

MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

(Affiliated to Periyar University)

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

KALIPPATTI-637501.



B.Sc. STATISTICS

**SYLLABUS
CHOICE BASED CREDIT SYSTEM (CBCS)**

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR

2016 – 2017 ONWARDS

SEMESTER - I

Sem	Part	Course	Paper Title	Hours Theory & Practical	Credit	Marks			Remarks
						CI A	UE	Total	
I	I	Tamil	Tamil –I	5	3	25	75	100	
	II	English	English- I	5	3	25	75	100	
	III	Core Theory-I	Descriptive Statistics	8	5	25	75	100	
		Allied I: Theory paper I	Mathematics I	5	3	25	75	100	
		Allied I : Practical	Allied mathematics practical *	2	-	-	-	-	
		Core Practical-I	Major practical I *	3	-	-	-	-	
	IV	Value Education (Yoga)		2	2	25	75	100	
	Total			30	16	No. of Course 7		500	

SEMESTER - II

Sem	Part	Course	Paper Title	Hours Theory & Practical	Credit	Marks			Remarks
						CIA	UE	Total	
II	I	Tamil	Tamil –II	5	3	25	75	100	
	II	English	English- II	5	3	25	75	100	
	III	Core Theory- Paper II	Probability Theory	8	5	25	75	100	
		Allied I theory paper II	Mathematics II	5	3	25	75	100	
		Allied Practical - I	Mathematics Practical I	2	3	40	60	100	
		Core Practical- I	Major Practical	3	4	40	60	100	
	IV	Environmental Studies		2	2	25	75	100	
	Total			30	23	No. of Course 7		700	

SEMESTER - III

Sem	Part	Course	Paper Title	Hours Theory & Practical	Credit	Marks			Remarks
						CIA	UE	Total	
III	I	Tamil	Tamil -III	5	3	25	75	100	
	II	English	English- III	5	3	25	75	100	
	III	Core Theory-III	Sampling techniques	5	4	25	75	100	
			Distribution Theory	5	4	25	75	100	
		Allied	Operation Research -I	4	4	25	75	100	
		Core Practical-II	Sampling and Operation Research	2	2	40	60	100	
	IV	NMEC-I	Skills for Employment - I	2	2	25	75	100	
V	SBEC-I	Competitive Exam-I	2	2	25	75	100		
		Total		30	24	No. of Courses- 8		800	

SEMESTER - IV

Sem	Part	Course	Paper Title	Hours Theory & Practical	Credit	Marks			Remarks
						CIA	UE	Total	
IV	I	Tamil	Tamil -IV	5	3	25	75	100	
	II	English	English- IV	5	3	25	75	100	
	III	Core Theory -IV	Theory of Estimation	7	5	25	75	100	
			Operation Research -II	5	4	25	75	100	
		Core Practical-III	Estimation Theory	2	4	40	60	100	
	IV	NMEC-II	Skills for Employment - II	2	2	25	75	100	
	V	SBEC-II	Competitive Exam-II	2	2	25	75	100	
III	Allied Practical- II	Allied Practical – II - Excel	2	3	40	60	100		
		Total		30	26	No. of Courses- 8		800	

SEMESTER - V

Sem	Part	Course	Paper Title	Hours Theory & Practical	Credit	Marks			Remarks
						CIA	UE	Total	
V	I	Core Theory-V	Testing of hypothesis	6	5	25	75	100	
	II	Core Theory-VI	Design of Experiments	6	5	25	75	100	
	III	Core Elective-I	Stochastic Process	5	5	25	75	100	
		Core Elective-II	Actuarial statistics	5	5	25	75	100	
		Core Practical-IV	Practical – IV - SPSS	4	3	40	60	100	
	IV	SBEC-III	Non-parametric Test	2	2	25	75	100	
	V	SBEC-IV	Indian Official Statistics	2	2	25	75	100	
		Total		30	27	No. of Courses- 7		700	

SEMESTER - VI

Sem	Part	Course	Paper Title	Hours Theory & Practical	Credit	Marks			Remarks
						CIA	UE	Total	
VI	I	Core Theory- VII	Statistical Quality Control	6	5	25	75	100	
	II	Core Theory- VIII	Applied Statistics	5	5	25	75	100	
	III	Core Practical-V	Practical-V Statistical Quality Control	4	3	40	60	100	
		Core Elective-II	Numerical Analysis	5	4	25	75	100	
		SBEC-V	Statistical Forecasting	2	2	25	75	100	
	IV	SBEC-VI	Regression Analysis	2	2	25	75	100	
	III		Project	6	5	25	75	100	
	V		Extension activities		-	1	-	-	
		Total		30	27	No. of Courses- 7		700	

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	5	10	10	43	56	9	900
	Core Practical	-	4	2	4	3	3	16	18	5	500
	Elective	-	-	-	-	10	4	14	15	3	300
	Project	-	-	-	-	-	5	5	6	1	100
	Allied	3	3	4	4	-	-	14	19	4	400
	Allied Practical	-	3	-	3	-	-	6	4	2	200
IV	SBEC	-	-	2	2	4	4	12	12	6	600
	NMEC	-	-	2	2	-	-	4	4	2	200
	Enhancement Compulsory Courses	2	2	-	-	-	-	4	4	2	200
V	Extension Activities	-	-	-	-	-	1	1	-	1	-
Total		16	23	24	26	27	27	143		43	4200

BACHELOR OF SCIENCE

BRANCH – STATISTICS CBCS PATTERN (2016 - 2017)

REGULATIONS

1. OBJECTIVES

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

- To build the basis for promoting theoretical and application aspects of Statistics.
- To underline the statistics as a science of decision making in the real life problems With the description of uncertainty.
- 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

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

3. DURATION OF THE COURSE

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

b) 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. SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

7. QUESTION PAPER PATTERN FOR ALL CORE, ALLIED & ELECTIVE COURSES & SKILL BASED ELECTIVE COURSES

Question Paper Pattern for Core Paper (Theory):

Time: Three hours

Maximum Marks: 75

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)

Question Paper Pattern for SBEC:

Time: Three hours

Maximum Marks: 75

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)

Note: No equal weightage is required for each unit. Question paper may be set irrespective of the units.

Evaluation of Continuous Internal Assessment (CIA)

The components for continuous internal assessment (CIA) are

Test - 10 marks

Seminar - 5 marks

Assignments - 5 marks

Attendance - 5 marks

Total 25 marks

7.3 Question Paper Pattern for Core & Allied Practical

Time: Three hours

maximum: 60 marks

Answer Any THREE questions out of FIVE questions

(One question from each unit)

Distribution of Marks for Core and Allied Practical:

University Examination (Written Practical)	-	60 marks
Continuous Internal Assessment (CIA) (Including Practical Record)	-	40 marks
Total	-	100 marks

Evaluation of Continuous Internal Assessment (CIA)

The components for continuous internal assessment (CIA) are

Record	-	25 marks
Test	-	10 marks
Attendance	-	5 marks
Total		40 marks

8. PASSING MINIMUM

The candidate shall be declared to have passed the examination if the candidate Secure not less than 30 marks out of 75 marks in the University Examination (UE) in each theory paper and 10 marks (out of 25) in the Continuous Internal Assessment (CIA) in each theory paper.

For the Practical paper, a minimum of 24 marks (out of 60) in the University Examination (UE) and 16 marks (out of 40) in the Continuous Internal Assessment (CIA) is required to pass the examination.

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

Maximum marks passing minimum Examination

	CIA	UE	Total	CIA	UE	Total
Theory paper	25	75	100	10	30	40
Practical paper	40	60	100	16	24	40

9. CLASSIFICATION OF SUCCESSFUL CANDIDATES

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

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

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

1. **Passing Minimum** is 40% of the ESE and also 40% of the minimum of the paper / course.
2. **Minimum Credits to be earned:** For THREE year Programme: Best 140 Credits.
(Part I and II: Languages, Part III Major, Elective, Part -IV Soft Skills and Part V: Extension activities).

3. Marks and Grades:

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

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

Range of Marks	Grade Points	Letter Grade	Description
90 - 100	9.0 - 10.0	O	Outstanding
80 - 89	8.0 - 8.9	D+	Excellent
75 - 79	7.5 - 7.9	D	Distinction
70 - 74	7.0 - 7.4	A+	Very Good
60 - 69	6.0 - 6.9	A	Good
50 - 59	5.0 - 5.9	B	Average
40 - 49	4.0 - 4.9	C	Satisfactory
00 - 39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

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

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

10. MAXIMUM DURATION FOR THE COMPLETION OF THE UG PROGRAMME:

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

11. COMMENCEMENT OF THIS REGULATION:

The CBCS regulations shall take effect from the academic year 2016-2017 ie, for the students who are admitted to the first year of the course during the academic year 2016-2017 and thereafter.

12. TRANSITARY PROVISION

Candidates who were admitted to the UG course of study prior to 2016-2017 shall be permitted to appear for the examination under those regulations for a period of three years ie, up to and inclusive of the examinations of April/May 2016. Thereafter they will be permitted to appear for the examination only under the regulations then in force.

LIST OF COURSES

1. CORE COURSES: (Theory 9 + Practical 4): 13

(i) CORE THEORY : 9

1. Descriptive Statistics
2. Probability Theory
3. Sampling Techniques
4. Distribution Theory
5. Theory of Estimation
6. Testing of Hypothesis
7. Design of Experiments
8. Statistical Quality Control
9. Applied Statistics

(ii) CORE PRACTICAL: 4

1. Major practical - I (Based on Core theory papers - 1 & 2)
2. Major practical – II (Based on core theory papers - 3, 4 & 5)
3. Major practical - III (Based on core theory papers - 6 & 7)
4. Major practical - IV
(Based on core theory papers - 8 & 9)

II. CORE ELECTIVES: 3

1. Stochastic Processes
2. Actuarial Statistics
3. Numerical Analysis
4. Bio- Statistics

III. ALLIED COURSES (Theory 4 + Practical 2)

(i). ALLIED THEORY: 4

1. Mathematics - I
2. Mathematics - II
3. Linear Programming and its Applications
4. Decision Theory and its Applications.

(ii). ALLIED PRACTICALS: 2

Allied I: Mathematics Practical

Allied II: Operations Research (Based on Allied theory papers 3 & 4)

IV. SKILLS BASED ELECTIVE COURSES: 6

1. Competitive Exam-I
2. Competitive Exam-II
3. Competitive Exam-III
4. Competitive Exam-IV
5. Non-Parametric Tests
6. Statistical Forecasting
7. Indian Official Statistics

V. NON MAJOR ELECTIVE COURSES: 2

1. Communication Skills
2. Statistical Computing

VI. ENVIRONMENTAL STUDIES: 1

VII. VALUE EDUCATION: 1

VIII. EXTENSION ACTIVITIES: 1

(For the candidates admitted from 2016 - 2017 onwards)

Core Course - I

B.Sc. STATISTICS

P. Code: M16UST01

SEMESTER - I

DESCRIPTIVE STATISTICS

UNIT - I

Collection and sources of statistical data - Formation of frequency distribution - discrete and continuous - Exclusive and Inclusive - cumulative frequency distribution (O'gives) - Representation of data - Graphs and Diagrams - Bar diagrams, Histogram, Pie diagram.

UNIT - II

Univariate data - Measures of Central Tendency - Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean - Inter Relationship between A.M, G.M and H. M - Weighted A.M - properties of a good Average.

UNIT - III

Measures of dispersion - Range, Quartile Deviation, Mean Deviation and Standard Deviation - Inter Relationship between Q.D., M.D., and S.D. - Co-efficient of Variation - Lorenz curve

UNIT - IV

Moments - Raw moments, Central moments - Relation 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 Person' s co-efficient of correlation - properties - Spearman's Rank correlation co-efficient - Concurrent deviation Method - Correlation co-efficient for grouped data.

Reference Books:

1. Gupta, S.C, and Kapoor, V.K. (2004). *Fundamental of Mathematical Statistics (11th - edition)*, Sultan Chand & Sons, New Delhi.
2. Goon Gupta A.M and Das Gupta, (1994). *Fundamentals of Statistics*, The World Press Private Limited, Calcutta.
3. S.P.Gupta, (2001). *Statistical Methods*, Sultan Chand & Sons, New Delhi.

(For the candidates admitted from 2016 - 2017 onwards)

Core Course - II

B.Sc. STATISTICS

P. Code: M16UST02

SEMESTER - II

PROBABILITY THEORY

UNIT - I

Concepts of Random experiment - Trial - Sample point - Sample space, Event, Algebra of Events, Mutually Exclusive - Exhaustive events, definition of probability, classical, statistical and Axiomatic approach - Properties of Probability, Theorems on Probability - Addition theorem, total theorem on probability – Conditional probability - Multiplication theorem – Baye's theorem.

UNIT - II

Concept of random variable - Discrete random variable, continuous random variables, probability mass function - Probability density function, distribution function - Properties of distribution function - Independence of random events and random variable - Pair wise independence and mutual independence.

UNIT - III

Mathematical expectation of random variables - Properties of mathematical expectation - moments - Raw moments, central moments - Measures of location and dispersion of a random variable – Tchebychev' s inequality and its application.

UNIT - IV

Moment generating function of a random variable - their properties and its uses - cumulants - Characteristic functions - Properties of characteristic function - simple examples - Inversion theorem, (statement only) - Statements and Application of weak law of large numbers.

UNIT - V

Bivariate distribution - Distribution functions of bivariate random variable and its properties - probability mass and density functions, marginal and conditional distributions - Conditional expectation - Concept of regression lines - covariance and correlation

Reference Books

1. A. Santhakumaran (2006). *Probability theory and Test of Hypothesis*
2. S.C.Gupta and V.K. Kapoor (2004). *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons Publications, New Delhi.
3. J.N.Kapur and H.C.Saxena (1989). *Mathematical Statistics*, S.Chand and Company Ltd., New Delhi.
4. Marek. Fisz, (1961). *Probability Theory and Mathematical Statistics*, John Wiley and Sons.

(For the candidates admitted from 2016 - 2017 onwards)

Core Practical - I

**B.Sc. STATISTICS
SEMESTER - II
MAJOR PRACTICAL - I**

P. Code: M16USTP01

UNIT - I

Formation of frequency distribution- Computation of Measures of Central Tendencies.

UNIT - II

Calculation of Measures of dispersion- Skewness and Kurtosis.

UNIT - III

Correlation Analysis - Product Moment correlation - Rank correlation.

UNIT - IV

Regression Analysis - Regression lines of two variables.

UNIT - V

Rank of the matrix - Inverse of the matrix - Solution of simultaneous equations of three variables using matrix inverse method.

Note:

Total : 100 marks

* University Examination : 60 "

(Written practical)

Continuous Internal Assessment : 40 "

(Including Practical Record)

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

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

(For the candidates admitted from 2016 - 2017 onwards)

Core Course - III

**B.Sc. STATISTICS
SEMESTER - III
SAMPLING TECHNIQUES**

P. Code: M16UST03

UNIT - I

Concept of sampling and population: Need for sampling - Design, Organization and execution of sample survey - Principal steps in sample surveys - preparation of questionnaire and schedules - Pilot survey - Sampling and Non-sampling Errors - Limitations of sampling.

UNIT - II

Sampling from finite population- Simple Random Sampling with and without replacement - Unbiased estimate of mean and Variance - finite population correction - Estimation of standard error from a sample - Determinations of sample size - Simple Random Sampling for attributes.

UNIT - III

Stratified Random Sampling: Concept of stratifying factor - Unbiased estimate of the mean and variance of the estimated mean - Proportional and optimum allocation - Relative precision of stratified random sampling and simple random sampling.

UNIT - IV

Systematic sampling: Estimation of the mean and variance of the estimated mean - comparison of simple, stratified and systematic sampling.

UNIT - V

Regression Estimators: Linear regression estimate, Regression estimate with pre assigned 'b' and regression estimates computed from sample.CSO, NSSO and its functions - Other agencies undertaking sample surveys.

REFERENCE BOOKS

1. W.G.Cochran (1985), *Sampling Techniques*, Wiley Eastern Ltd, New Delhi.
2. S.C. Gupta and V.K.Kapoor (2007), *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.
3. Parimal Mukhopadhyay (2012), *Theory and methods of survey sampling*. 4th Edition (EEE) PHI Learning private limited, New Delhi.

(For the candidates admitted from 2016 - 2017 onwards)

Core Course - IV

**B.Sc. STATISTICS
SEMESTER - III
DISTRIBUTION THEORY**

P. Code: M16UST04

UNIT – I

Univariate discrete distributions - their properties - Binomial, Poisson, Geometric, Hyper geometric and Negative binomial distributions -Limiting form of Binomial to Poisson distribution.

UNIT - II

Continuous Univariate distributions - Uniform - Normal - Exponential-Cauchy - Gamma - Beta distribution - their simple applications.

UNIT - III

Bivariate normal distributions - marginal and conditional distributions and their properties - Sampling distributions - Standard error,

UNIT - IV

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

UNIT - V

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

REFERENCE BOOKS:

1. S.C.Gupta and V.K.Kapoor, (2004), *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. V.K. Rohatgi, (1985), *An introduction to probability theory and mathematical statistics*, Wiley Eastern Ltd., New Delhi.

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

Allied II: Theory - I

P. Code: M16UMAA04

SEMESTER - III

OPERATION RESEARCH - I

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 Method.

UNIT - II

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

UNIT - III

Duality in LPP - Formulation of Dual LPP - Primal - Dual relationship - Solving LPP using Dual concepts - Dual simplex method.

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 method.

Reference Books:

1. Kanti Swarup, P.K.Gupta, Manmohn (1980) , *Operations Research*, Sultan Chand and sons, New Delhi.
2. J.K. Sharma: (1997), *Operations Research and Application*, Mc.Millan and Company, New Delhi.
3. Nita H.Shah, Ravi M.Gor, Hardik Soni (2010), *Operations Research*, PHI Learning Private Limited, New Delhi.
4. Dr.B.S.Goel & Dr.S.K.Mittal , *Operations Research* , Pragathi Prakasam Publishers.

(For the candidates admitted from 2016 - 2017 onwards)

Core Course - V **B.Sc. STATISTICS** **P. Code: M16UST05**
SEMESTER - IV
THEORY OF ESTIMATION
UNIT - I

Point Estimation - Parameter - Statistic - Estimate and Estimator - Properties of Estimators - Concept of Unbiasedness, Consistency, Efficiency and Sufficiency - Simple Applications.

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 – Simple problems on MLE - Method of moments - Simple illustrations - 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.

REFERENCE BOOKS:

1. Rohatgi, V.K. (1988), *An introduction to probability Theory and Mathematical Statistics*, Wiley Eastern Ltd., New Delhi.
2. Lehmann, E.L. (1986), *Theory of point estimation* (Student edition).
3. Hogg, R.V. and Craig, A.T. (1978), *Introduction to Mathematical Statistics*, Fourth Edition, Collier Macmillan Publishers.
4. Mood, A.M., Graybill, F. a., and Bies, D.C. (1974), *Introduction to the Theory of Statistics*, Third Edition, McGraw Hill.
5. Rao, C.R. (1973), *Linear Statistical Inference and its Applications*, Revised Edition, Wiley Eastern Ltd., New Delhi.

For the candidates admitted from 2016 - 2017 onwards

Major Practical : – II

P.Code: M16USTP02

B.Sc. STATISTICS
SEMESTER – III
SAMPLING AND OPERATION RESEARCH

UNIT – I

Simple Random Sampling with and without replacement - mean and Variance of Unbiased estimator.

UNIT – II

Stratified Random Sampling- Proportional and optimum allocation

UNIT – III

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

UNIT – IV

Transportation problem – Vogel’s Approximation Method (VAM) - Modified Distribution (MODI) method.

UNIT – V

Assignment problem - Balanced - Unbalanced – Maximization problems (Hungarian Method).

Reference Books:

1. Kanti Swarup, P.K.Gupta, Manmohn (1980), *Operations Research*, Sultan Chand and sons, New Delhi.
2. J.K. Sharma: (1997), *Operations Research and Application*, Mc.Millan and Company, New Delhi.
3. S.C. Gupta and V.K.Kapoor (2007), *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.

(For the candidates admitted from 2016 - 2017 onwards)

Allied II: Theory II

B.Sc. STATISTICS
SEMESTER - IV

PCode:M16UMAA05

OPERATION RESEARCH - II

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 $2 \times n$ and $n \times 2$ 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.

UNIT - IV

Replacement problem - Replacement of items that deteriorate with time - Replacement of items whose maintenance cost increases with time and the values of money remain same during the period and the value of money also changes with time - selection of best machine amongst two.

UNIT - V

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

REFERENCE BOOKS:

1. Kanti Swarup P.K. Gupta and Manmohan, (1980), *Operations Research*, Sultan chand and sons, New Delhi.
2. J.K.Sharma, (1977): *Operations Research, Theory & Application* - Mc.Millan India Ltd.
3. Nita H.Shah, Ravi M.Gor, Hardik Soni (2010)- *Operations Research*, PHI Learning Private Limited, New Delhi.
4. Dr.B.S.Goel & Dr.S.K.Mittal: *Operations Research*. Pragathi Prakasam Publishers.

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

Allied II: Practical

SEMESTER - IV
OPERATIONS RESEARCH- II

P. Code:M16UMAA05

UNIT - I

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

UNIT - II

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

UNIT - III

Game Theory - Pure and Mixed Strategy situation with and without saddle point - Dominance rule - Graphical method for 2 x n and n x 2 Game.

UNIT - IV

Decision theory - Decision making under deterministic and 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.

NOTE:

Total : 100 marks

* University Examination : 60 ”

(Written practical)

Continuous Internal Assessment : 40 ”

(Including Practical Record)

* 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.

(For the candidates admitted from 2016 - 2017 onwards)

Core Course -VI

B.Sc. STATISTICS

SEMESTER - V

P. Code: M16UST06

TESTING OF HYPOTHESIS

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 - Simple problems.

UNIT - II

Testing of Significance - Large sample and small sample tests - Normal test for mean, variance, proportion and coefficient of correlation - Small sample tests based on t, F for testing mean and variance - Paired t test.

UNIT - III

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

UNIT - IV

Analysis of variance (ANOVA) – Statistical Analysis of One Way – Two Way – Classifications.

UNIT - V

Sequential analysis - Need for Sequential rules – Wald's sequential Probability Ratio Test (SPRT) - Average Sample Number (ASN) and Operating Characteristic (OC) functions - Simple illustrations.

REFERENCES BOOKS:

1. Rohatgi, V.K. (1988), *An introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern Ltd., New Delhi.
2. Lehmann, F.L.(1986), *Testing of Statistical Hypothesis* (Student edition).
3. Hogg, R.V. and Craig, A.T. (1978), *Introduction to Mathematical Statistics*, Fourth edition, Colliar Mac.Millan Publishers.
4. Mood, A.M., Graybill, F.F. and Boes, D.C.(1974), *Introduction to the Theory of Statistics*, Third Edition, Mcgraw Hill.
5. Rao, C.R. (1973), *Linear Statistical Inference and its Applications*, Revised edition, Wiley Eastern Ltd., New Delhi.

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

Core Course - VII

SEMESTER - V

P. Code: M16UST07

DESIGN OF EXPERIMENTS

UNIT-I

Basic principles of experimental design – Experimental errors - Replication
Randomization and local control - Uniformity Trails - Transformation of data and its need.

UNIT-II

Multiple Comparison methods - LSD test - SNK test – Duncan's multiple range
test - Tukey(HSD) test - Basic designs - Completely Randomized design (CRD) and its
Analysis.

UNIT-III

Randomized Block Design (RBD. and their analysis - Missing plot technique for
RBD (one and two missing values) - Latin Square Design (LSD) and its analysis-
Missing plot technique.

UNIT-IV

Factorial Experiments: Concept of main effects and interactions effects, 2^2 , 2^3
Analysis of experiments - principle of confounding (Concept Only).

UNIT-V

Analysis of 3^2 Factorial Experiment - Need and analysis of split - plot design (two
factors only - main plot treatments with RBD layout).

REFERENCE BOOKS

1. S.C.Gupta & V.K.Kapoor (2007), *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.
2. A.M.Goon M.K.Gupta and B.Das Gupta (1994), *Fundamentals of Statistics V-II*, The world press Ltd., Calcutta.
3. M.N.Das and N.C.Giri, (1998), *Design and Analysis of experiments*, Wiley Eastern Ltd, New Delhi.

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

Core Elective - I

**SEMESTER - V
STOCHASTIC PROCESSES**

P. Code: M16USTE01

UNI - 1:

Basic Concepts : Definition and examples of stochastic process, classification of general stochastic processes into discrete and continuous time, discrete and continuous state spaces, types of stochastic processes, elementary problems.

UNIT- II:

Markov chains: Definition and examples of Markov chain, Transition Probability Matrix, classification of states, recurrence, simple problems

UNIT - 3:

Basic limit theorem of Markov chain (statement only), stationary probability distribution, applications.

UNIT - 4:

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

UNIT - 5:

Branching process: Definition and examples of discrete time branching process, probability generating function, mean and variance, probability of extinction, simple problems.

Books For Study and Reference:

1. Karlin, S. and Taylor, H.M. (1975): A first course in Stochastic processes, Academic press.
2. Hoel, P.M.G., Port, S.C. and Stone, C.J. (1991): *Introduction to Stochastic processes*, Universal Book Stall.
3. Parzen, E. (1962): *Stochastic processes*, Holden-Day.
4. Cinlar, B. (1975) *Introduction to Stochastic processes*, Prentice Hall.
5. Adke, S.R. and Manjunath, S.M. (1984): *An introduction to Finite Markov Processes*, Wiley Eastern.
6. Medhi, J. (1996): *Stochastic processes*, New Age International (p) Ltd.
7. Ross, S.M. (1983): *Stochastic processes*, John Wiley.
8. Taylor, H.M. and Karlin, S. (1999): *Stochastic Modelling*, Academic press.

(For the candidates admitted from 2016 - 2017 onwards)

Core Elective – II

B.Sc. STATISTICS
SEMESTER – V
ACTUARIAL STATISTICS

P. Code: M16USTE04

UNIT - I

Effective Rate of Interest i – Nominal Rate of Interest $i^{(m)}$ – Force of interest \ddot{a} - Relation between different Rates of Interest – Expression for \ddot{a} by use of calculus – Present values - Effective Rate of discount d – Nominal Rate of discount $d^{(m)}$.

UNIT - II

Annuities – Immediate Annuity - Annuity due – Perpetuity – Accumulation and Present values of Annuities – Increasing and Decreasing Annuities – Annuities and interest rates with different frequencies Continuous Annuities.

UNIT - III

Analysis of Annuity Payments – Capital and Interest elements included in the Annuity Payments – Loan outstanding after t Payments – Purchase price of Annuities – Annuities involving income tax – Purchase price of an Annuity net of tax.

UNIT - IV

Stochastic Interest rates – Independent annual interest rates – The definition of S_n – Mean and Variance of S_n – Definition of A_n – Mean and Variance of A_n – Simple problems.

UNIT – V

Probabilities of living and dying – The force of Mortality i_x – Estimation of i_x – Uniform Distribution of deaths – Select and Ultimate Rates.

BOOKS FOR REFERENCE AND STUDY:

1. Donald D.W.A (1975), *Compound Interest and Annuities certain Heinemann*, London.
2. Frank Ayres, J.R (1983), *Theory and problems of Mathematics of finance*, Schaum's outline series, McGraw Hill Books Company, Singapore.
3. Mc Cutcheon J.J, and Scott (1989), *Mathematics of Finance*, Heinemann, London.
4. Neill A (1977), *Life Contingencies*, Heinemann, London.

(For the candidates admitted from 2016 - 2017 onwards)

SBEC- IV (2Hrs/Week)

B.Sc. STATISTICS

P. Code: M16USTS03

SEMESTER – V

NON-PARAMETRIC TESTS

UNIT- I

Introduction of Non-Parametric Test-advantages and limitations. Distinction between non-parametric and distribution free tests.

UNIT - II

Test for randomness - Run test - Test for rank - 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.

REFERENCES BOOKS:

1. J.D. Gibbons (1976) *Non-parametric methods for quantitative analysis*, New York.
2. J.V.Desphande, A.P.Gune, A.Shanubhogur: *Statistical Analysis of non-normal data*.
3. Richard I. Lerin : *Statistics for Management*, Practice Hall of India, New Delhi.

Note: Question paper may be set irrespective of the units

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS
SBEC- IV (2Hrs/Week) SEMESTER – V P.Code: M16USTS04
INDIAN OFFICIAL STATISTICS

UNIT I :

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

UNIT II :

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

UNIT III :

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

UNIT IV :

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

UNIT V :

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

Books Reference:

1. Gupta SP, *Statistical Methods*, Sultan Chand & Sons.
2. Saluja MR, *Indian Official Statistical System*, Publication of Indian Econometric Society.
3. *Central Statistical Organisation, Guide to Official Statistics*, 1979 Ed, Department of Statistics, Ministry of Planning, India

For the candidates admitted from 2016-2017 onwards)

ODD SEMESTER

ALLIED PAPER -I

P.Code:M16USTP04

SPSS (Practical)

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:

1. A Hand book of statistical analysis using SPSS –Sabine landau and Brian S.Everitt SPSS for social statistics and Research methods – Willam E.Wagner

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS **P. Code: M16UST08**
SEMESTER - VI
Core Course -VIII **STATISTICAL QUALITY CONTROL**

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 (\bar{X} and R - Charts).

UNIT - III

Control charts for Attributes (p, np, c for fixed and varying sample sizes) - Criteria for no process quality control.

UNIT - IV

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

UNIT - V

Sequential sampling plan procedure - estimation of parameters - OC, AOQ, ASN curves, comparison with single and double sampling plans.

REFERENCE BOOKS

1. M.Mahajan (2001), **Statistical quality control**, Dhanpat Rai & co (p) Ltd., Delhi.
2. S.C.Gupta, V.K.Kapoor, (2007), *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.
3. A.J.Duncan, (1974), *Quality control and industrial statistics*, Irwin inc. Homewook
4. E.L.Grant and R.S.Leavenworth (1991), *Statistical Quality Control*, Mc-Graw-Hill, New york.

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

Core Course -IX

P. Code: M16UST09

**SEMESTER - VI
APPLIED STATISTICS**

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 - First order & second order polynomials and logistic curves.

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 - Auto correlation and correlogram analysis - Random components - Variate difference method.

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 and Edge worth Index Numbers - Dorbish and 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 - Wholesale price Index Numbers (Concept only).

UNIT - V

Cost of living Index Numbers - Methods of construction - Aggregate method - Family budget method - splicing and deflating - Base shifting - Uses of cost of living Index Numbers.

REFERENCE BOOKS

1. A.M.Goon M.K.Gupta and B.Das Gupta (1994), *Fundamentals of Statistics V-II*, The world press Ltd., Culcutta.
2. Croxton : *Applied General Statistics*.
3. S.C.Gupta, V.K.Kapoor, (2007), *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

Core Elective - III

SEMESTER - VI

P. Code: M16USTE07

NUMERICAL ANALYSIS

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 - nth 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 - Trapezoidal rule - Simpson 1/3 and 3/8 rules- Weddle's rule - Simple applications.

REFERENCE BOOKS

1. G.Shanker Rao, *Numerical Analysis*, New Age International Publications.
2. S.S.Sastry,(2010),*Introductory Methods of Numerical Analysis*, Prentice Hall.
3. K.E. aitkinson, *An introduction to Numerical Analysis*, John Wiley and sons.
4. V.Rajaraman, *Computer Orinted Numerical Methods*, Prentice Hall.
5. P.Scheild, (1968), *Numerical Analysis*, Schaum Series.

(For the candidates admitted from 2016 - 2017 onwards)

Core Practical -IV

B.Sc. STATISTICS
SEMESTER - VI
MAJOR PRACTICAL - V

P. Code: M16USTP04

Unit - I

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

Unit - II

Acceptance sampling 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

Estimation of seasonal indices by sample average method- Ratio to trend , Ratio to Moving Average and link relative methods.

Unit - V

Weighted Index Numbers – Laspeyer’s – Paasche’s – Fisher’s - Marshall and Edge worth - Dorbish and Bowley’s methods - Optimum tests of Index Numbers - Time reversal test - Factor Reversal Test - Cost of living index Number - Family budget method - Aggregate expenditure method.

NOTE

Total : 100 marks

* University Examination : 60 ”

(Written practical)

Continuous Internal Assessment : 40 ”

(Including Practical Record)

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

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

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

SBEC- V (2 Hr/Week)

SEMESTER – VI

P. Code: M16USTS05

STATISTICAL FORECASTING

UNIT - I

Concept of partial correlation – simple application.

UNIT - II

Concepts of multiple correlations – simple illustration.

UNIT - III

Regression coefficients and its properties.

UNIT - IV

Concepts of multiple regressions – simple illustration.

UNIT - V

Fitting of multiple regression lines and estimations (three variables only)

REFERENCE BOOKS

1. Gupta, S.C, and Kapoor, V.K. (2004), *Fundamental of Mathematical Statistics 11th -edition*), Sultan Chand & Sons, New Delhi.
2. Hogg, R.V. and Craig, A.T. (1978), *Mathematical Statistics, Fourth edition*, Colliar Mac.Millan Publishers.

(For the candidates admitted from 2016 - 2017 onwards)

B.Sc. STATISTICS

SBEC- V (2 Hr/Week)

SEMESTER – VI

P. Code: M16USTS06

REGRESSION ANALYSIS

UNIT - I

Concept of correlation and its types- methods of correlation – Rank correlation – equal and unequal ranks.

UNIT - II

Concepts of regression - Linear, Non linear regression – Regression line – Regression coefficient – properties of regression coefficients.

UNIT - III

Curve fitting – methods – Linear equations – methods of least square.

UNIT - IV

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

UNIT - V

Growth curve fitting – exponential, Gompertz and logistic curves.

REFERENCE BOOKS

1. Fundamentals of Mathematical Statistics (2000), Gupta, S.C, and Kapoor, V.K..
2. Mathematical statistics – J.N. Kapoor and H.C Saxena (1989)
3. Mathematical Statistics- Hogg, R.V. and Craig, A.T. (1989).

Note: Question paper may be set irrespective of the unit.

(For the candidates admitted from 2016 - 2017 onwards)
SUBJECT CODES

I .CORE COURSES (Theory 9 + Practical 4 = 13)

i. CORE THEORY PAPERS: 9

S.NO.	TITLE	SUBJECT CODE	SEMESTER
1.	Descriptive Statistics	M16UST01	I
2.	Probability Theory	M16UST02	II
3.	Sampling Techniques	M16UST03	III
4.	Distribution Theory	M16UST04	III
5.	Theory of Estimation	M16UST05	IV
6.	Testing of Hypothesis	M16UST06	V
7.	Design of Experiments	M16UST07	V
8.	Statistical Quality Control	M16UST08	VI
9.	Applied Statistics	M16UST09	VI
10.	Project	M16USTPR1	VI

ii. CORE PRACTICAL PAPERS :4

S.NO.	TITLE	SUBJECT CODE	SEMESTER
1.	Major Practical-I (Based on core theory papers -1&2)	M16USTP01	II
2.	Major Practical-II (Based on core theory papers -3,4)	M16USTP02	III
3.	Major Practical-III (Based on core theory papers -5)	M16USTP03	IV
4.	Major Practical-IV	M16USTP04	V
5.	Major Practical V (Based on core Theory - 8)	M16USTP05	VI

II. CORE ELECTIVES PAPERS: 3

S.NO.	TITLE	SUBJECT CODE	SEMESTER
1.	Stochastic Processes	M16USTE01	V
2.	Actuarial Statistics	M16USTE04	V
3.	Numerical Analysis	M16USTE01	VI

III. ALLIED COURSES (Theory 4 + Practical 2 = 6)**i. ALLIED THEORY PAPERS: 4**

S.NO.	TITLE	SUBJECT CODE	SEMESTER
1.	Mathematics-I	M16UMAA01	I
2.	Mathematics-II	M16UMAA02	II
3.	Operation Research –I	M16UMAA04	III
4.	Operation Research –II	M16UMAA05	IV

ii. ALLIED PRACTICAL: 1+1

	TITLE	SUBJECT CODE	SEMESTER
1.	Allied I: Mathematics Practical	M16UMAAP01	II

IV. SKILL BASED ELECTIVE COURSES: 6

S.NO.	TITLE	SUBJECT CODE	SEMESTER
1.	Competitive Exam-I	M16USTS01	III
2.	Competitive Exam-II	M16USTS02	IV
3.	Nan-Parametric Tests	M16USTS03	V
4.	Indian official Statistics	M16USTS04	V
5.	Statistical Forecasting	M16USTS05	VI
6.	Regression Analysis	M16USTS06	VI

V. NON-MAJOR ELECTIVE COUSES: 2

S.NO.	TITLE	SUBJECT CODE	SEMESTER
1.	Skills for Employment I	M16UENN01	III
2.	Skills for Employment II	M16UENN03	IV
VI. VALUE EDUCATION: 1		M16UVE01	I
VII. ENVIRONMENTAL STUDIES: 1		M16UES01	II
VIII. EXTENSION ACTIVITIES: 1		M16UEX01	VI