3

குணநலப்பேறு

வாழ்வின் நோக்கம் - எண்மை ஆராய்தல் - ஆசை சீரமைத்தல் - சினம் தவிர்த்தல்.

அலகு 4

கவலை ஒழித்தல் - வாழ்த்தும் பயனும் - நட்பு நலம் - தனிமனித அமைதி.

அலகு 5

செயல்விளைவுத் தத்துவம் - மனத்தூய்மை, வினைத்தூய்மை – அன்பும் கருணையும் - பண்பாட்டுக் கல்வி.

பாடநூல்:

'மனவளக்கலை யோகா'
உலக சமுதாய சேவா சங்கம்
வேதாத்திரி பதிப்பகம்
156, காந்திஜி ரோடு
ஈரோடு – 638 001.
போன்: 0424 – 2263845.

பார்வை நூல்கள்:

மனவளக்கலை யோகா –I - உலக சமுதாய சேவா சங்கம்
மனவளக்கலை யோகா –II- வேதாத்திரி பதிப்பகம்
மனவளக்கலை யோகா –III-156, காந்திஜி ரோடு
எளிமுறை உடற்பயிற்சி - ஈரோடு – 638 001.
யோகப்பயிற்சிகள்　　　 - போன்: 0422-2263845

Core Course - II	B.Sc. STATISTICS	2019 - 2020
Code: M19UST02	PROBABILITY THEORY	
Credits: 5		

Objective:

This course is to introduce to the students about the applications of probability. It is hoped to convey that this subject is both a fascinating and important one. Many systems encountered in science and engineering require an understanding of probability concepts because they possess random variations. The study area is drawn mainly from the biological sciences but some originate in the engineering, physical, social and statistical sciences. Furthermore, the techniques are not limited to any one area. To study the basic concepts for promoting theoretical as well as applications of statistics.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Conduct random experiments in real life data and Understand the Axioms of probability.	K1
CO2	Create the Joint probability density function and Understand how to get density from marginal density.	K2
CO3	Compute the probability values for sum random variables using mathematical expectation.	K3
CO4	Obtain the cumulent generating functions and its properties.	K4
CO5	Compute the probability values for sum random variables using Chebyshev's inequality and Weak law of large numbers	K3

Unit - I

Probability – Mathematical Probability - Statistical probability - Axiomatic approach to probability -Addition theorem - Multiplication theorem - Conditional probability - Bayes theorem - Independence of events – Pair wise and mutual independence of events.

Unit - II

Random Variable – Distribution function and its properties - Discrete random variable - Continuous random variable -Two dimensional random variable - Joint and marginal distribution function - Joint and marginal density function - Conditional distribution function and conditional probability density function.

Unit - III

Mathematical Expectation - Properties of expectation - Properties of variance - Co-variance – Correlation – Mean and Variance of a linear combination of a random variable.

Unit - IV

Moment Generating Function- Properties of moment generating function - Cumulents and their properties - Moment generating function and its properties - Characteristic function and its properties - Inversion theorem.

Unit - V

Chebyshev's inequality - Weak law of large numbers - Probability generating function - Simple problems.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition)	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Introduction to the theory of Statistics	Mood A.M Graybill, F.A and Bose, D.C	McGraw Hill Publishing Co.nc, New York	1974
2.	Fundamentals of Statistics	Goon Gupta A.M., and Das Gupta	The World Press Private Limited, Calcutta.	1982

Mapping with Programme Outcomes

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

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

SEMESTER – II

Core Practical- II	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP02	**MAJOR PRACTICAL – II**	
Credits: 2	**Probability Theory**	

Objective:

This course introduces fundamental concepts such as practical based Probability Theory. It covers concepts such Addition theorem - Multiplication theorem - Conditional probability - Bayes theorem, Mathematical Expectation and Conditional Expectations. It provides technical skills to understand and develop various applications for Probability Theory.

Course Outcomes

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

CO Number	Statement	Knowledge Level
CO1	Finding Probabilities of discrete and continuous random variables	K2
CO2	Apply Addition theorem and Multiplication theorem for real life problems.	K3
CO3	Obtain Bayes Theorem.	K3
CO4	Apply Joint and marginal distribution function and Joint and marginal density function.	K4
CO5	Compute the probability values for sum random variables using mathematical expectation.	K3

Unit - I

Discrete and continuous random variables – Finding Probabilities - Distribution functions and moments.

Unit - II

Addition theorem - Multiplication theorem - Problems.

Unit - III

Conditional probability - Bayes Theorem Problems.

Unit - IV

Joint and marginal distribution function – Joint, marginal and conditional density function - Problems

Unit - V

Bivariate distribution - Discrete and Continuous Random Variable - Mathematical Expectation – Conditional Expectations- Calculation of Variance, Co - variance and Correlation Coefficients.

Mapping with Programme Outcomes

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

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

Common Paper for all Under Graduate

Environment Studies

Unit – I – Fundamentals

Environment – Definition, Scope, Structure and Function of Ecosystems – Producers, Consumer and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chain, Food Webs and Ecological Pyramids – Concept of Sustainable Development.

Unit – II – Natural Resources

Renewable Resources – Air, Water, Soil, Land and Wildlife resources, Non-Renewable Resources, Coal, Oil and Natural Gas, Environment problems related to the extraction and use of Natural Resources.

Unit – III – Biodiversity

Biodiversity – Definition – Values – Consumption use, Production Social, Ethical, Aesthetic and Option Values Threats to Biodiversity – Hotspots of Biodiversity – Conservation of Biodiversity: In-situ, Ex-situ, Bio-Wealth National and Global Level.

Unit – IV – Environmental Pollution

Definition – Causes, Effects and Mitigation Measures – Air, Water, and Soil Pollution, Noise Pollution, Thermal pollution, Nuclear Hazards, Solid Wastes, Acid Rain, Climate change and Global Warming, Environmental Laws and Regulations in India – Earth summit.

Unit – V – Pollution and Environment

Population Explosion – Environment and Human Health – HIV/AIDS – Women and Child Welfare – Resettlement and rehabilitation of people, Role of Information Technology in Environmental Health – Environment Awareness, Environmental Awareness, Environment Disaster Management – Fire Safety and Prevention.

Core Course - III	**B.Sc. STATISTICS**	2019 - 2020
Code: M19UST03	SAMPLING TECHNIQUES	
Credits: 4		

Objective:

This course introduces the challenges posed by less-than-perfect samples, giving background knowledge and practical guidance for those who have to deal with them. Samples used in social and commercial surveys, especially of the general population, are usually less random (often by design) than many people using them realize. Unless it is understood, this 'non-randomness' can compromise the conclusions drawn from the data. To learn the basic concepts and Applications of Sampling techniques for real life situations.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Learn the role of survey in sampling.	K1
CO2	Understand the properties of simple random sampling unbiased estimate of the mean and variance of the estimated mean.	K2
CO3	Understand the properties of Stratified random sampling and Proportional allocation.	K2
CO4	Comparison of simple random sampling and stratified random sampling.	K3
CO5	Obtain the role of Regression estimation and Understand the concept of sampling and non sampling errors	K4

Unit - I

Basic concepts of sampling and population – Principle steps of sampling theory - Sampling Unit - Sampling frame - Complete enumeration versus sampling - Merits and demerits - Basic concepts of sampling distribution - Sampling errors – Non-sampling errors - Sources of non – sampling errors.

Unit - II

Simple random sampling with and without replacement - Lottery method - Use of random number tables - Estimation of population parameters – Mean, Variance and proportion - simple random sampling for proportion.

Unit - III

Stratified random sampling - Principle of stratification - Estimation of population mean and variance; Allocation techniques - Equal allocation - Proportional allocation - Neyman's allocation and Optimum allocation.

Unit - IV

Systematic sampling Estimation of mean and its sampling variance – Comparison of simple - stratified and systematic sampling.

Unit - V

Regression estimation – Linear regression estimate – Regression estimate with preassigned 'b' and regression estimates computed from sample.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Sampling Techniques	William G. Cocharan	John wiley sons, New York.	2008

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Theory and analysis of sample survery designs	Daroga Singh and Choudary F.S.	New Age International Publishers, New Delhi.	1996
2.	Fundamentals of Applied Statistics 4th Edition	Gupta S.C and Kapoor V.K.	Sultan Chand & Company,New Delhi.	2007
3	Sampling Theory	Desraj	New Age International Pvt. Ltd, New Delhi.	1997

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	M
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 Course - IV	B.Sc. STATISTICS	2019 - 2020
Code: M19UST04	DISTRIBUTION THEORY	
Credits: 4		

Objective:

This course introduces to build probability models for non mathematical forms of real life problems into mathematical forms and emphasize relevance statistical tools to make decision on the real life problems. To discuss various univariate distributions. To expose the applicability of various distributions in different disciplines.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Apply standard discrete probability distribution to different situations.	K2
CO2	Learn the characteristics of Univariate Continuous distribution. To expose the applicability of various distributions in different disciplines.	K1
CO3	Obtain the Bivariate normal distributions and Marginal and Conditional distributions.	K3
CO4	Understand the relationship between t and F distributions.	K2
CO5	Apply sampling distribution to different situations and relationship for t, F and chi-square.	K4

Unit - I

Univariate discrete distribution – Bernoulli, Binomial , Poisson, Geometric, Hyper geometric and Negative Binomial distributions - Recurrence relation for moments - Additive property - Moment generating function - Characteristic function and limiting case of Binomial as Poisson distribution.

Unit - II

Continuous Univariate distributions – Uniform, Normal, Exponential, Cauchy – Derivation of moments, Moment Generating function (M.G.F), Characteristic function.

Unit - III

Gamma distribution – Beta distribution- Mean and Variance and their properties – Sampling distributions – Standard error.

Unit - IV

Derivation of 't' distribution and its properties and applications – Derivation and properties of 'F' distribution and its uses.

Unit - V

Derivation and properties of Chi-square distribution – Uses of Chi-square distribution – Relationship between t, F and Chi-square distributions.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Mathematical Statistics	Gupta, S.C and V.K.Kapoor	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	An introduction to probability theory and mathematical statistics	Rohatgi, V.K	Wiley Eastern Ltd., New Delhi.	1985

Mapping with Programme Outcomes

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

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

Core Practical- III	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP03	**MAJOR PRACTICAL – III**	
Credits: 2	**Sampling & Distribution Theory**	

Objective:

This course introduces practical based Sampling and Distribution Theory. It covers concepts such as Simple random sampling, Stratified random sampling and Systematic Sampling. Fitting of curves and goodness of fit. It provides technical skills to understand and develop various applications for sampling and distribution theory.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Conduct random experiments in real life data in simple random sampling.	K1
CO2	Conduct random experiments in real life data in stratified random sampling and proportional & optimum allocations	K2
CO3	Comparison of practical life simple random sampling and stratified random sampling.	K3
CO4	Fitting of curves by the least square method.	K4
CO5	Testing goodness of fit using chi-square test.	K4

Unit - I

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

Unit - II

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

Unit - III

Systematic sampling: Estimation of mean and its variance.

Unit - IV

Ratio and Regression methods of estimation based on simple random sampling.

Unit - V

Fitting of Binomial and Poisson distribution - Testing goodness of fit using chi-square test.

Mapping with Programme Outcomes

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

SEMESTER – III

SKILL ENHANCEMENT COURSE -I

SEC-I	B.Sc., Statistics	2019 - 2020
Code:M19USTS01 Credits: 2	QUANTITATIVE APTITUTE	

Objective:

This course introduces fundamental concepts such as Numbers, system in Quantitative aptitude. It covers concepts such HCF, LCM, Square Root, Problems on Ages, Percentages, Profit & Loss, Simple interest and Compound interest. It provides technical skills to understand and develop various department examinations like Group Exams, TNPSC, RRB, SSC & IBPS.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Identify the logic behind H.C.F & L.C.M of Numbers-Simplification .	K1
CO2	Understand the concepts of Square root, cube root and average.	K2
CO3	Develop the problems on Numbers and Ages.	K2
CO4	Analyze the problems on Percentages and Profit & Loss.	K2
CO5	Apply the concepts to solve a problem for simple interest and compound interest.	K3

Unit - I

H.C.F & L.C.M of Numbers-Simplification.
(Section-I: 2 &4)

Unit - II

Square Roots and Cube Roots-Averages.
(Section-I: 5 &6)

Unit - III

Problems on Numbers - Problems on Ages.
(Section-I: 7 & 8)

Unit - IV

Percentages- Profit & Loss.
(Section-I: 10 & 11)

Unit - V

Simple interest- Compound interest.
(Section-I: 21 & 22)

TEXT BOOK:

S.No.	Name of the Book	Author	Publisher	Year Of Publication.
1.	Quantitative Aptitude For Competitive Examinations	R.S.Aggarwal	S.Chand & Co Ltd,152, Annasalai, Chennai.	2001

Mapping with Programme Outcomes

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

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

SEMESTER – IV

Core Course – V	B.Sc. STATISTICS	2019 - 2020
Code: **M19UST05**	ESTIMATION THEORY	
Credits: 5		

Objective:

The purpose of this course is to present up-to-date theory and techniques of statistical inference (estimation theory) in a logically integrated and practical form. Essentially, it incorporates the important developments in the subject that have taken place in the last three decades. Statistical inference techniques, if not applied to the real world, will lose their import and appear to be deductive exercises. Furthermore, it is belief that in a statistical course emphasis should be given to both mathematical theory of statistics and to the application of the theory to practical problems. The objective is to diagnose statistical distributions of real life problems and thereby represent reasonable approximations of statistical patterns of recognition by inductive logic.

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 Minimum Variance Unbiased. Estimator and Obtain the importance of Cramer Rao rule.	K2`
CO3	Obtain Sufficient statistic and importance concept of Neyman - Factorization theorem.	K3
CO4	Apply for Maximum likelihood estimator and Method of moments.	K4
CO5	Obtain the Confidence interval in interval estimation real situations.	K3

Unit - I

Statistical Inference – Characteristics of good estimators – Invariance property of consistent estimators – Most efficient estimators.

Unit - II

Minimum Variance Unbiased Estimator (MVUE) - Uniqueness property of MVUE - Cramer - Rao inequality - Regularity conditions – Minimum Variance Bound Estimator (MVBE).

Unit - III

Sufficient statistic - Statement of Neyman - Factorization theorem - Concept of Blackwellisation - Statement and proof of Rao - Blackwell theorem.

Unit - IV

Methods of estimation - Maximum likelihood estimator (MLE. and their properties - Method of moments - Methods of minimum chi-square and modified minimum chi-square.

Unit - V

Interval estimation - Distinction between point estimation and interval estimation - Confidence interval and confidence Coefficients - Construction of confidence intervals for mean, difference of means and variance.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition)	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Introduction to the theory of Statistics	Mood A.M Graybill, F.A and Bose, D.C	McGraw Hill Publishing Co.nc, New York	1974
2.	Fundamentals of Statistics	Goon Gupta A.M., and Das Gupta	The World Press Private Limited, Calcutta.	1982

Mapping with Programme Outcomes

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

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

Core Course – VI	B.Sc. STATISTICS	2019 - 2020
Code: M19UST06	TESTING OF HYPOTHESIS	
Credits: 4		

Objective:

The purpose of this course is to present up-to-date theory and techniques of statistical inference (Testing of Hypothesis) in a logically integrated and practical form. Essentially, it incorporates the important developments in the subject that have taken place in the last three decades. Statistical inference techniques, if not applied to the real world, will lose their import and appear to be deductive exercises. Furthermore, it is belief that in a statistical course emphasis should be given to both mathematical theory of statistics and to the application of the theory to practical problems. The objective is to diagnose statistical distributions of real life problems and thereby represent reasonable approximations of statistical patterns of recognition by inductive logic.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the Statistical Hypothesis and Learn the Types of errors, Level of Significance.	K1
CO2	Obtain the Large sample tests and test for the equality of means of two normal populations.	K3
CO3	Obtain the Small sample tests and single mean, difference of means, paired t-test.	K3
CO4	Learn the role of Likelihood Ratio (LR) test and Properties.	K2
CO5	Apply for Sequential Probability Ratio Test and Average Sample Number (ASN) and Operating Characteristic (OC) functions in real situations.	K4

Unit - I

Statistical Hypothesis - Simple and composite hypothesis - Critical Regions - Types of errors - Level of Significance - Size and power of the test - Most powerful (MP) test - Neymann - Pearson Lemma - UMP test.

Unit - II

Large Sample Tests – Test for the mean of a normal population – test for the equality of means of two normal populations – test for the variance of a normal population – test for the equality of variances of two normal populations.

Unit - III

Small Sample Tests : t–Test - single mean – difference of means –paired t-test.

Unit - IV

Likelihood Ratio (LR) test - Procedure – Properties – Simple Applications. Chi- Square, Goodness of fit and independence of attributes.

Unit - V

Non-Parametric Tests: Sign, Wilcoxon's Signed rank test and Run test for one sample problems. Median, Mann – Whitney test for two sample problems – Kruskal – Wallis test- Simple applications.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition)	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Introduction to the theory of Statistics	Mood A.M Graybill, F.A and Bose, D.C	McGraw Hill Publishing Co.nc, New York	1974
2.	Fundamentals of Statistics	Goon Gupta A.M., and Das Gupta	The World Press Private Limited, Calcutta.	1982

Mapping with Programme Outcomes

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

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

SEC – II	B.Sc. STATISTICS	2019 - 2020
Code:M19USTS02	STATISTICAL APTITUDE	
Credits: 2		

Objective:

This course 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. For brevity and clarity "fill in the banks" and "multiple choices" type questions have been setup. It 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

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

Unit - I

Statistics – Classification, Tabulation and Frequency Distribution – Diagrammatic and Graphical Representation.

Unit - II

Measures of Central Tendency – Measures of Dispersion, Skewness and Kurtosis.

Unit - III

Elementary Probability – Mathematical Expectation – Sampling Methods.

Unit - IV

Theory of Estimation – Testing Parametric Hypothesis.

Unit - V

Regression and Correlation Methods.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Programmed Statistics	Agarwal, B.L	New Age International Publishers.	2013

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
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 Practical- IV	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP04	**MAJOR PRACTICAL – IV** **Estimation & Testing of Hypothesis**	
Credits: 2		

Objective:

This course introduces practical based Estimation and Testing. It covers concepts such as Multinomial distribution, exponential, normal, binomial and Poisson distributions. Method of maximum likelihood, Fitting of curves and Testing of hypothesis on the parameters of various distributions and Test of significance t, F 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	Conduct parameter estimation in real life data in Multinomial distribution and exponential.	K2
CO2	Obtain the Method of maximum likelihood estimator in exponential family.	K3
CO3	Test the parameter value in Binomial, Normal, Exponential and Cauchy distributions	K4
CO4	Obtain the Single mean – difference of two means and Chi-Square test.	K3
CO5	Test of significance paired t test and F test for equality of two variances	K4

Unit - I

Estimation of parameters of statistical model binomial and Poisson distributions – Construction of confidence intervals for mean and variance.

Unit - II

Method of maximum likelihood and method of moments – Fitting of Binomial, Poisson, Normal, Exponential distributions.

Unit - III

Testing of hypothesis on the parameters of Binomial, Normal, Exponential and Cauchy distributions, when alternatives are one sided / two sided.

Unit - IV

Test of significance: Large sample - Single proportion- difference of proportions – Single mean – difference of two means – correlation coefficient – Chi square test for independence of attributes.

Unit - V

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

Mapping with Programme Outcomes

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

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

Core Course – VII	B.Sc. STATISTICS	2019 - 2020
Code: M19UST07	OFFICIAL STATISTICS	
Credits: 5		

Objective:

This course is to provide foundation as well as comprehensive background of graphics displaying different strengths of association between two variables and data collection and presentation. For learning the basic concepts which aims to resolve the government organization.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Learn the Statistical organization.	K2
CO2	Learn the Industrial statistics – ASI.	K2
CO3	Obtain Price statistics – Price index numbers.	K3
CO4	Apply for Wage statistics and trade statistics	K4
CO5	Learn Indian Economy.	K2

UNIT-I

Official Statistics: Present official statistical systems in India –Ministry of Statistics and Programme Implementation - NSSO, CSO and their functions - Registration of vital events - Statistical organization – Population Statistics.

UNIT-II

Agricultural Statistics – Indices of Agricultural production – Miscellaneous Agricultural Statistics - Industrial statistics – ASI – Indices of Industrial Production and profits.

UNIT-III

Price statistics – Price index numbers – Trade Statistics in India – Labour Statistics in India – Financial Statistics in India - Labour Bureau; Index number of Retail prices – Indices of security prices.

UNIT-IV

Wage statistics – trade statistics – Financial statistics – National income statistics - National sample surveys – Activities and publications of CSO and the Department of Statistics, Government of Tamil Nadu - National Income compilation.

UNIT-V

Statistical information on Indian Economy published by Reserve Bank of India - Statistics of Department of Economics and Statistics of State Governments.

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods	Gupta and Kapoor	Sultan Chand Publications	2008

Mapping with Programme Outcomes

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

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

Core Course - VIII	B.Sc. STATISTICS	2019 - 2020
Code: **M19UST08**	DESIGN OF EXPERIMENTS	
Credits: 5		

Objective:

Throughout the course stressed the importance of experimental design as a tool for engineers and scientists to use for product design and development as well as process development and improvement. The use of experimental design in developing products those are robust to environmental factors and other sources of variability. Because the prerequisites are relatively modest, this course on statistics focusing on statistical design of experiments for undergraduate students in engineering, the physical and chemical sciences, statistics, mathematics, and other fields of science. This course as the basis of an industrial short course on design of experiments for practicing

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Know the basic principles of experimental design.	K1
CO2	Learn the multiple comparison methods.	K2
CO3	Understand the applications of CRD and LSD.	K2
CO4	Apply the factorial experiments in practical situations. .	K4
CO5	Obtain the Split plot design.	K3

Unit - I

Principles of Experimental Designs - Replication, Randomization and Local control technique – Basic designs - Analaysis of variance (ANOVA) – Statistical Analysis of One way and Two way classified data concepts and applications.

Unit - II

LSD test – SNK test – Duncan's multiple range test – Tukey (HSD) test - Multiple Comparison methods.

Unit - III

Analysis of Completely Randomized Design (CRD) - Randomized Block Design (RBD) and Latin Square Design (LSD) and their efficiencies - missing plot techniques (One missing Observation in RBD, LSD).

Unit - IV

Analysis of Factorial design- 2^2 - 2^3 factorial designs - Concepts of Confounding – Analysis of 3^2 factorial experiment.

Unit - V

Analysis of Split plot design - Balanced Incomplete Block Design (BIBD) (Concepts only).

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Applied Statistics, 4th, Edition.	Gupta S.C and Kapoor V.K	Sultan Chand and Company	2009

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Statistics	Goon Gupta A.M., and Das Gupta	The World Press Private Limited, Calcutta.	1982
2.	Design and analysis of experiments, 3rd Edition.	Das M.N and Giri N.C.	New Age International publication	2007

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
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.

Core Course - IX	B.Sc. STATISTICS	2019 - 2020
Code: M19UST09	LINEAR PROGRAMMING AND ITS APPLICATIONS	
Credits: 5		

Objective:

The purpose of this course is provides a quantitative analysis of the problem from which management can make an objective decision. 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. Operations Research and Management Science methodologies and their applications continue to grow and flourish in a number of decision-making fields. To impart basic knowledge of various optimization techniques. 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

CO	Statement	Knowledge Level
CO1	Know the different types of Operations Research models.	K1
CO2	Obtain the role of Linear Programming Problem in real life problem.	K3
CO3	Calculate the relationship between dual and primal problem.	K2
CO4	Obtain the real situation of Transportation problems in Transport company.	K4
CO5	Apply the practical situations in Assignment problems in a company.	K4

Unit - I

Introduction – Origin – Nature of OR – Structure – Characteristics – OR in Decision Making – Models in OR – Phase of OR – Uses and Limitations of OR – LPP – Mathematical formulation of LPP – Graphical Methods.

Unit - II

LPP – Standard form of LPP – Maximization – Minimization – Simplex method – Artificial variable technique – Big-M methods.

Unit - III

Duality in LPP – Formulation of Dual LPP – Primal and Dual relationship – Solving LPP using Dual concepts – Dual simplex methods.

Unit - IV

Transportation problem – Balanced – Unbalanced T.P. – Initial basic feasible solution – North West Corner Rule – Row minima – Column minima – Matrix minima (LCM) – Vogels approximation method – Optimum solution – MODI method.

Unit - V

Assignment problem – Introduction – Balanced – Unbalanced – Maximization – Minimization – Hungarian methods.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research	Kanti Swarup, P.K.Gupta, Manmohn	Sultan Chand and sons, New Delhi.	1980

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research and Application	Sharma, J.K	Mc.Millan and Company, New Delhi.	1997
2.	Operations Research	Nita H.Shah, Ravi M.Gor, Hardik Soni	PHI Learning Private Limited, New Delhi.	2010

Mapping with Programme Outcomes

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

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

Core Practical- V	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP05	**MAJOR PRACTICAL – V** **Design & Linear Programming**	
Credits: 2		

Objective:

This course introduces practical based Design of Experiment and Operation Research. It covers concepts such as ANOVA One Way - Two Way Classification, Analysis of CRD, RBD and LSD and Analysis of factorial experiments 2^2 and 2^3. Linear programming problem and Transportation Problem & Assignment Problem. It provides technical skills to understand and develop various applications for design of experiment and operation research.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Test the Multiple Comparison methods and Analysis of one way & two way ANOVA.	K4
CO2	Analysis the practical life CRD, RBD and LSD problems.	K4
CO3	Comparison of practical life Analysis of factorial experiments	K2
CO4	Obtain the Linear programming problem, Simplex Method & Big – Method.	K3
CO5	Obtain the Transportation Problem & Assignment Problem	K3

Unit - I

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

Unit - II

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

Unit - III

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

Unit - IV

Linear programming problem – Graphical Method – Simplex Method – Big – Method – Two phase method (Not more than three constraints).

Unit - V

Transportation Problem – By NWC rule – Matrix minima – Vogel's Approximation Method – Optimum solution by MODI Method – Balanced & Unbalanced TP. Assignment Problem – Balanced & Unbalanced AP (Hungarian Method).

Mapping with Programme Outcomes

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

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

Core Practical- VI	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP06	**MAJOR PRACTICAL – VI** STATISTICAL DATA ANALYSIS	
Credits: 2		

Objective:

This course is aimed primarily at academic researchers, MBA students, doctoral, masters and undergraduate students of mathematics, management science, and various other science and social science disciplines, practicing managers, marketing research professionals etc. Statistics and Marketing Research and for use in such courses in business schools and engineering colleges. This course is an effort towards facilitating business managers and researchers in solving statistical problems using computers. We have chosen SPSS, which is a very comprehensive and widely available package for statistical analyses.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Obtain the graphs and diagrams using SPSS.	K3
CO2	Formation of frequency distribution using SPSS.	K3
CO3	Obtaining the Regression lines using SPSS.	K3
CO4	Learn the solution of compare means using SPSS.	K2
CO5	Test the association between the attributes using SPSS.	K4

Unit - I

Graphs and diagrams – Pie , bar, line and scatter diagrams - Histogram and Normal probability plot.

Unit - II

Formation of discrete and continuous frequency distributions - descriptive statistics.

Unit - III

Correlation coefficient Rank correlation - Regression : Simple and multiple linear regression.

Unit - IV

Compare means: Independent sample t test and paired t- test - Cross tabulation and Chi-square – test.

Unit - V

One way and two way ANOVA.

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	M
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.

Elective Course - I	B.Sc. STATISTICS	2019 - 2020
Code: **M19USTE01**	ACTUARIAL STATISTICS	
Credits: **4**		

Objective:

The purpose of this course is actuarial statistics are ways of quantifying the dynamic relationships of sequences of random events. Stochastic models play an important role in elucidating many areas of the natural and engineering sciences. They can be used to analyze the variability inherent in biological and medical processes, to deal with uncertainties affecting managerial decisions and with the complexities of psychological and social interactions, and to provide new perspectives, methodology, models, and intuition to aid in other mathematical and statistical studies.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Know the basic concepts of annuity.	K1
CO2	Understand the redemption of loan by uniform early payments.	K2
CO3	Obtain the Mortality table.	K3
CO4	Learn Principles of Insurance & Types of assurance.	K3
CO5	Formation whole life assurance plans.	K4

Unit - I

Present value and accumulated value at fixed rate and varying rates of interest – effective rate of interest corresponding to a nominal rate of interest – annuity – types of annuities excluding perpetuity – derivation of the formula for $a_n\%$, $s_n\%$, $a..n\%$ and $s..p\%$ simple problems.

Unit - II

Derivation of the formula for $a(p)n\%$, $s(p)n\%$, $a..(p)n\%$ and $s..(p)n\%$ simple problems – redemption of loan by uniform early payment – definitions of sinking fund – redemption of loan by a sinking fund (uniform early payment) simple problems.

Unit - III

Mortality table: Definition- Uses – mentioning the types and the construction of a mortality table – complete and incomplete mortality table – computing the probabilities of survival and death using LIC (1970-1973) Mortality table- defining expectation of life, complete expectation of life and central death rate – simple problems.

Unit - IV

Principles of Insurance – Types of assurance – temporary assurance, pure endowment assurance, endowment assurance and whole life assurance – Expressions for present values of assurance benefits under temporary assurance, pure endowment assurance, endowment assurance and whole life assurance plans – simple problems

Unit - V

Definitions of premium, Natural premium level, Annual Premium, Net Premium and Office Premium – Expressions for level annual premium under temporary assurance, pure endowment assurance, endowment assurance and whole life assurance plans – simple problem involving the calculations of level annual present annual premium, office premium and the four types of plans only.

TEXT BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Mathematics Basis of Life Insurance		Insurance Institute of India.	

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	M
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.

Elective Course – I	B.Sc. STATISTICS	2019 - 2020
Code: M19USTE02	NON – PARAMETRIC TEST	
Credits: 4		

Objective:

This course is aimed Testing hypotheses in non-parametric models are discussed. A statistical model is non parametric if it cannot be written in terms of a finite dimensional parameter. The main hypotheses tested in such models are hypotheses on the probability distribution of elements of the following: data homogeneity, randomness and independence hypotheses.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand parametric and non parametric test.	K1
CO2	Test for run test and sign test in real data.	K4
CO3	Obtain the Median and Mann Whitney U test in practical situations.	K3
CO4	Understand the Median test for several samples.	K2
CO5	Apply the goodness of fit by Kolmogorov – Smirnov test.	K4

Unit - I

Introduction of non-parametric test – Its comparison with parametric test – Advantage and limitations of non-parametric test.

Unit - II

Test for randomness – Run test – Test for rank correlation co-efficient – Sign test.

Unit - III

Comparison of two populations: median test – Mann Whitney U test – Wilcoxon signed rank test for paired observations.

Unit - IV

Comparison of several populations: Median test for several samples – Kruskal Walli's test – Friedman ANOVA.

Unit - V

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

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Non-parametric methods for quantitative analysis	Gibbons, J.D.	New York	1976

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Analysis of non-normal data	Desphande, J.V. Gune,A.P. Shanubhogur,	Practice Hall of India, New Delhi.	1997

Mapping with Programme Outcomes

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

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

Elective Course – I	B.Sc. STATISTICS	2019 - 2020
Code: **M19USTE03**	QUEUING THEORY	
Credits: **4**		

Objective:

The purpose of this course is many of the statistical methods now take for granted had not yet been invented, and given the computational intensity of techniques such as Queuing system and Kendal's Terminology, Poisson Queues, death process $M/M/1; \infty$ / FIFO queuing model and $M/M/1; N$ / FIFO queuing model 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

CO	Statement	Knowledge Level
CO1	Learn the Queuing system Kendal's terminology.	K1
CO2	Understand the Poisson queues.	K2
CO3	Learn the Pure Birth – Death process	K1
CO4	Know the importance of $M/M/1; \infty$ / FIFO queuing Model.	K2
CO5	Obtain the $M/M/1; N$ / FIFO queuing model.	K3

Unit - I

Queuing system – Kendal's terminology – Classification of States – Poisson axioms.

Unit - II

Distribution of arrival and departure under Poisson queues.

Unit - III

Pure Birth – Death process – transient state and steady state solution.

Unit - IV

$M/M/1; \infty$ / FIFO queuing Model – steady state solution - Averages – Little's formula.

Unit - V

$M/M/1; N$ / FIFO queuing model – steady state solution –Averages – simple problems.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Applied Statistics	Kanti Swarup, P.K.Gupta and Man Mohan	Sultan Chand and Sons, New Delhi.	1985

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research	P.K.Gupta and D.S.Hira	S.Chand and Co., Ltd, New Delhi.	1983

Mapping with Programme Outcomes

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

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

SEC – IV	B.Sc. STATISTICS	2019 - 2020
Code:**M19USTS03**	STATISTICAL SOFTWARE PACKAGES	
Credits: 2		

Objective:

This course is designed to help students learn how to analyze and interpret research data with intermediate statistics. For this reason, most of the practical statistical analyses is done with the help of an appropriate software package. A 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.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Learn the data entry using SPSS and Importing and Exporting data	K1
CO2	Formation of frequency distribution using SPSS.	K2
CO3	Learn the difference between the t test and Independent Samples t-test using SPSS.	K2
CO4	Obtain the Analysis of Variance in SPSS.	K3
CO5	Apply for Chi-square Test for Independence using SPSS.	K4

Unit - I

Introduction to SPSS – Starting SPSS – SPSS Main Menus – Working with the Data Editor – SPSS Viewer – Importing and Exporting data.

Unit - II

Types of variables - Probability value (p-value) – Descriptive Statistics - Frequencies using SPSS.

Unit - III

Basic Concepts of One Sample t-test, Independent Samples t-test, Paired samples t-test using SPSS.

Unit - IV

Basic concepts of ANOVA – One Way and Two Way ANOVA.

Unit - V

Chi-square Test for Independence using SPSS – Bi-variate Correlation and Regression using SPSS.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods for Practice and Research A guide to data analysis using SPSS, First Edition	Ajai J Gaur and Sanjaya S. Gaur	Sage Publications.	2008

Mapping with Programme Outcomes

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

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

Core Course - X	B.Sc. STATISTICS	2019 - 2020
Code: M19UST10	STATISTICAL QUALITY CONTROL	
Credits: 5		

Objective:

This course gives an exposure to various concepts in statistical quality control and the notions of reliability theory are the components to be dealt with in this course. This course is about the use of modern statistical methods for quality control and improvement. It provides comprehensive coverage of the subject from basic principles to state of the art concepts and applications. The objective is to give the reader a sound understanding of the principles and the basis for applying them in a variety of situations.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the general theory of Control charts	K1
CO2	Apply the X-Bar, R and S Charts	K4
CO3	Learn the approach of attribute and variable control charts. .	K2
CO4	Obtain the acceptance sampling.	K3
CO5	Apply for Sequential sampling plan, OC, AOQ, ASN curve.	K4

Unit - I

Basic concepts of quality – Meaning of quality – Quality of design – Quality of conformance – Specification of quality concepts of S.Q.C. – Causes of variation.

Unit - II

Process control – Control chart – Basis of control chart – uses - Rational subgroups – Control charts for variables ($\overline{X}$, R and S – Charts).

Unit - III

Control charts for Attributes (P, np, c for fixed and varying sample sizes) – comparison of control charts for variable and attributes – Applications of theory of runs in quality control.

Unit - IV

Product control – Acceptance sampling – Sampling inspection by attributes – Producer's and consumer's risk, AQL, LTPD, IQL – Single, Double sampling plan procedure, OC, AOQ, AOQL, ASN and ATI curve.

Unit - V

Sequential sampling plan procedure – Estimation of parameters – OC, AOQ, ASN curve - Multiple sampling - Comparison between single - Double and multiple sampling.

TEXT BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Quality Control	Mahajan, M	Dhanpat Rai & co (p) Ltd., Delhi.	2001
2.	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	Publishing Company	Year of Publication
1.	Quality control and industrial statistics	Duncan, A.J	Irwin inc. Home wook	1974

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
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.

Core Course – XI	B.Sc. STATISTICS	2019 - 2020
Code: **M19UST11**	APPLIED STATISTICS	
Credits: 5		

Objective:

In this course we have aimed to discuss the ideas involved in applying statistical methods to advance knowledge and understanding. 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. While 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

CO	Statement	Knowledge Level
CO1	Learn the concept of time series.	K1
CO2	Obtain the seasonal variation in real life data.	K3
CO3	Apply the Laspeyre's and Passche's and Fisher's index numbers in real life problems.	K4
CO4	Compute the different index numbers.	K3
CO5	Study the functions of NSSO – CSO.	K2

Unit - I

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

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

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

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

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	Publishing Company	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	Publishing Company	Year of Publication
1.	Fundamentals of Statistics V-II	Goon, A.M.,Gupta, M.K and Das Gupta, B	World press Ltd., Calcutta.	1994

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
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.

Core Course - XII	B.Sc. STATISTICS	2019 - 2020
Code: M19UST12	DECISION THEORY AND ITS APPLICATIONS	
Credits: 5		

Objective:

The purpose of this course is provides a quantitative analysis of the problem from which management can make an objective decision. Operations Research and Management Science methodologies and their applications continue to grow and flourish in a number of decision-making fields. To impart basic knowledge of various optimization techniques. To find the optimal solution for real life situation with help of Operations Research Techniques. Operations research uses analyses and techniques from a variety of branches of mathematics, statistics, and other scientific disciplines. Certain analytical results arise repeatedly in applications of operations research to industrial and service operations.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Know the different types of game theory.	K1
CO2	Obtain the role of decision theory in real life problem working.	K3
CO3	Apply the Sequencing and Replacement problems.	K4
CO4	Know the role of queuing theory concept $M/M/1; \infty$ / FIFO.	K2
CO5	Obtain the network analysis for Critical path method & Program Evaluation Review Technique.	K3

Unit - I

Game Theory – Introduction – Two person zero sum game: - Maximin – Minimax principle – Game's with saddle points - Game's without saddle points – Dominance property – Graphical solutions of 2 x n and n x 2 Games – Reducing Game problem by LPP.

Unit - II

Decision theory – Introduction- Types of Decision Making Environment – Decision Making under uncertainty – Maximin criterion – Maximax criterion – Minimax criterion – Laplace criterion – Hurwitz criterion – Decision Making under risk – EMV – EOL – EVPI - Decision Tree Analysis – Concepts only.

Unit - III

Sequencing problem – Problems with n-jobs on two machines – problems with n-jobs on three machines – problems with n-jobs on m-machines - Replacement problem – Replacement of items that deteriorate with time – selection of best machine amongst two.

Unit - IV

Queuing system – Kendal's terminology – Classification of States – Poisson axioms - Distribution of arrival and departure under Poisson queues - $M/M/1; \infty$ / FIFO queuing Model - $M/M/1; N$ / FIFO queuing model.

Unit - V

Network analysis – Basic concepts – Constraints in network – Construction of network – Critical path method (CPM) - Program Evaluation Review Technique (PERT).

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research	Kanti Swarup, P.K.Gupta, Manmohn	Sultan Chand and sons, New Delhi.	1980

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research and Application	Sharma, J.K	Mc.Millan and Company, New Delhi.	1997
2.	Operations Research	Nita H.Shah, Ravi M.Gor, Hardik Soni	PHI Learning Private Limited, New Delhi.	2010

Mapping with Programme Outcomes

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

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

Core Practical- VII	B.Sc. STATISTICS	2019 - 2020
Code: M19USTP07	MAJOR PRACTICAL – VII APPLIED STATISTICS & DECISION THEORY	
Credits: 2		

Objective:

This course introduces practical based applied statistics and operation research. It covers concepts such as control charts, Acceptance samplig plan for attributes, OC, ASN & AOQ curves. Fitting of least square, Sequencing problem, Replacement problem & Network analysis. It provides technical skills to understand and develop various applications for sampling and distribution theory.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Obtain control charts in real life data.	K3
CO2	Apply for OC, ASN & AOQ curves in acceptance sampling plan.	K4
CO3	Obtain the Fitting of least square & Seasonal variations in practical situations.	K3
CO4	Apply for Sequencing problem in real life situations.	K4
CO5	Obtain the replacement and network analysis in practical situations.	K3

Unit - I

Construction of control charts for variables: $\bar{X}$, R and S charts. Control charts for attributes of fixed and varying sample size – p, np and C charts.

Unit - II

Acceptance samplig plan for attributes: single sampling plan – OC, AOQ, ASN and ATI curves; Double sampling plan – OC, AOQ, ASN and ATI curves.

Unit - III

Estimation of trend by moving averages, least square methods – First degree and second degree polynomials - Computation of quarterly and monthly trends.

Unit - IV

Decision theory - Decision making under deterministic & probabilistic situations – EMV. Sequencing problem n jobs on two machines and n jobs on three machines.

Unit - V

Replacement problem – Items that deteriorate gradually and money value constant with time – Money value changing with time. Network analysis – Critical Path Method (CPM. and PERT).

Mapping with Programme Outcomes

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

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

Elective Course - II	B.Sc. STATISTICS	2019 - 2020
Code: M19USTE04	STOCHASTIC PROCESS	
Credits: 4		

Objective:

The purpose of this course is Stochastic processes are ways of quantifying the dynamic relationships ofsequences of random events. Stochastic models play an important role in elucidating many areas of the natural and engineering sciences. They can be used to analyze the variability inherent in biological and medical processes, to deal with uncertainties affecting managerial decisions and with the complexities of psychological and social interactions, and to provide new perspectives, methodology, models, and intuition to aid in other mathematical and statistical studies.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Know the basic concepts of stochastic process.	K1
CO2	Understand the Markov chains.	K2
CO3	Obtain the classification of Random processes.	K3
CO4	Obtain the Pure birth process.	K3
CO5	Understand the Social mobility, disease and recovery.	K3

Unit - I

Basic Concepts: Definition and examples of Stochastic Processes – Classification of general stochastic processes into discrete and continuous time – Discrete and continuous state spaces – Types of stochastic processes – Elementary problems.

Unit - II

Markov chain – Definition and examples of Markov chain – Transition Probability Matrix – Classification of states – Recurrence – Simple problems.

Unit - III

Basic limit theorem of Markov chain (Statement only) – Stationary probability distribution – Applications – Continuous Time Markov chain.

Unit - IV

Continuous Time Markov chain: Pure birth process, Poisson process, Birth and Death process – Simple problems.

Unit - V

Applications of Markov Chain: Social mobility, disease and recovery, consumer behavior, discount for insurance premium.

TEXT BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Stochastic Processes	Medhi, J	Wiley Eastern Ltd, New Delhi.	1982
2.	First Course in Stochastic Processes	Karlin, S & Taylor, H.M	Academic Press.	1966

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Stochastic Process	Ross,S.M.	Wiley, New York	1983

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	M
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.

Elective Course - II	B.Sc. STATISTICS	2019 - 2020
Code: M19USTE05	**NUMERICAL ANALYSIS**	
Credits: 4		

Objective:

This course introduces fundamental concepts of Numerical methods. It covers concepts such as Bisection method, Iteration method, Regular Falsi method, Newton-Raphson method, Iterative methods Gregory-Newton interpolation formulae , Interpolation with unequal intervals, Lagrange's interpolation formula , Inverse interpolation, Trapezoidal rule, Simpson's one third rule, Simpson's three-eighth rule, Taylor series method. It provides technical skills to understand and study various concepts in Numerical analysis.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Acquiring knowledge of basic idea of the solution of algebraic and transcendental equations.	K1
CO2	Understand the Solution of Finite Differences.	K2
CO3	Obtain the Interpolation with equal and unequal intervals	K3
CO4	Obtain the Numerical Differentiation: based on Newton's Forward and Backward Interpolation.	K3
CO5	Apply the Numerical Integration.	K4

Unit - I

Solution of Algebraic and transcendental equations- Method of successive bisection - Method of Regula-Falsi - The Secant method - Newton - Raphson iterative method.

Unit - II

Finite Differences: Definition and properties of Forward Difference Operator, Backward Difference Operator and Shift Operator - Relations between them - n^{th} differences of polynomials - Difference Equations.

Unit - III

Interpolation with equal and unequal intervals: Newton- Gregory forward Interpolation and Backward Interpolation formula for equal intervals- Lagrange Interpolation formula for unequal intervals.

Unit - IV

Numerical Differentiation: Numerical Differentiation based on Newton's Forward and Backward Interpolation formulas - Computation of Second order derivatives numerically.

Unit - V

Numerical Integration: General quadrature for equidistant ordinate - Trapeziodal rule - Simpson 1/3 and 3/8 rules- Weddle's rule - Simple applications.

TEXT BOOK:

S.No.	Title of the Book	Author	Publisher	Year of Publication
1.	Numerical Methods	Dr.A.Singaravelu	Meenakshi Agency	2009

REFERENCE BOOKS:

S.No.	Title of the Book	Author	Publisher	Year of Publication
1.	Introducing methods of Numerical analysis	S. S. Sastry	Prentice Hall of India private limited, New Delhi	3rd Edition 2002
2.	Numerical Methods	P.Kandasamy, K.Thilagavath, K.Gunavathy	Chand & Company limited, NewDelhi	2009

Mapping with Programme Outcomes

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

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

Elective Course - II	B.Sc. STATISTICS	2019 - 2020
Code: M19USTE06	REGRESSION ANALYSIS	
Credits: 4		

Objective:

The purpose of this course is many of the statistical methods now take for granted had not yet been invented, and given the computational intensity of techniques such as regression analysis and curves. Furthermore, it is belief that in a statistical course emphasis should be given to both mathematical theory of statistics and to the application of the theory to practical problems. The objective is to diagnose regression forecasting of real life problems and thereby represent reasonable approximations of statistical patterns of recognition by inductive logic.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Learn the concept of Simple regression models.	K2
CO2	Obtain Fitting of straight line by matrix method.	K3
CO3	Learn the Multiple regression analysis.	K3
CO4	Apply for prediction with multiple regression.	K4
CO5	Obtain ANOVA and ANACOVA models.	K3

Unit - I

Simple regression models with one independent variable, assumptions, estimation of parameters, standard error of estimator, testing the significance of regression coefficients, standard error of prediction.

Unit - II

Fitting of straight line by matrix method (General Linear model), Analysis of variance, General linear hypothesis testing in regression situation weighted least squares bias in regression estimates.

Unit - III

Multiple regression analysis: Estimation of parameters. Partial regression Coefficient, OLS and ML estimation, Coefficient of multiple R^2 and adjusted R^2. Polynomial regression model.

Unit - IV

Multiple regression analysis: Hypothesis testing about individual regression coefficients, testing the overall significance of the sample regression, testing the equality of two regression coefficients, prediction with multiple regression.

Unit - V

Dummy variable regression models: ANOVA and ANACOVA models. Selection of variables is regression. Forward, backward & optimum method.

TEXT BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Applied Regression Analysis	Draper N.R. & Smith .H	John Wiley & Sons	1981
2.	Basic Econometrics	D.N.Gujarati	Tata Mc Graw Hill Publishing	2008

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Mathematical Statistics	J.N. Kapoor and H.C. Saxena	S.Chand and Co., Ltd, New Delhi.	1989
2.	Introduction to mathematical Statistics	R.V. Hogg and A.T. Craig	Macmillan Publishing Co.,Inc.	1989

Mapping with Programme Outcomes

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

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

SEC – II	B.Sc. STATISTICS	2019 - 2020
Code: M19USTS04	STATISTICAL FORECASTING	
Credits: 2		

Objective:

The purpose of this course is to present up-to-date theory and techniques of statistical forecasting analysis in a logically integrated and practical form. Essentially, it incorporates the important developments in the subject that have taken place in the last three decades. Statistical forecasting techniques, if not applied to the real world, will lose their import and appear to be deductive exercises. Furthermore, it is belief that in a statistical course emphasis should be given to both mathematical theory of statistics and to the application of the theory to practical problems. The objective is to diagnose statistical forecasting of real life problems and thereby represent reasonable approximations of statistical patterns of recognition by inductive logic.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Understand the partial and multiple correlation applications.	K1
CO2	Compute the regression coefficients.	K2
CO3	Obtain the curve fitting for least square method.	K3
CO4	Obtain the power and exponential curve in real life situations.	K3
CO5	Apply for Gompertz and Logistic curves in real life situations.	K4

Unit - I

Concept of partial correlation – Concept of multiple correlation - Simple applications.

Unit - II

Concept of regression – Liner, Non liner regression – Regression line – Regression Coefficient – properties of regression coefficient.

Unit - III

Curve fitting- methods – liner equations – methods of least square.

Unit - IV

Regression curves – conversion of data into linear form (Power curve, Exponential curves).

Unit - V

Growth curve fittings – Exponential - Gompertz and logistic curves.

TEXT BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamental of Mathematical Statistics, 11th edition	Gupta, S.C, and Kapoor, V.K	Sultan Chand and sons, New Delhi.	2004

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Mathematical Statistics, 4th edition	Hogg, R.V. and Craig, A.T.	Colliar Mac.Millan Publishers.	1978

Mapping with Programme Outcomes

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

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

ALLIED-I: MATHEMATICAL STATISTICS

(For B.Sc., Mathematics Major Students admitted
from the year   2019 – 2020 onwards)

ALLIED-I	B.Sc (MATHEMATICS)	2019 - 2020
Code:	MATHEMATICAL STATISTICS	
Credits: 4		

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

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

TEXT BOOK:

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition) Problems.	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No.	Title of the Book	Author	Publishing Company	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.

ALLIED -I - BUSINESS STATISTICS

ALLIED – I	B.Com & B.Com (CA) & BBA	2019 - 2020
Code:	BUSINESS STATISTICS	
Credits: 4		

Objective:

In this 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

CO	Statement	Knowledge Level
CO1	Learn the uses of statistics in society and Understand the method of data collection and Measures of central tendency.	K2
CO2	Learn the Measures of Dispersion	K2
CO3	Applications of correlation and regression in real life situations	K4
CO4	Applications of index numbers in real life situations	K4
CO5	Analyze of time series data in practical life.	K4

UNIT – I

Introduction – Collection and Tabulation of Statistical data – Frequency Distribution – Measures of Central Tendency (Mean, Median, Mode).

UNIT – II

Measures of Dispersion - Range – Quartile Deviation – Mean Deviation – Standard Deviation and their Coefficients.

UNIT – III

Correlation – Types of Correlation – Measures of Correlation – Karl Pearson's Coefficient of Correlation – Spearman rank Correlation Coefficient.

UNIT – IV

Index Number – Definition of Index Numbers, Uses & Problems in the constructions of index numbers, Simple and Weighted Index Numbers.

UNIT – V

Analysis of Time Series – Definition – Components of Time Series, Uses, Measures of Secular trend, Measures of Seasonal Variations, Method of Simple average only.

TEXT BOOK:

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Business Statistics	P.A. Navanithan	Jai Publications	2010

REFERENCE BOOK:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistics	Sancheti.D.C and Kapoor.V.K (2005),	Sultan Chand & Sons, New Delhi.	2008

Mapping with Programme Outcomes

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

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

ALLIED- II	B.Sc (MATHEMATICS)	2019 - 2020
Code:	STATISTICAL INFERENCE	
Credits: 4		

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

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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.

TEXT BOOK:

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamental of Mathematical Statistics (11th - Edition) Problems.	Gupta, S.C and Kapoor, V.K	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Mathematical Statistics	S.C Gupta andV.K Kapoor	Sultan Chand & Sons, New Delhi.	2004
2.	Statistics	Sancheti.D.C and Kapoor.V.K	Sultan Chand & Sons, New Delhi.	2006

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.

ALLIED PAPER-II - BUSINESS STATISTICAL DECISION TECHNIQUES

ALLIED - II	B.Com & B.Com (CA)	2019 - 2020
Code:	BUSINESS STATISTICAL DECISION TECHNIQUES	
Credits: 4		

Objective:

The purpose of this course is provides a quantitative analysis of the problem. It covers the basic concepts of matrix. It covers the basic concepts of probability. The purpose of this course is provides a quantitative analysis of the problem from which management can make an objective decision. To impart basic knowledge of various optimization techniques. 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

CO	Statement	Knowledge Level
CO1	Know the operations on matrix and methods	K1
CO2	Learn the sequence and series and progressions	K2
CO3	Conduct random experiments in real life data and Understand the Axioms of probability.	K1
CO4	Obtain the transportation problem in Transport company.	K4
CO5	Obtain the real situation of Assignment problems in a company.	K4

UNIT – I

       Matrix : Definitions – Operations on Matrix – Determinant of Matrix – Inverse of a Matrix (Ad-Joint method only) – Application.

UNIT – II

       Sequence and Series – Arithmetic Progression and Geometric Progression (Simple Problems Only).

UNIT – III

       Probability – Definition – Addition and Multiplication Theorems – Conditional Probability (Simple Problems Only).

UNIT – IV

       Transportation problems – North West Corner method – Vogel's Approximation method.

UNIT – V

       Assignment problems – Balanced and Unbalanced - Hungarian assignment method.

TEXT BOOK:

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Business Statistics	P.A. Navnitham	Jai Publications	2004

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REFERENCE BOOK:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Business Mathematics and Statistics	P.R.Vittal	Margham Publications	2011.

Mapping with Programme Outcomes

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

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

ALLIED - II	BBA	2019 - 2020
Code: : M19USTA05	**OPERATIONS RESEARCH**	
Credits: 4		

OBJECTIVES

To portray the students about the decision making process through operations research models and could solve the business problems through graphical methods.

COURSE OUTCOMES

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

CO	Statement	Knowledge level
CO1	Understand the operation research models and its applications	**K1**
CO2	Get the importance of solving business problems by using linear programming and graphical methods	**K2**
CO3	Find out the feasible solutions by using transportation models	**K3**
CO4	Know about the formulation of assignment problems and solutions	**K3**
CO5	Know about the applications of Baye's theorem and decision making	**K3**

UNIT -I

        *Oper*ations research –meaning –scope –uses –operations research in India –models in operations research –limitations of model –general methods for solving operations research models.

UNIT -II

        Linear programming problems –requirements –formulation of L.P.P. by graphical method – simplex method (simple problem only).

UNIT –III

        Transportation problems – obtaining initial basic feasible solution – various methods of Solving transportation problems.

UNIT-IV

Assignment problems –   formulation and solution assignment problems.

UNIT-V

Decision theory – Types of decision making criteria statement of Baye's theorem – application of Baye's theorem – uses of probability – decision tree.

TEXT BOOKS:

S.no	Title of the book	Author	Publishers	Year of Publication
1.	Operations Research	V. K. Kapoor	Sultan Chand & Sons	2014
2.	Introduction to Operations Research	Vital P.R	Margham Publications	2011

REFERENCE BOOK:

S.no	Title of the book	Author	Publishers	Year of Publication
1.	Operations Research	P. K. Man Mohan	Sultan Chand & Sons	2011

MAPPING WITH PROGRAMME OUTCOMES

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

S- STRONG   M-MEDIUM

Allied Practical- I	B.Sc. MATHEMATICS	2019 - 2020
Code:	Allied Practical – I : MATHEMATICAL STATISTICS	
Credits: 2		

Objective:

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. This course introduces practical based Distribution Theory. 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. 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	Learn the Measures of central tendency.	K2
CO2	Obtain the theoretical distributions	K3
CO3	Obtain the curve fitting using data	K3
CO4	Applications of correlation and regression	K4
CO5	Analyse the data using test for independence of attributes and paired t-test	K4

UNIT – I

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

UNIT – II

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

UNIT – III

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

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

UNIT – V

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	M
CO2	S	S	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.

NON MAJOR ELECTIVE COURSE - I

NMEC – I		2019 - 2020
Code:	**APPLIED STATISTICS**	
Credits: 2		

Objective:

This course is to provide foundation as well as comprehensive background of 'Descriptive Measure', Correlation and Regression to beginners in simple and interesting manner. It covers concepts such as descriptive statistics and introduces common measures of central tendency, variability and frequently used graphs and charts, Moments, Skewness and Kurtosis and introduces the concept of association with graphics displaying different strengths of association between two variables. 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

CO	Statement	Knowledge Level
CO1	Learn the uses of statistics and sources of data in life science	K2
CO2	Learn the Measures of central tendency.	K2
CO3	Learn the Measures of Dispersion	K2
CO4	Applications of correlation	K4
CO5	Applications of Regression in real life situation	K4

UNIT-I

     Statistics - Definition –Types of data- Sources of data in life science- uses of statistics.

UNIT-II

     Measures of Central Tendency- Mean Median, Mode.

UNIT-III

     Measures of Dispersion- Range- Standard Deviation- Quartile deviation, - Coefficient of variations.

UNIT-IV

     Correlation- Types and methods of correlation-Rank correlation.

UNIT-V

     Regression-Simple regression equation.

REFERENCE BOOK:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods	Gupta and Kapoor	Sultan Chand Publications	2008
2.	Business Statistics -	P.A. Navanithan.	Jai Publications.	2006

Mapping with Programme Outcomes

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

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

NMEC – I		2019 - 2020
Code:	**STATISTICAL SURVEY**	
Credits: 2		

Objective:

This course is to provide foundation as well as comprehensive background of graphics displaying different strengths of association between two variables and data collection and presentation. 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

CO	Statement	Knowledge Level
CO1	Learn the Organizing a statistical survey.	K2
CO2	Learn the Sampling - Census and Sample method.	K2
CO3	Obtain Primary data and Secondary data in practical life.	K3
CO4	Understand Types of Classification in real life.	K2
CO5	Obtain the tabulation of data in practical life.	K4

UNIT-I

Organizing a statistical survey- Planning the survey, Executing the survey - Drafting an effective questionnaire.

UNIT-II

Sampling - Census and Sample method. Sampling and Non-sampling errors.

UNIT-III

Collection of data - Primary data - methods of collecting primary data. Internet Survey and Telephone Survey. Secondary data - methods.

UNIT-IV

Classification of data – Types of Classification - Formation of discrete frequency distribution and Formation of continuous frequency distribution.

UNIT-V

Tabulation of data - Parts of a table and general rules of tabulation. Types of tables - simple and complex table, Machine tabulation and Cross tabulation.

REFERENCE BOOK:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods	Gupta and Kapoor	Sultan Chand Publications	2008
2.	Business Statistics	P.A. Navanithan.	Jai Publications.	2006

Mapping with Programme Outcomes

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

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

NON MAJOR ELECTIVE COURSE -III

NMEC – II		2019 - 2020
Code:	**STATISTICAL METHODS** **(Using Statistical Packages)**	
Credits: 2		

Objective:

This course is to provide foundation as well as comprehensive background of 'Descriptive Measure', Correlation and Regression to beginners in simple and interesting manner. It covers concepts such as descriptive statistics and introduces common measures of central tendency, variability and frequently used graphs and charts, Moments, Skewness and Kurtosis and introduces the concept of association with graphics displaying different strengths of association between two variables. 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

CO	Statement	Knowledge Level
CO1	Learn the uses Diagrammatic representation in real situations.	K2
CO2	Learn the Measures of central tendency.	K2
CO3	Learn the Measures of Dispersion	K2
CO4	Applications of correlation	K4
CO5	Obtain Regression and their equations	K4

UNIT-I

      Diagrammatic representation of data – Simple, Multiple and Percentage Bar diagram; Pie diagram and Graphical representation of data.

UNIT-II

      Measures of Central tendency – Mean; Median and Mode.

UNIT-III

      Measures of Dispersion- Range; Quartile Deviation; Mean Deviation; Standard Deviation; Coefficient of Variation.

UNIT-IV

      Measure of Bivariate data, Scatter diagram and Pearson's method correlation

UNIT-V

      Regression and their equations.

REFERENCE BOOK:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods	Gupta and Kapoor	Sultan Chand Publications	2008
2.	Business Statistics	P.A. Navanithan. -	Jai Publications.	2006

Mapping with Programme Outcomes

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

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

NON MAJOR ELECTIVE COURSE - IV

NMEC – II		2019 - 2020
Code:	AGRICULTURAL STATISTICS	
Credits: 2		

Objective:

This course introduces for the benefit of the more enterprising students, who wishes to pursue the study of the subject in greater detail, references to further sources of information concerning various aspects of statistical methods and design of experiments have been given. It is to be hoped that in its present form the course will meet the day-to-day needs of the agricultural and other biological research workers and form a suitable course to the students of these sciences. In Agricultural Universities, sufficient knowledge of statistics is being imparted to Agricultural, Veterinary and Home Science students by offering several courses from undergraduate to Doctorate level.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Obtain the univariate and bivariate data.	K3
CO2	Compute the distributions and confidence limits.	K2
CO3	Large and small sample test apply for agricultural field.	K4
CO4	Test of Goodness of Fit and Testing Heterogeneity for agricultural field.	K4
CO5	Obtain the role of design of experiments	K3

Unit- I

Frequency distributions – Graphic Representation – Frequency Curve and its Characteristics.

Unit - II

The Normal and Binomial Distributions – Random sampling – Expectation of Sample Estimates – Distribution of Sample Means .

Unit - III

Significance of Means in Large Samples – Significance of Difference of Means in Large Samples.

Unit - IV

The Chi-Square Test of Goodness of Fit – Testing Heterogeneity.

Unit - V

Principles of Field Experimentation – Replication – Randomization – Local Control – Efficiency of Designs.

TEXT BOOK:

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	"Statistical Methods for Agricultural Workers"	Panse, V.G &Sukhatme, P.V	Indian Council of Agricultural Research, New Delhi.	1967

REFERENCE BOOK:-

S.No.	Title of the Book	Author	Publishing Company	Year of Publication
1.	Fundamentals of Statistics	Goon Gupta A.M., and Das Gupta	The World Press Private Limited, Calcutta.	1982

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	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.

ALLIED – I (ADVANCED BUSINESS STATISTICS)

ALLIED - I		2019 - 2020
Code:	**ADVANCED BUSINESS STATISTICS**	
Credits: 4		

Objective:

This course is to provide foundation as well as comprehensive background of Correlation. It covers concepts such as theoretical 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. Throughout the course stressed the importance of experimental design as a tool for engineers and scientists to use for product design and development as well as process development and improvement. This course as the basis of an industrial short course on design of experiments for practicing

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Learn the partial and multiple correlation	K2
CO2	Applications of theoretical probability distribution	K3
CO3	Analyze the small and large test using data	K4
CO4	Analyze the chi square test using real life problems	K4
CO5	Analyze the one way and two classification	K4

UNIT-I

Statistics –Partial correlation-Partial correlation coefficient –Partial correlation in case of three variables-Multiple correlation.

UNIT-II

Theory of Probability- Probability Distribution – Characteristics and applications of Binomial, Poisson and normal Distribution.

UNIT-III

Sampling- Sampling Distribution- Sampling error-standard error. Testing of Hypothesis-Testing of Means and Proportions –Large and small samples.

UNIT-IV

Chi square distibution-Charactristics and application-test of goodness of fit and test for independence of attributes. (Simple Problems).

UNIT-V

F-test (test for variance) - testing equality of population variances-analysis of variance- one way and two way classification.

TEXT BOOK:

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods	P.R.Gupta	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Business statistics	D.C Sanncheti and V.K Kapoor	Sultan chand and sons ,New Delhi

Sultan chand &Sons | 2011. |
| 2. | Business Statistics | J.K Sharma | pearson education | 2010 |

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Mapping with Programme Outcomes

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

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

ALLIED PRACTICAL – I (ADVANCED BUSINESS STATISTICS)

ALLIED PRACTICAL - I		2019 – 2020
Code:	**ADVANCED BUSINESS STATISTICS (PRACTICAL)** **(Using Statistical Software Packages)**	
Credits: 2		

Objective:

This course is designed to help students learn how to analyze and interpret research data with intermediate statistics. For this reason, most of the practical statistical analyses is done with the help of an appropriate software package. A 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.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Obtain the graphs and diagrams using SPSS.	K3
CO2	Formation of frequency distribution using SPSS.	K3
CO3	Obtaining the Regression lines using SPSS.	K3
CO4	Learn the solution of Non parametric methods using SPSS.	K2
CO5	Test the association between the attributes using SPSS.	K4

Using SPSS Package

Introduction- Data Entry –The Data View Spreadsheet- the variable view spreadsheet- Description of data – Methods of Analysis- Analysis.

UNIT-I

Diagrammatic Representation-Bar –Multiple Bar – Line-histogram-Percentage Bar-Sub-Divided Bar Diagram.

UNIT-II

Frequency Distribution-Arithmetic Mean-Median-Mode-GM-HM

UNIT-III

Range-Quartile Deviation-Standard Deviation.

UNIT-IV

Correlation- Regression

UNIT-V

T-test-Chi square test-ANOVA

REFERENCE BOOK:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	A Hand book of statistical analysis using SPSS	sabine landau and Brian S.Everitt		2006

Mapping with Programme Outcomes

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

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

Elective Core -I		2019 - 2020
Code:	**BIO- STATISTICS**	
Credits: 4		

Objective:

The purpose of this course is to present up-to-date theory and techniques of statistical inference (estimation theory) in a logically integrated and practical form. Essentially, it incorporates the important developments in the subject that have taken place in the last three decades. Statistical inference techniques, if not applied to the real world, will lose their import and appear to be deductive exercises. Furthermore, it is belief that in a statistical course emphasis should be given to both mathematical theory of statistics and to the application of the theory to practical problems.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Know the correlation and methods of correlation	K1
CO2	Learn the basic concepts of inferential statistics	K2
CO3	Obtain the testing of hypothesis using statistical data	K3
CO4	Analyze the statistical data using single means and difference of mean	K4
CO5	Analyze data using the chi square test	K4

UNIT-I

     Correlation -Types and methods of correlation-Rank correlation.

UNIT-II

     Sampling Methods-Population, sample –Parameter- Statistics-Estimation-Estimator-standard error.

UNIT-III

     Test of significance-Hypothesis – Simple hypothesis – types of errors – level of significance – Tests based on small samples (t-test)

UNIT – IV

     Tests based on large samples – tests for single means, tests for difference of two means.

UNIT- V

     Chi – Square test- uses of Chi – square test goodness of fit and independence of attributes- Simple problems.

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Statistical Methods	Gupta and Kapoor	Sultan Chand Publications	2008
2.	Statistics	Pillai.R.S.N. and Bagavathi.V.	S.Chand & company Ltd., New Delhi	

Mapping with Programme Outcomes

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

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

ALLIED PAPER-I: RESOURCE MANAGEMENT TECHNIQUES

ALLIED- I		2019 - 2020
Code:	RESOURCE MANAGEMENT TECHNIQUES	
Credits: 4		

Objective:

The purpose of this course is provides a quantitative analysis of the problem from which management can make an objective decision. 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. Operations Research and Management Science methodologies and their applications continue to grow and flourish in a number of decision-making fields. To impart basic knowledge of various optimization techniques. 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

CO	Statement	Knowledge Level
CO1	Applications of LPP (graphical, simplex method and BIG M method)	K3
CO2	Applications of transportation problems. (VAM and MODI)	K3
CO3	Applications of assignment problems in real life situations.	K3
CO4	Obtain the role of decision theory in real life problem working.	K3
CO5	Obtain the network analysis for Critical path method & Program Evaluation Review Technique.	K3

UNIT – I

Linear Programming Problems – Graphical method - Simplex method – Big M method.

UNIT – II

Transportation model – Definitions – Formulation and Solutions of transportation models – NWCR – MMM – VAM and MODI.

UNIT – III

Assignment problems – Definitions – Formulation and Solution of Assignment models – Hungarian method.

UNIT – IV

Decision Theory – Decision theory under uncertainty – Maximin Criterion – Maximax Criterion – Minimax Regret Criterion – Decision theory under risk – Expected Monetary value – Expected opportunity loss – Expected value under perfect information.

UNIT – V

Network Analysis – Basic concepts – Construction of network – Critical Path Method (CPM) – Program Evaluation Review Technique (PERT)

TEXT BOOK:

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research	P.R.Gupta and Manmohan	Sultan Chand & Sons, New Delhi.	2004

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Quantitative Techniques	C.R.Kothari	Vikas Publishing House	2011.
2.	Mathematical Models in Operations Research	J.K.Sharma	TMH Publishers.	2010

Mapping with Programme Outcomes

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

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

ALLIED PRACTICAL-I: RESOURCE MANAGEMENT TECHNIQUES

Allied Practical-I		2019 - 2020
Code:	Allied Practical: RESOURCE MANAGEMENT TECHNIQUES	
Credits: 2		

Objective:

This course introduces practical based operation research. It covers concepts LPP such as transportation and assignment problems. Decision theory & Network analysis. It provides technical skills to understand and develop various applications for operations research.

Course Outcomes

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

CO	Statement	Knowledge Level
CO1	Obtain the linear Programming Problem in real life problem.	K3
CO2	Obtain the real situation of Transportation problems in Transport company.	K3
CO3	Apply the practical situations in Assignment problems in a company.	K4
CO4	Learn the practical problem in EMV and EVPI method	K3
CO5	Learn the practical problem in CPM and PERT method	K4

UNIT – I

Solving LPP – Graphical method – Simplex method.

UNIT – II

Transportation problem – North West Corner Rule – Least Cost Method – Vogel's Approximation Method.

UNIT – III

Assignment problem – Balanced – Unbalanced problems.

UNIT – IV

Expected Monetary Value (EMV) – Expected Value of Perfect Information (EVPI).

UNIT – V

Critical Path Method (CPM) – Program Evaluation Review Technique (PERT).

TEXT BOOK:

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S.No	Title of the Book	Author	Publishing Company	Year of Publication
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REFERENCE BOOKS:-

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Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	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.