KANNUR UNIVERSITY

(Abstract)

B.Sc. Statistics Programme- Scheme, Syllabus and Pattern of Question Papers of Core, Complementary Elective and Generic Elective Course under Choice Based Credit and Semester System (Outcome Based Education System-OBE) in Affiliated colleges with effect from 2019 Admission-Implemented-Orders issued.

Academic Branch

No.Acad.C2/12349/2019 Civil Station P.O Dated 20/06/2019

Read:- 1. U.O.No.Acad.C2/429/2017 dated10-10-2017

2. The Minutes of the Meeting of the Curriculum Restructuring Committee held on 28-12-2018.
3. U.O No.Acad.C2/429/2017 Vol.II dated .03-06-2019
4. The Minutes of the meeting of the Board of Studies in Statistics(UG) held on 06-06-2019
5. Submission of the Syllabus by the Chairperson, Board of Studies in Statistics (UG) dated 13/06/2019

ORDER

1. A Curriculum Restructuring Committee was constituted in the University vide the paper read (1) above to co-ordinate the activities of the Syllabus Revision of UG programmes in Affiliated colleges of the University.

2. The meeting of the Members of the Curriculum Restructuring Committee and the Chairpersons of different Boards of Studies held, vide the paper read (2) above, proposed the different phases of Syllabus Revision processes such as conducting the meetings, of various Boards of Studies, Workshops and discussions.

3. The Revised Regulation for UG programmes in Affiliated colleges under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) was implemented with effect from 2019 Admission as per paper read (3) above.

4. Accordingly, as per paper read (4) above, the Board of Studies in Statistics (UG) finalized the Scheme, Syllabus & Pattern of Question Paper of Core, Complementary Elective & Generic Elective Course of B.Sc.Statistics Programme to be implemented with effect from 2019 Admission.

--2

5. Subsequently, as per paper read (5) above, the Chairperson, Board of Studies in Statistics (UG) submitted the finalized copy of the Scheme, Syllabus & Pattern of Question Papers of B.Sc.Statistics Programme for implementation with effect from 2019 Admission.

6. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with accorded sanction to implement the Scheme, Syllabus & Pattern of Question Paper(Core/Complementary Elective/Generic Elective Course) of B.Sc. Statistics programme under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) in Affiliated colleges with effect from 2019 Admission, subject to reporting to the Academic Council.

7. The Scheme, Syllabus & Pattern of Question Paper of B.Sc. Statistics Programme are uploaded in the University website (kannuruniversity.ac.in)

Orders are issued accordingly.

Sd/-
DEPUTY REGISTRAR(ACADEMIC)
For REGISTRAR

To

The Principals of Colleges offering B.Sc. Statistics programme

Copy to:-

1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in Statistics (UG)
3. PS to VC/PA to PVC/PA to Registrar
4. DR/AR-I, Academic
5. The Computer Programmer(for uploading in the website)
6. SF/DF/FC

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

Forwarded/By Order

SECTION OFFICER

KANNUR UNIVERSITY

BOARD OF STUDIES, STATISTICS (UG)

SYLLABUS FOR
BSc STATISTICS CORE,
COMPLEMENTARY ELECTIVE COURSE
FOR BSc MATHEMATICS / COMPUTER SCIENCE /
GEOGRAPHY / PSYCHOLOGY PROGRAMMES
AND GENERIC ELECTIVE COURSES

CHOICE BASED CREDIT AND SEMESTER SYSTEM
(2019 ADMISSION ONWARDS)

KANNUR UNIVERSITY
VISION AND MISSION STATEMENTS

Vision: To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavors.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

KANNUR UNIVERSITY

PROGRAMME OUTCOMES (PO)

PO 1.Critical Thinking:

1.1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.

1.2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.

1.3 Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO 2.Effective Citizenship:

2.1. Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.

2.2. Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalization and the ability to understand and resist various kinds of discriminations.

2.3. Internalise certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO 3.Effective Communication:

3.1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language

3.2. Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.

3.3. Generate hypotheses and articulate assent or dissent by employing both reasons and creative thinking.

PO 4.Interdisciplinarity:

4.1. Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.

4.2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.

4.3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

PREFACE

This syllabus is based on the Outcome Based Education (OBE) Curriculum proposed by the Kerala State Higher Education Council. Kannur University is implementing this revised syllabus from the academic year 2019 -2020.

KSHEC and Kannur University jointly conducted a three-day workshop (29-01-2019, 30-01-2019 & 31-01-2019) on OBE with the intention of setting up a suitable syllabus for this goal. The Board of Studies Statistics (UG) Kannur University further conducted a two-day workshop (9-05-2019 & 10-05-2019) for faculty members from various colleges of Kannur University for the proper restructuring of the curriculum. This proposed syllabus (Choice Based Credit and Semester System in OBE-system) is finalized after consulting with eminent academicians and researchers in the field of statistics. The new syllabus is sure to play a great role in equipping the students to meet the challenges of the present time through the development of their knowledge in statistics.

Sd/-
Anitha B
Chairperson
Board of Studies Statistics (UG)

Kannur University

Programme Specific Outcome of BSc Statistics

PSO 1: To cultivate statistical thinking among students by acquainting them with various statistical methods and its applications.

PSO 2: Be able to construct statistical models of real world problems and obtain their solutions.

PSO 3: To acquire a good knowledge in decision making and inferences.

PSO 4: To familiarize with statistical software packages and can serve as a data analyst in the public or private sector.

INDEX

PART B:

STATISTICS COMPLEMENTARY ELECTIVE COURSES

[FOR B.Sc. MATHEMATICS / COMPUTER SCIENCE PROGRAMMES]

WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
						CE	ESE	TOTAL
1C01 STA	BASIC STATISTICS	I	4	3	3	10	40	50
2C02 STA	PROBABILITY THEORY AND RANDOM VARIABLES	II	4	3	3	10	40	50
3C03 STA	PROBABILITY DISTRIBUTIONS	III	5	3	3	10	40	50
4C04 STA	STATISTICAL INFERENCE	IV	5	3	3	10	40	50

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT	WEIGHTAGE	REMARKS
COMPONENT 1 TEST PAPER	**3**	For each theory course there shall be a minimum of 3 written tests and the average mark of the best two tests is to be considered for internal mark. Each test paper may have duration of minimum one hour.
COMPONENT 2 ASSIGNMENT/ SEMINAR/VIVA	**1**	For each theory course each student is required to submit two assignments or to present a seminar or to attend a viva-voce. Assignments /seminar / viva-voce shall be evaluated on the basis of student performance.

COMPLEMENTARY ELECTIVE COURSE I: BASIC STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1C01 STA	4	3	3

COURSE OUTCOME

Student should be able to

CO1: understand the different types of data.

CO2: compute various measures of central tendency, measures of variation.

CO3: analyse the relationship between two variables.

CO4: acquire knowledge in time series data and compute various index numbers.

Unit I : Statistical Methods - Scales of measurement - Nominal, Ordinal, Ratio and Interval, Collection of data, Primary and Secondary data, Census method, Sample survey method, Comparison of census method and sample survey method, Principal steps in a sample survey, Types of sampling - probability, restricted and non-restricted sampling, judgement and mixed sampling, SRSWOR, SRSWR, stratified and systematic random sampling(concepts only).

(12 Hrs.)

Unit II : Measures of Central Tendency Definition and properties of various measures of central tendency - A.M,weighted A.M, Median, Mode, G.M., H.M. and weighted averages, Partition values - Quartiles, Deciles, Percentiles, Dispersion - Definition and properties of various measures of dispersion - Range, Q.D, M.D, S.D, and relative measures of dispersion, Moments - raw moments, central moments and relation between them, Skewness and Kurtosis - Definition and various measures of skewness and kurtosis.

(30 Hrs)

Unit III: Correlation and Regression Analysis - Method of least squares - Fitting of linear, quadratic and exponential curves, Regression analysis - linear regression, fitting of regression lines, regression coefficients and their properties, Correlation analysis - Definition and properties of correlation coefficient, Rank correlation coefficient-formula and problems only, Definitions of partial and multiple correlation coefficients(trivariate case only).

(18 Hrs)

Unit IV: Time Series and Index Numbers- Time series - Meaning, need, components and models of time series, estimation of linear trend by moving average

method and least square method, Index numbers - Meaning and uses of index numbers, weighted index numbers - Laspeyer's, Paasche's and Fisher's index numbers, time reversal and factor reversal tests.

(12 Hrs)

Books for Study:

1. Gupta, S. C. & Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). *Statistical Methods*, Sultan Chand & Sons, New-Delhi.

Books for Reference:

1. Mukhopadhyay, P. (1996). *Mathematical Statistics*, New Central Book Agency (P) Ltd., Kolkata.
2. Agarwal, B. L. (2006). *Basic Statistics*, 4th Edition, New Age International (P) Ltd., New Delhi.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	10	20	15	15	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE II: PROBABILITY THEORY AND RANDOM VARIABLES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2C02STA	4	3	3

COURSE OUTCOME

Student should be able to

CO 1: evaluate the probability of events.

CO 2: understand the concept of random variables with examples in real life

CO3: calculate the probability distribution of discrete and continuous random variables.

CO 4: understand the change of variable technique.

Unit I: Probability Theory-I

Random experiments, sample space, events, classical definition and frequency approach to probability, laws of events, sigma field, axiomatic definition of probability, probability space, addition theorem (2 and 3 events), Boole's inequalities.

(25 Hrs)

Unit II: Probability Theory-II

Conditional probability, multiplication theorem, independence of events, pair wise and mutual independence, Baye's theorem and its applications.

(18 Hrs)

Unit III: Random Variables - Discrete and continuous random variables, probability mass function and probability density function, distribution function - definition and properties, transformation of random variables-discrete and continuous.

(17 Hrs)

Unit IV: Bivariate Random Variables - Definitions, joint probability distributions, marginal and conditional distributions, independence of random variables, transformations of bivariate random variables.

(12 Hrs)

Books for Study:

1. Gupta, S. C. &Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Rao, C. R. (1973). Linear Statistical Inference and its Applications, 2/e, Wiley, New York.

2. Dudewicz, E. J. & Mishra S. N. (1988). Modern Mathematical Statistics, John Wiley & Sons, New York.
3. Pitman, J. (1993). Probability, Narosa Publishing House, New Delhi.
4. Rohatgi, V. K. (1993). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern, New Delhi. Hsu, H. P. (1997).
5. Hsu,H.P.(1997) Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes, The McGraw-Hill Companies, Inc., New York.
6. Lipschutz, S.& Schiller, J. J. (1998). Schaum's Outline of Theory and Problems of Introduction to Probability and Statistics, The McGraw-Hill Companies, Inc., New York.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	20	15	15	10	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

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Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE III: PROBABILITY DISTRIBUTIONS

SEMESTER	COURSE CODE	HOURS PER WEEK	SEMESTER	COURSE CODE
III	3C03 STA	5	3	3

COURSE OUTCOME

Student should be able to
CO1: compute mathematical expectation of a random variable.
CO2: familiarize with different discrete probability distribution associated with real life situations.
CO3: understand the characteristics of different continuous distributions.
CO4: identify the appropriate probability model that can be used.

Unit I: Mathematical Expectation: Definition and properties of mathematical expectation, Addition and multiplication theorem on expectation, Expectation of functions of random variables, Moments - Definition of raw and central moments, relation between raw and central moments, Expectation of bivariate random variables, conditional mean and variance, Coefficient of correlation between random variables. Moment generating function - Definition and properties, Characteristic function - Definition and properties.

(22 Hrs)

Unit II: Discrete Distributions - Definition, moments, m.g.f., characteristic function, properties and different characteristics of discrete uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution and Geometric distribution.

(25 Hrs)

Unit III: Continuous Distributions Definition, moments, m.g.f., characteristic function, properties and different characteristics of Uniform distribution, Normal distribution, Standard normal distribution, Exponential distribution, Gamma distribution with one and two parameters, Beta distributions of I and II kind.

(25 Hrs)

Unit IV: Sampling distributions - Definition, standard error, sampling distribution of sample mean and sample variance, Chi-square, Student's t and F distributions, Interrelations between chi-square, t and F distributions.

(18Hrs)

Books for Study:

1. Gupta, S. C. &Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Goon, A. M., Gupta, M. K. & Dasgupta, B. (2003). *An Outline of Statistical Theory,* Volume I, 4thEdn, The World Press Pvt. Ltd., Kolkata.

Books for Reference:

1. John E. Freund (1980). *Mathematical Statistics*, Prentice Hall of India, New Delhi.
2. Rohatgi, V. K. (1993). *An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern, New Delhi.
3. Mood, A. M., Graybill, F. A. &Boes, D. C. (2007). *Introduction to the Theory of Statistics*, 3rdEdn (Reprint). Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	14	17	17	12	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

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Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE IV: STATISTICAL INFERENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C04 STA	5	3	3

COURSE OUTCOME

Student should be able to

CO 1: understand the uses of Chebychev's Inequality and Central Limit Theorem.

CO 2: apply various method of estimation

CO 3: understand the concept of testing statistical hypotheses and its importance in real life situation

CO 4: apply ANOVA

Unit I: Chebychev's Inequality and Law of Large Numbers Chebychev's Inequality and its applications, convergence in probability, Weak law of large numbers, Bernoulli's law of large numbers, Convergence in distribution and central limit theorem for IID random variables (Statement only).

(15 Hrs)

Unit II: Theory of Estimation Point estimation, Desirable properties of a good estimator, Cramer-Rao inequality (statement only), Methods of estimation - method of MLE and method of moments. Interval estimation - Confidence interval for mean, proportion, variance, difference of means, difference of proportions.

(25 Hrs)

Unit III : Testing of Hypotheses - Statistical hypotheses, Simple and composite hypotheses, Null and alternative hypotheses, Types of errors, Critical region, Size and power of test – Definition and problems, most powerful test, Neyman - Pearson lemma (without proof).

(20 Hrs)

Unit IV: Large and small sample tests - Test for mean, proportion, equality of means, equality of proportions, paired t-test, test for variance and equality of variance, Chi-square test for goodness of fit, test for independence of attributes, One-way ANOVA (assumptions and problem only).

(30 Hrs)

NOTE: Numerical computations involved in Assignments submitted may preferably be done using any computer packages.

Books for Study:

1. Gupta, S. C. & Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. &Kapoor, V. K. (1994). *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. John E. Freund (1980). *Mathematical Statistics*, Prentice Hall of India, New Delhi.
2. Rohatgi, V. K. (1993). *An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern, New Delhi.
3. Medhi, J. (2005). *Statistical Methods-An Introductory Text*, New Age International (P) Ltd., New Delhi.
4. Spiegel, M. R., Schiller, J. J. &Srinivasan, R. A. (2013). *Schaum's Outline of Probability and Statistics*, 4thEdn. The McGraw-Hill Companies, Inc., New York.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	10	17	13	20	60

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- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
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KANNUR UNIVERSITY
(Abstract)

B.A. Economics/ Development Economics Programme- Scheme, Syllabus and Pattern of Question Papers of Core, Complementary Elective and Generic Elective Course under Choice Based Credit and Semester System (Outcome Based Education System-OBE) in Affiliated colleges with effect from 2019 Admission-Implemented-Orders issued.

ACADEMIC BRANCH

No.Acad.C1/12530/2019 Dated, Civil Station P.O., 20 .06. 2019

Read:- 1. U.O.No.Acad.C2/429/2017 dated,10-10-2017

2. The Minutes of the Meeting of the Curriculum Restructuring Committee held on 28-12-2018.

3. U.O. No.Acad.C2/429/2017 Vol.II dated,03-06-2019.

4. The Minutes of the Meeting of the Board of Studies in Economics (UG) held on 07.06.2019

5. Letter and Syllabus of B.A. Economics/ Development Economics Programme , Submitted by the Chairperson, Board of Studies in, Economics (UG) dated , 15.06.2019

ORDER

1. A Curriculum Restructuring Committee was constituted in the University vide the paper read (1) above to co-ordinate the activities of the Syllabus Revision of UG programmes in Affiliated colleges of the University.

2. The meeting of the Members of the Curriculum Restructuring Committee and the Chairpersons of different Boards of Studies held, vide the paper read (2) above, proposed the different phases of Syllabus Revision processes such as conducting the meeting of various Boards of Studies ,Workshops, discussions etc.

3. The Revised Regulation for UG programmes in Affiliated colleges under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) was implemented with effect from 2019 Admission as per paper read (3) above.

4. Subsequently, as per paper read (4) above, the Board of Studies in Economics (UG) finalized the Scheme, Syllabus & Pattern of Question Paper for Core, Complementary Elective & Generic Elective Course of B.A.Economics/ Development Economics Programmes to be implemented with effect from 2019 Admission.

5. As per paper read (5) above, the Chairperson, Board of Studies in Economics (UG) submitted the finalized copy of the Scheme, Syllabus & Pattern of Question Papers of B.A. Economics/ Development Economics Programmes for implementation with effect from 2019 Admission.

6. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with accorded sanction to implement the Scheme, Syllabus & Pattern of Question Paper (Core/Complementary Elective/Generic Elective Course) of B.A Economics/ Development Economics programmes under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) in the Affiliated colleges under the University with effect from 2019 Admission, subject to reporting to the Academic Council.

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Sd/-

DEPUTY REGISTRAR(ACADEMIC)
For REGISTRAR

To
The Principals of Colleges offering B.AEconomics/ Development Economics Programme

Copy to:-
1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in Economics (UG)
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KANNUR UNIVERSITY * CIVIL STATION P.O. KANNUR Pin-670 002 * THAVAKKARA *

Forwarded/By Order

SECTION OFFICER

KANNUR UNIVERSITY

BOARD OF STUDIES, ECONOMICS (UG)

SYLLABUS FOR B A PROGRAMME IN
ECONOMICS/DEVELOPMENT ECONOMICS CORE,
COMPLEMENTARY ELECTIVE COURSE
AND GENERIC ELECTIVE COURSES

CHOICE BASED CREDIT AND SEMESTER SYSTEM

(2019 ADMISSION ONWARDS)

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- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
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KANNUR UNIVERSITY
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PO1. Critical Thinking

1.1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.
1.2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.
1.3 Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO2. Effective Citizenship

2.1. Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.
2.2. Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalisation and the ability to understand and resist various kinds of discriminations.
2.3. Internalise certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO3. Effective Communication

3.1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language
3.2. Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.
3.3. Generate hypotheses and articulate assent or dissent by employing both reason and creative thinking.

PO4. Inter disciplinarity

4.1. Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.
4.2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.
4.3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

PREFACE

Economic science has become one of the most dynamic and complex disciplines across natural, physical and social sciences. Its scientific as well as dynamic character has strengthened not only the scope of economics but positively contributed to other streams of knowledge as well. The new BA syllabi of Kannur University have greater scope for using mathematical and statistical techniques, apart from theory and policy. Further it has become more interdisciplinary or/ and multidisciplinary in terms of methods of enquiry and modes of analysis. In the revised syllabi we have incorporated new frontiers of economics such as gender economics, economic geography, economic history, heterodox economics, econometrics and mathematical economics. These interdisciplinary /multidisciplinary areas will strengthen the integrated knowledge profile of the students. Restructuring was done under the initiative of Kannur University and the active involvement of the Members of the Board of Studies in Economics (UG) through a series of deliberations and discussions. In order to make it more participatory and democratic, we have organized a two day workshop to finalize the restructured curriculum and the outcome based syllabi for the BA Economics Programme. Undergraduate economics teachers of all colleges affiliated to Kannur University have actively participated in the workshop and made significant contributions towards the Outcome Based Under Graduate Education. Apart from teachers of affiliated colleges, faculty members of national repute have been invited as resource persons to streamline the syllabi in terms of method, content, and integrity of its epistemology. The basic objective of the revised syllabi is to equip our undergraduates to face the academic and real life challenges in the fast changing world tuned by knowledge revolution, science, technology, research and development. We believe that the revised curriculum and syllabi may open new horizons of knowledge and meet the vision and mission of higher education in the country. It is our privilege to introduce the revised curriculum and syllabi before the fresh undergraduates who are getting enrolled in June 2019 onwards and other stake holders of Economics Undergraduate Education.

Dr. A. Ashokan
Chairperson
Board of Studies, Economics (UG)
Kannur University

Kannur University
Programme Specific Outcome of B.A Economics /
Development Economics Programme

The revised curriculum and syllabi of BA Economics Programme of Kannur University provide a structure of core courses, complementary elective courses and generic elective courses. Diversified course structure will contribute towards all round development of the student. The undergraduate programme in economics borrows ideas and techniques from a variety of other disciplines including history, geography, mathematics, statistics, management and environmental science. An undergraduate programme with sound footing in economic theory and empirics would equip the students to a range of career options in the field of economics, finance, commerce, entrepreneurship and management. The specific outcomes of the programme are summarized below:

1. The programme with structured curricula will support the academic development of the undergraduates.
2. The programme will provide the students with the opportunity to pursue courses that emphasize quantitative, qualitative and theoretical aspects of economics.
3. The programme will provide a well resourced teaching learning environment for the students of economics, which will definitely lead to the ultimate educational goal of "learning to be".
4. The programme will promote academic writing, critical thinking and research aptitude among the students.
5. Needless to point out, the students will gain a source of livelihood by expanding their skill set and widening their knowledge horizon.

INDEX

CORE COURSE VII:
BASIC TOOLS FOR ECONOMIC ANALYSIS I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 B0 7ECO/ DEV ECO	6	4	3

COURSE OUTCOME

1. To enable the students to understand economic concepts with the aid of mathematical and Statistical tools.
2. To equip the students to quantify economic variables and to enable them to apply statistical techniques in Economics.
3. To analyze and interpret empirical data with the help of statistical tools

Module I: Elementary Mathematics

Number system, laws of indices, logarithm, arithmetic and geometric progressions, compound growth rate. Equations: linear and quadratic equations and their solution. Applications in economics – market equilibrium (28 hours).

Module 2: Elementary Set theory and economic functions: Set theory: Concept, types, operations, Cartesian product-Functional relations and functions-graphs- application in economics. Cost, revenue, total product, average cost, demand and supply curves, PPC Curve –indifference curve –isoquant. (24 hours).

Module 3: Introduction to Statistics: Meaning, definition of statistics- role of statistics in economics-Collection of data: types of Data – Census and Sampling-Types of sampling. Classification of data-tabulation. Presentation of data: Histograms, polygon, frequency curves, bar and pie diagrams. Analysis and interpretation of data: Measures of central value: Mean, Median, Mode, Geometric Mean and Harmonic Mean-partition values-Measures of Dispersion: Range, Quartile deviation, Mean deviation and Standard Deviation-Lorenz Curve and Gini Coefficient and its economic application- Skewness and Kurtosis (40 hours).

Module 4: Basic Probability: Meaning and approaches, definition of probability, addition theorem, conditional probability, independence of events and multiplication theorem (Simple examples) (16 hours)

Books for Study

1. Allen, R.G.D. (1980) Mathematical Analysis for Economists, Palgrave MacMillan.
2. Monga G.S. (2007), Mathematics and Statistics for Economists, Vikas Publishing House, New Delhi.
3. Mehta and Madnani(2000), Mathematics for Economists, Sultan Chand & Sons, New Delhi
4. Gupta S.P(1996): Statistical Methods, Sultan Chand& Sons, New Delhi

5. S. C. Gupta (1999) Fundamentals of Statistics, Himalaya Publishing House, Delhi.

Books for Reference

1. Veerachamy R. (2005), Quantitative Methods for Economics, New Age International (P) Limited Publishers, New Delhi.
2. Dowling, E.T (2006): Introduction to Mathematical Economics, Schaum's Online Series, McGraw Hill, New Delhi.
3. Chiang, A.C (2005): Fundamental Methods of Mathematical Economics, McGraw Hill.
4. Taro Yamane (1996): Mathematics for Economists: An Elementary Survey, Prentice Hall.
5. Agarwal, D.R (1995): Mathematics for Economics, Vrinda Publications, Delhi.
6. Yule and Kendall (1984): An Introduction to the Theory of Statistics, Charles Gtiffin & Co, London.
7. Spiegel, M.R (2000): Theory and Problem of Statistics, McGraw Hill, London.

CORE COURSE XII
BASIC TOOLS FOR ECONOMIC ANALYSIS II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B 12 ECO/ DEV ECO	6	4	3

COURSE OUTCOME

1. To enable the students to understand and interpret economic concepts with the aid of mathematical and statistical tools.
2. To enable students to apply statistical techniques in Economics.
3. To analyze and interpret empirical data with the help of statistical tools

Module I: Matrices

Concepts, Types, Operation, addition, subtraction, multiplication, determinants, inverse (for 2x2 matrices only). Solution of simultaneous equations in 3 unknowns using Cramer's rule, solution of simultaneous equations in 2 unknowns using matrix inversion method, solving market equilibrium.

(18 hours)

Module II: Differential calculus

Limit and continuity (definition only), differentiation of single variable function: rules, higher order derivatives, sign and magnitude of derivatives and its interpretation – concept of slope, maxima and minima of unbounded functions. Applications of simple derivatives in economics: Elasticity of demand, Marginal Cost and Marginal Revenue. Differentiation of two variable functions: partial derivatives of first and second order- Application of Partial derivatives in economics: Demand analysis and Production analysis-Cobb-Douglas production function.

(32 hours)

Module III: Bivariate Data Analysis

Simple correlation – meaning and types and measurement – scatter diagram, Pearson's coefficient and rank correlation coefficient, interpretation. Simple linear regression – meaning, OLS method of estimation. Relationship between correlation and regression coefficients. Examples from economics: Estimation of consumption function, saving function and production function and interpretation of results. (28 hours)

Module IV: Time series analysis and Index numbers

Components of time series, measurement of trend – semi average, moving average, method of least squares. Types of index numbers – weighted and unweighted, price and quantity indices, Laspyer's, Paasche's and Fisher's index numbers. Time reversal and factor reversal tests,

construction of consumer price and wholesale price indices, base shifting and splicing, deflating, uses of index numbers. (30hours)

Books for Study

1. Allen, R.G.D. (1980) Mathematical Analysis for Economists, Palgrave MacMillan.
2. Monga G.S. (2007) Mathematics and Statistics for Economists, Vikas Publishing House, New Delhi.
3. Mehta and Madnani (2000) Mathematics for Economists, Sultan Chand & Sons.
4. Gupta S.P (1996): Statistical Methods, Sultan Chand& Sons, New Delhi
5. S. C. Gupta (1999) Fundamentals of Statistics, Himalaya Publishing House, Delhi.

Books for Reference

1. Chiang, A.C (2009): Fundamental Methods of Mathematical Economics, McGraw Hill.
2. Yamane, T. (1968). Mathematics for economists: An Elementary Survey.
3. Aggarwal, D.M: Business Mathematics and Statistics, Ane Books, New Delhi.
4. Yule, G. U., & Kendall, M. G. (1968). An Introduction to the Theory of Statistics, Charles Griffin and Co. *Ltd, London.*
5. Spiegel, M. R. (2016). Schaum's Outlines Probability and Statistics.

KANNUR UNIVERSITY

(Abstract)

B.Sc. Statistics Programme- Scheme, Syllabus and Pattern of Question Papers of Core, Complementary Elective and Generic Elective Course under Choice Based Credit and Semester System (Outcome Based Education System-OBE) in Affiliated colleges with effect from 2019 Admission-Implemented-Orders issued.

Academic Branch

No.Acad.C2/12349/2019 Civil Station P.O Dated 20/06/2019

Read:- 1. U.O.No.Acad.C2/429/2017 dated10-10-2017

2. The Minutes of the Meeting of the Curriculum Restructuring Committee held on 28-12-2018.
3. U.O No.Acad.C2/429/2017 Vol.II dated .03-06-2019
4. The Minutes of the meeting of the Board of Studies in Statistics(UG) held on 06-06-2019
5. Submission of the Syllabus by the Chairperson, Board of Studies in Statistics (UG) dated 13/06/2019

ORDER

1. A Curriculum Restructuring Committee was constituted in the University vide the paper read (1) above to co-ordinate the activities of the Syllabus Revision of UG programmes in Affiliated colleges of the University.

2. The meeting of the Members of the Curriculum Restructuring Committee and the Chairpersons of different Boards of Studies held, vide the paper read (2) above, proposed the different phases of Syllabus Revision processes such as conducting the meetings, of various Boards of Studies, Workshops and discussions.

3. The Revised Regulation for UG programmes in Affiliated colleges under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) was implemented with effect from 2019 Admission as per paper read (3) above.

4. Accordingly, as per paper read (4) above, the Board of Studies in Statistics (UG) finalized the Scheme, Syllabus & Pattern of Question Paper of Core, Complementary Elective & Generic Elective Course of B.Sc.Statistics Programme to be implemented with effect from 2019 Admission.

--2

5. Subsequently, as per paper read (5) above, the Chairperson, Board of Studies in Statistics (UG) submitted the finalized copy of the Scheme, Syllabus & Pattern of Question Papers of B.Sc.Statistics Programme for implementation with effect from 2019 Admission.

6. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with accorded sanction to implement the Scheme, Syllabus & Pattern of Question Paper(Core/Complementary Elective/Generic Elective Course) of B.Sc. Statistics programme under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) in Affiliated colleges with effect from 2019 Admission, subject to reporting to the Academic Council.

7. The Scheme, Syllabus & Pattern of Question Paper of B.Sc. Statistics Programme are uploaded in the University website (kannuruniversity.ac.in)

Orders are issued accordingly.

Sd/-
DEPUTY REGISTRAR(ACADEMIC)
For REGISTRAR

To

The Principals of Colleges offering B.Sc. Statistics programme

Copy to:-
1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in Statistics (UG)
3. PS to VC/PA to PVC/PA to Registrar
4. DR/AR-I, Academic
5. The Computer Programmer(for uploading in the website)
6. SF/DF/FC

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

Forwarded/By Order

SECTION OFFICER

KANNUR UNIVERSITY

BOARD OF STUDIES, STATISTICS (UG)

SYLLABUS FOR
BSc STATISTICS CORE,
COMPLEMENTARY ELECTIVE COURSE
FOR BSc MATHEMATICS / COMPUTER SCIENCE /
GEOGRAPHY / PSYCHOLOGY PROGRAMMES
AND GENERIC ELECTIVE COURSES

CHOICE BASED CREDIT AND SEMESTER SYSTEM
(2019 ADMISSION ONWARDS)

KANNUR UNIVERSITY
VISION AND MISSION STATEMENTS

Vision: To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavors.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

KANNUR UNIVERSITY

PROGRAMME OUTCOMES (PO)

PO 1.Critical Thinking:

1.1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.

1.2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.

1.3 Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO 2.Effective Citizenship:

2.1. Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.

2.2. Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalization and the ability to understand and resist various kinds of discriminations.

2.3. Internalise certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO 3.Effective Communication:

3.1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language

3.2. Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.

3.3. Generate hypotheses and articulate assent or dissent by employing both reasons and creative thinking.

PO 4.Interdisciplinarity:

4.1. Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.

4.2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.

4.3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

PREFACE

This syllabus is based on the Outcome Based Education (OBE) Curriculum proposed by the Kerala State Higher Education Council. Kannur University is implementing this revised syllabus from the academic year 2019 -2020.

KSHEC and Kannur University jointly conducted a three-day workshop (29-01-2019, 30-01-2019 & 31-01-2019) on OBE with the intention of setting up a suitable syllabus for this goal. The Board of Studies Statistics (UG) Kannur University further conducted a two-day workshop (9-05-2019 & 10-05-2019) for faculty members from various colleges of Kannur University for the proper restructuring of the curriculum. This proposed syllabus (Choice Based Credit and Semester System in OBE-system) is finalized after consulting with eminent academicians and researchers in the field of statistics. The new syllabus is sure to play a great role in equipping the students to meet the challenges of the present time through the development of their knowledge in statistics.

Sd/-
Anitha B
Chairperson
Board of Studies Statistics (UG)

Kannur University

Programme Specific Outcome of BSc Statistics

PSO 1: To cultivate statistical thinking among students by acquainting them with various statistical methods and its applications.

PSO 2: Be able to construct statistical models of real world problems and obtain their solutions.

PSO 3: To acquire a good knowledge in decision making and inferences.

PSO 4: To familiarize with statistical software packages and can serve as a data analyst in the public or private sector.

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KANNUR UNIVERSITY

BSc STATISTICS PROGRAMME

WORK AND CREDIT DISTRIBUTION STATEMENT

(BSc: Common English: 22, Additional Common: 16,
Core: 56, First Complementary Elective: 12,
Second Complementary Elective: 12, Generic Elective: 2)

First Complementary Elective : Mathematics

Second Complementary Elective : Computer Science

Semester	Course Title	Credits	Hours per week	Marks		
				CE	ESE	TOTAL
I	Common Course (English)	4	5	10	40	50
	Common Course (English)	3	4	10	40	50
	Common Course (Additional language)	4	4	10	40	50
	Introductory Statistics	3	4	12	48	60
	Complementary Elective1 (Mathematics)	3	4	10	40	50
	Complementary Elective 2 (Computer science)	2	2	8	32	40
	Complementary Elective 2 (Computer science- Practical)	-	2			
TOTAL		**19**	**25**	**60**	**240**	**300**
II	Common Course (English)	4	5	10	40	50
	Common Course (English)	3	4	10	40	50

	Common Course (Additional language)	4	4	10	40	50
	Probability theory and Mathematical Expectation	3	4	12	48	60
	Complementary Elective 1 (Mathematics)	3	4	10	40	50
	Complementary Elective 2 (Computer science)	2	2	8	32	40
	Complementary Elective 2 (Computer science-Practical)	-	2			
TOTAL		**19**	**25**	**60**	**240**	**300**
III	Common Course (English)	4	5	10	40	50
	Common Course (Additional language)	4	5	10	40	50
	Probability Distribution and Limit Theorems	3	5	12	48	60
	Complementary Elective 1 (Mathematics)	3	5	10	40	50
	Complementary Elective 2 (Computer science)	2	3	8	32	40
	Complementary Elective 2 (Computer science-Practical)	-	2			
TOTAL		**16**	**25**	**50**	**200**	**250**
IV	Common Course (English)	4	5	10	40	50
	Common Course (Additional language)	4	5	10	40	50
	Statistical Inference I	3	5	12	48	60
	Complementary Elective 1 (Mathematics)	3	5	10	40	50
	Complementary Elective 2 (Computer science)	2	3	8	32	40

	LAB Complementary Elective 2 (Computer science)	4	2	8	32	40
TOTAL		**20**	**25**	**58**	**232**	**290**
V	Statistical Inference - II	4	4	12	48	60
	Mathematical Methods for Statistics- I	4	4	12	48	60
	Regression Techniques and Time series	4	5	12	48	60
	Statistical Quality Control and Operations Research	4	4	12	48	60
	Practical Using R- I	4	4	12	48	60
	Generic Elective Course	2	2	5	20	25
	Project	0	2	0	0	0
TOTAL		**22**	**25**	**65**	**260**	**325**
VI	Mathematical Methods for Statistics – II	4	4	12	48	60
	Mathematical Methods for Statistics – III	4	5	12	48	60
	Sampling Techniques and Design of Experiments	4	5	12	48	60
	Discipline Specific Elective	4	5	12	48	60
	Practical Using R –II	4	4	12	48	60
	Project	4	2	7	28	35
TOTAL		**24**	**25**	**67**	**268**	**335**

TOTAL CREDIT (Sum of total credits of all semester): 120

TOTAL MARKS (Sum of total marks of all semester): 1800

PART A

STATISTICS CORE COURSES
WORK AND CREDIT DISTRIBUTION
(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HRS
1B01STA	Introductory Statistics	I	4	3	3
2B02STA	Probability Theory and Mathematical Expectation	II	4	3	3
3B03STA	Probability distribution and limit theorems	III	5	3	3
4B04STA	Statistical Inference – I	IV	5	3	3
5B05STA	Statistical Inference – II	V	4	4	3
5B06STA	Mathematical methods for Statistics – I	V	4	4	3
5B07STA	Regression Techniques and Time series	V	5	4	3
5B08STA	Statistical Quality Control and Operations Research	V	4	4	3
5B09STA	Practical Using R- I	V	4	4	3
	Generic Elective course	V	2	2	2
	Project	V	2	0	0
6B10STA	Mathematical methods for Statistics –II	VI	4	4	3
6B11STA	Mathematical methods for	VI	5	4	3

	Statistics – III				
6B12STA	Sampling Techniques and Design of Experiments	VI	5	4	3
Discipline Specific Elective		VI	5	4	3
6B13ASTA	Applied Statistics				
6B13BSTA	Actuarial Statistics				
6B13CSTA	Stochastic Processes				
6B14STA	Practical Using R – II	VI	4	4	3
6B15STA	Project	VI	2	4	

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

CONTINUOUS INTERNAL ASSESSMENT

COMPONENT	WEIGHTAGE	REMARKS
COMPONENT 1 TEST PAPER	**3**	For each theory course there shall be a minimum of 3 written tests and the average mark of the best two tests is to be considered for internal mark. Each test paper may have duration of minimum one hour.
COMPONENT 2 ASSIGNMENT/ SEMINAR /VIVA	**1**	For each theory course each student is required to submit two assignments or to present a seminar or to attend a viva-voce. Assignments /seminar / viva-voce shall be evaluated on the basis of student performance.

CORE COURSE I: INTRODUCTORY STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
1	1B 01STA	4	3	3

COURSE OUTCOME

Student should be able to

CO1: understand the elementary concepts in statistics.
CO2: compute various measures of central tendency, measures of variation.
CO3: analyse the relationship between two variables in real life.
CO4: compute and interpret various index numbers.

Unit I: Introduction, collection and Presentation of Data - Definitions of statistics, importance and scope of statistics in various streams. population, census, parameter, sample, sample survey, statistic, different types of data-quantitative, qualitative, geographical and chronological, nominal, ordinal, ratio, interval scale, time series, cross sectional and longitudinal data methods of collecting data and editing of primary data; designing of a questionnaire and a schedule; sources and editing of secondary data; classification and tabulation of data; basic principles of tabulation, construction of frequency tables, diagrammatic presentation- line diagram, bar diagrams and pie diagram; graphical representation of frequency distribution by histogram, frequency polygon, frequency curve and ogives.

(15 Hrs.)

Unit II: Summary statistics: Measures of central tendency - arithmetic mean, weighted arithmetic mean, median, positional averages – quartiles, deciles and percentiles; mode, geometric mean, harmonic mean, properties and scope of these averages, Measures of dispersion - absolute and relative measures - range, quartile deviation, mean deviation, standard deviation and their relative measures, properties and scope of these measures. Lorenz curve, Gini coefficient.

(20 Hrs.)

Unit III: Moments - Raw and central moments and their inter-relationships. Skewness and kurtosis - definition and measures of skewness and kurtosis, correlation coefficient - Karl Pearson correlation coefficient, Spearman Rank correlation coefficient.

(20 Hrs.)

Unit IV: Index Number: Definition, uses, simple and weighted index number, fixed base index number, Laspeyre's, Paasche's, Marshall– Edgeworth and Fishers' index

numbers, quantity index number, criteria of a good index number, chain base index number, cost of living index numbers and their construction. Inflation and splicing.

(17 Hrs.)

Books for Study

1. B L Agrawal (2013): Basic Statistics – New Age International Publishers.
2. Gupta S. C. and Kapoor, V. K. (2002): *Fundamentals of Mathematical Statistics*, Sultan Chand & Co.
3. Gupta S. C. and Kapoor, V. K.: *Fundamentals of Applied Statistics,* Sultan Chand & Co.

Books for References

1. Mood A. M., Gray bill F. A., Boes D C (2007): Introduction to the theory of statistics - Tata Magrow Hill.
2. Goon A. M., Gupta M. K., Das Gupta. B. (1999): *Fundamentals of Statistics*, Vol. I, World Press, Calcutta.
3. Croxton. F. E and Cowden. D. J (1973): *Applied General Statistics*, Printice Hall of India.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	14	20	20	18	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE II: PROBABILITY THEORY AND MATHEMATICAL EXPECTATION

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
2	2B02STA	4	3	3

COURSE OUTCOME

Student should be able to

CO1: evaluate the probability of events
CO2: understand the concept of random variables with examples in real life.
CO3: compute the expectation of the random variable
CO4: understand various generating functions and their applications.

Unit I : Probability – Random experiment, Sample point, Sample space, Events, Algebra of events, Statistical regularity, Classical definition, Frequency and axiomatic approaches to probability, Probability Space, Addition theorem, Conditional probability, Multiplication theorem, Independence of events, Bayes' theorem and applications.

(22 Hrs.)

Unit II: Random variables – Discrete and continuous random variables, Probability distribution and distribution function – definitions and properties, Bivariate Random Variables, Joint, marginal and conditional distributions, Independence of random variables, transformation of variables. (univariate and bivariate cases).

(20 Hrs.)

Unit III: Mathematical expectation – Mathematical expectation -definition and properties, addition and multiplication theorems on expectation, expectation of functions of random variables, moments, relation between raw and central moments, skewness and kurtosis of random variables. conditional expectation and properties, correlation between random variables.

(20 Hrs.)

Unit IV: Generating functions – Definition, properties and uses of probability generating function, moment generating function, cumulant generating function, characteristic function.

(10 Hrs.)

Books for Study

1. Gupta. S. C & Kapoor. V. K. (2002): *Fundamentals of Mathematical Statistics,* Sultan Chand & Sons (P) Ltd

Books for Reference:

1. Robert V Hogg Allen T Craig Introduction to Mathematical Statistics- Macmillan Publishing Co. Inc. NEW YORK
2. Goon A. M, Gupta M. K. , Das Gupta. B. (1999): *Fundamentals of Statistics*, Vol. I and Vol. II, World Press, Calcutta.
3. Mood A. M, Graybill F. A and Boes D. C. (1974): *Introduction to the Theory of Statistics*, McGraw Hill.
4. V. K Rohatgi, A K Md Ehsanes Saleh (2008): An Introduction to Probability and Statisticsy – John Wiley and Son Inc
5. M. R. Spiegel, L J Stephens(2010): Statistics- Schaum's outline series- Fourth edition Tata McGraw Hill Publishing Company Ltd

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	20	20	20	12	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE III: PROBABILITY DISTRIBUTIONS AND LIMIT THEOREMS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
3	3B03STA	5	3	3

COURSE OUTCOME

Student should be able to

CO1: familiarize with different discrete probability distributions associated with various real life situations.
CO2: understand the characteristics of different continuous distributions
CO3: identify the appropriate probability models.
CO4: understand the uses of Chebychev's inequality and Central Limit Theorem.

Unit I: Discrete Distributions : Definition, moments, generating functions (PGF, MGF, Characterstic function and cumulant generating functions) and various characteristics of Degenerate distribution, Uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution, Geometric distribution, Hyper Geometric distribution, Negative binomial distribution.

(35 Hrs)

Unit II : Continuous Distributions I: Definition, moments, generating functions (MGF, Characterstic function and cumulant generating functions) and various characteristics of Uniform distribution, Normal distribution and Standard normal distribution, area property normal distribution, Log-normal distribution (mean and variance only).

(20 Hrs.)

Unit III : Continuous Distributions II: Definition, moments, generating functions (MGF, Characterstic function and cumulant generating functions) and various characteristics of Exponential distribution, Gamma distribution, Beta distributions of first and second kinds, Cauchy distribution, Bivariate normal distribution.

(20 Hrs.)

Unit IV: Inequalities and Convergence of random variables -Chebychev's inequality, convergence in probability, Definition of weak law of large numbers, Bernoulli's weak law of large numbers, Chebychev's Weak law of large numbers , Convergence in distribution, Central limit theorems- De-Moivere Laplace, Lindberg Levy.

(15 Hrs.)

Books for Study:

1. S.C.Gupta &V. K. Kapoor (2002): *Fundamentals of Mathematical Statistics,* Sultan Chand & Sons

Books for Reference:

1. Hogg, R. V and Craig, A. T (1970). *Introduction to Mathematical Statistics,* Amerind Publishing Co.Pvt Ltd.
2. Mukhopadhaya. P (1996). *Mathematical Statistics,* New Central Book Agency (P) Ltd., Calcutta.
3. A. M. Mood, F. A. Graybill and D. C. Boes: *Introduction to the Theory of Statistic*, Mc Graw Hill.
4. S. M. Ross: Introduction to Probability and Statistics for Engineers and Scientists- Elsevier Science.
5. V. K Rohatgi, A K Md Ehsanes Saleh (2008): An Introduction to Probability and Statisticsy – John Wiley and Son Inc

Marks including choice:

Unit	**Unit I**	**Unit II**	**Unit III**	**Unit IV**	**Total**
Marks	20	16	16	20	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*
- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE IV: STATISTICAL INFERENCE- I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
4	4B04 STA	5	3	3

COURSE OUTCOME

Student should be able to

CO1: derive sampling distribution of sample mean and sample variance

CO2: understand the concept of point estimation

CO3: apply the various methods of estimation

CO4: obtain the confidence interval of population parameters

Unit I: Sampling Distributions: Sampling distribution, standard error; distribution of sample mean and variance; Chi square distribution-mean and variance, MGF, additive property; Student's *t* distribution – mean and variance; *F*-distribution– mean and variance; inter-relationships between Chi square, *t*, and *F* distributions

(25 Hrs.)

Unit II: Point Estimation – Point estimation, Desirable properties of a good estimator-unbiasedness, consistency, sufficiency, efficiency; minimum variance unbiased estimator (MVUE), Cramer Rao inequality and MVB estimators, Fisher's information.

(25 Hrs.)

Unit III: Methods of Estimation: Method of moments, Properties of moment estimators (Statement only), Method of Maximum Likelihood, Properties of MLE (statement only), Method of minimum variance.

(25 Hrs.)

Unit IV: Interval Estimation–Concept of confidence interval, Confidence intervals for mean, proportion, variance of normal population; confidence interval for the difference of means, proportions and variances of two normal populations and ratio of variances confidence intervals for parameters of one parameter exponential distribution and Poisson distribution in the large sample case.

(15 Hrs.)

Books for Study:

1. Gupta, S. C and Kapoor, V. K (2002). Fundamentals of Mathematical Statistics, Amerind Publishing Co. Pvt. Ltd
2. Manoj Kumar Sreevastava, Abdul Hameed Khan Namitha Sreevastava - Statical Inference: Theory of Estimation PHI Learning Pvt. Limited

Books for Reference:

1. A.M.Mood, F.A.Graybill and D.C. Boes: Introduction to the Theory of Statistic, Mc Graw Hill.
2. Mukhopadhaya. P (1996). Mathematical Statistics, New Central Book Agency (P) Ltd., Calcutta.
3. George Casella & Roger L Berger Statistical Inference Duxbury

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	18	18	18	18	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - **Essay** (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE V: STATISTICAL INFERENCE - II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
V	5 B 05 STA	4	4	3

COURSE OUTCOME

Student should be able to

CO 1: understand the concept of statistical hypothesis and its importance in real life.
CO 2: apply parametric and non parametric tests.
CO 3: conduct test for goodness of it.
CO 4: understand methods for checking normality of data.

Unit I : Statistical Hypotheses – Simple and Composite Hypotheses, Null and Alternative hypotheses, Critical Region, Type I and Type II errors, size and power of a test, most powerful and uniformly most powerful tests, p-value, Neymann -Pearson Lemma and its applications in testing of Hypothesis based on Binomial, Poisson, Normal and Exponential distributions; Likelihood ratio test and its properties

(20 Hrs)

Unit II : Small sample and large sample tests – Test for mean, equality of means, paired t test, test for significance of correlation coefficient, testing for significant difference between two correlation coefficients; test for proportion, equality of proportions.

(20 Hrs.)

Unit III: Tests based on Chi-square distribution Chi-square test for goodness of fit, test for homogeneity and independence of attributes, tests for significance of variance, F test for equality of variances.

(20 Hrs.)

Unit IV: Tests for normality and Non- parametric tests - Box plot, Q-Q plot, Shapiro Wilks's Test for normality of data. one sample tests- run test, test for randomness, sign test, signed rank test. Two sample tests-Mann-Whitney 'U' Test, Median test, Kolmogrov-Smirnov test for one sample and two sample cases. The Kruskal-Wallis Test.

(12 Hrs.)

Books for Study:

1. S.C.Gupta &V.K.Kapoor (2002): Fundamentals of Mathematical Statistics, Sulthan Chand & Sons.
2. Manoj Kumar Sreevastava, Namitha Sreevastava - Statical Inference : Testing of Hypotheses PHI Learning Pvt. Limited 2009

Books for Reference:

1. Sudha G purohid - Statistics using R Alpha Science International
2. Gopal.K.Kanji- 100 Statistical Tests (SAGE Publishers)
3. Goon A. M, Gupta M. K and Das Gupta B (1986) - Fundamentals of Statistics Vol I. The World Press Pvt Ltd.
4. Kandethody M.Ramachandran (2009), Mathematical Statistics with Applications, Elsevier
5. Mukhopadhaya. P (1996). Mathematical Statistics, New Central Book Agency (P) Ltd., Calcutta.

Marks including choice:

Unit	**Unit I**	**Unit II**	**Unit III**	**Unit IV**	**Total**
Marks	22	18	16	16	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*
- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE VI: MATHEMATICAL METHODS FOR STATISTICS - I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
V	5 B 06 STA	4	4	3

COURSE OUTCOME

Student should be able to

CO 1: understand the concept of real sequence.

CO2: test the convergence and divergence of infinite series.

CO3: understand the concept of limit and continuity of single variable.

CO4: familiarize with derivative, its existence and application.

Unit I: Sequence - Real sequences, monotonic sequence, limit of a sequence, limit infimum and supremum, convergence and divergence, Cauchy's Principle of convergence, algebra of sequences, Bolzano-Weirstrass theorem,

(24 Hrs.)

Unit II: Infinite Series - Definition, positive term series, comparison test, Cauchy's root test, D'Alembert's ratio test, Raabe's test, Logarithmic test, alternative series, Leibnitz test, absolute convergence and conditional convergence.

(22 Hrs.)

Unit III: Functions of single variable - Limits of a function, continuous function, continuity at a point, continuity in closed interval, types of continuity, continuity on closed intervals, uniform continuity.

(12 Hrs.)

Unit IV: Differential Calculus: Derivatives, Darboux's theorem, Rolle's Theorem, mean value theorem, Taylor's theorem.

(14 Hrs.)

Books for Study:

1. S.C.Malik & Savita Arora: Mathematical Analysis, Wiley Eastern Ltd

Books for Reference:

1. Robert G Bartle: Introduction to Real Analysis,4th Edition Wiley Eastern Ltd
2. Shanti Narayanan: Elements of Real Analysis Sultan Chand & Sons l

3. Shanti Narayanan: A course of Mathematical Analysis, Sultan Chand & Sons 1
4. Goldberg: Introduction to real analysis

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	24	22	13	13	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)\

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE VII: REGRESSION TECHNIQUES AND TIME SERIES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B07STA	5	4	3

COURSE OUTCOME

Student should be able to

CO1: apply Gauss Markov's theorem for obtaining BLUE
CO2: understand the statistical modeling of correlated datasets.
CO3: create modeling datasets arising in different real life situations using regression models.
CO4: acquire knowledge in time series data.

Unit I: Linear Estimation: Linear parametric function, estimability, BLUE, Necessary and sufficient conditions for estimability of a linear parametric function, linear hypothesis, Gauss Markov's theorem and simple problem.

(22 Hrs.)

Unit 2: Linear Regression: Concept of regression, Least Square estimation of linear, quadratic and exponential curves Simple linear regression model, Least square estimation of parameters, Hypothesis testing of slope and intercept, coefficient of determination.

(18 Hrs.)

Unit 3: Multiple Regressions: Model, estimation of model parameters,
test for significance of regression, regression coefficient, coefficient of determination, Polynomial and logistic regression: Models and method of estimation

(25 Hrs.)

Unit 4: Time series analysis - Definition, application in various fields, components of time series, additive and multiplicative models, measurement of trend - semi average, moving average, least square method measurement of seasonal variation - method of simple average, ratio to trend, ratio to moving average and link relative method.

(25 Hrs.)

Books for study

1. D C. Montegomery, E A Peak and G G Vining, Introduction to Linear regression analysis, Wiley 2003
2. SC Gupta and V K Kapoor, Fundamentals of applied statistics,Sulthan Chand and sons

Books for Reference

1. Box G E P and Jenkins G M, Time series analysis, Holden Day

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	16	16	15	25	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course - 48***

CORE COURSE VIII: STATISTICAL QUALITY CONTROL AND OPERATIONS RESEARCH

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 B08STA	4	4	3

COURSE OUTCOME

Student should be able to

CO1: inculcate knowledge in maximizing the profit and minimizing the cost.
CO2: formulate the given problem as a LPP and use simplex method for solving it.
CO3: distinguish between process control and product control.
CO4: construct control chart for variables and attributes.

Unit 1: Linear Programming Problem-Introduction, mathematical formulation of LPP, solution of LPP – graphical method, convex sets, statement of extreme value theorem, simplex method, duality in LPP.

(20 Hrs.)

Unit II: Transportation and Assignment Problems - Transportation problem: mathematical formulation, solution of a transportation problem -North-West Corner rule, Matrix minima, Vogel's Approximation Method, Modi Method. Assignment Problem: Mathematical formulation, Solution of an A.P – Hungarian Method,

(20 Hrs.)

Unit III: Statistical Quality Control-I: Process control, general theory of control charts, control charts for variables – $\bar{x}$ chart, R chart, σ chart; control charts for attributes –p chart, np chart, c chart and modified control chart.

(16 Hrs.)

Unit IV: Statistical Quality Control-II: Product control, acceptance sampling for attributes, Quality of a lot, AQL, LTPD, AOQ, AOQL, producers and consumers risks, ASN, ATI, types of sampling plan- single and double sampling plans, OC-curves for single sampling plan**.**

(16 Hrs)

Books for Study:

1. Kantiswarup, P K Gupta, Manmohan: Operations Research, Sultan Chand and Sons
2. SC Gupta &V.K.Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. Mukhopadhaya. P, Applied Statistics, New Central Book Agency (P)Ltd., Calcutta.
2. Goon A. M, Gupta M. K and Das Gupta B (1986): Fundamentals of Statistics Vol II.
3. Montgomery & Douglus: Statistical Quality Contol, Wiley Student Edition
4. S.Kalavathy: Operations Research Vikas Publishing House Pvt Ltd.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	20	16	20	16	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE IX: PRACTICAL USING R – I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
V	5B09STA	4	4	3

COURSE OUTCOME

Student should be able to
CO 1: give an introduction to R software.
CO 2: do exploratory data analysis using R.
CO 3: learn various features of probability distributions using R.
CO 4: conduct correlation and regression analysis.

Unit I: Introduction to R and Exploratory Data Analysis - R as a statistical software and language, R preliminaries, method of data input, data accessing or indexing, data frames, functions, graphics with r, saving, storing and retrieving work, work space and files, using scripts, using packages; Descriptive statistics using R – diagrammatic and graphical representation of data – bar diagram, histogram, pie diagram, Box plot, Q-Q plot, the plot function and curve function;

(15 Hrs.)

Unit II: Summary Statistics using R - Measures of central tendency, measures of dispersion, partition values, measures of skewness and Kurtosis.

(25 Hrs.)

Unit III: Probability distributions using R – Random generation of common probability distribution in R, the inverse transform method.

(15 Hrs.)

Unit IV: Correlation and Regression Analysis – Correlation coefficient, rank correlation coefficient, inferential procedures for correlation coefficients, linear regression, the coefficient of determination, inferential procedures for linear models. index numbers – computation of various index numbers

(17 Hrs.)

Books for Study:

1. Sudha. G. Purohit et al. (2008): Statistics Using R, Narosa Publishing House.

Books for Reference:

1. Maria.L. Rizzo (2007): Statistical Computing with R, Chapman& Hall/CRC.
2. Peter Dalgard : Introducing Statistics with R, Springer.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
No of Questions with 6marks each	2	4	3	3	12
No of Questions To be answered	1	3	2	2	8
Marks	6	18	12	12	48

Guidelines for Practical

- Both internal and external examinations will be conducted.
- Computer lab facilities should be provided by the college.
- Practical exam will be conducted externally at the end of fifth semester by the University with a common time table.
- External Examiners will be appointed by the University from the list of V semester board of examiners in consultation with the Chairperson of the Board
- There shall be an external and one internal examiner for the practical examination.
- The chairman of the V semester examinations should form and co-ordinate the evaluation team and their work

INTERNAL EVALUATION

Components	% of Marks
Record	25 %
Test Paper	75 %

CORE COURSE X: MATHEMATICAL METHODS FOR STATISTICS - II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B10STA	4	4	3

COURSE OUTCOME

Student should be able to

CO1: acquire knowledge about integral calculus.
CO2: apply differential calculus to functions of more than one variable
CO3: understand improper integrals
CO4: compute the Eigen values and Eigen vectors of a matrix

Unit I: The Riemann Integral - Definition and existence of the integral, Refinement of partitions, conditions of integrability, properties of Riemann integral, integral as a limit of sums. Integrability of continuous and monotonic functions, Integration and differentiation (the primitive), first mean value theorem and fundamental theorem of integral calculus.

(30 Hrs.)

Unit II: Function of two variables: continuity, partial derivatives and differentiability, Taylors theorem (statement only); Extreme Values- Maxima and minima of functions of two variables, method of Lagrange's multipliers.

(17 Hrs.)

Unit III: Improper Integrals- comparison tests for convergence of integration of unbounded function with finite limits of integration, Beta and gamma integrals.

(10 Hrs.)

Unit IV: Vector Space- vector space, subspaces, algebra of vectors, linear independence & dependence of vectors; dimension and basis, dimension theorem. Eigen values and Eigenvectors of a matrix-Definition and examples, Cayley-Hamilton theorem (statement only), Inverse of a matrix using Cayley-Hamilton theorem.

(15 Hrs.)

Books for Study:

1. S. C. Malik: Mathematical Analysis, Wiley Eastern Ltd
2. Shanti Narayan: A course of Mathematical Analysis, Sultan Chand & Sons
3. Shanti Narayanan: Text book of matrices, Sultan Chand & Sons

Books for Reference:

1. Suddhendu Biswas : Matrix Algebra,PHI Learning Pvt Ltd.

2. Apostol : Mathematical Analysis, Adison Wesley Publication Company Inc.

3.Devi Prasad : Elementary Linear Algebra, Narosa Publishing House, Chennai

4. Bartle- Theory of integration, American Mathematical society.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	24	16	16	16	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE XI: MATHEMATICAL METHODS FOR STATISTICS - III

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B11STA	5	4	3

COURSE OUTCOME

Student should be able to

CO1: understand complex numbers and their basic features
CO2: integrate complex functions.
CO3: understand integration differentiation, multiplication and division of power series.
CO4: understand residues and poles and applications in evaluation of integrals.

Unit I: Analytical functions: Analytical function, Cauchy- Riemann equation, harmonic function, necessary condition for a function to be analytic, sufficient condition for function to be analytic, polar form of Cauchy- Riemann equation, construction of analytical function.

(20 Hrs)

Unit II: complex integration : Complex line integral, Cauchy's theorem, Cauchy's integral formula and its generalized form. Poisson integral formula, Morera's theorem. Cauchy's inequality, Lioville's theorem.

(25 Hrs)

Unit III: Power series and Singularities : Power series, radius of convergence of a power series. Taylor series and Maclaurin series, Taylor's Theorem , important special Taylor series, Laurent's theorem , Zeroes of a function, singular point, different types of singularities. residue at a pole, residue at infinity.

(25 Hrs)

Unit IV: Residuals and poles - Cauchy's residue theorem and its applications- Jordan's lemma, integration around a unit circle, poles lie on the real axis, integration involving many valued function

(20 Hrs)

Books for Study:

1. E .Kreyszig, Advanced Engineering Mathematics WILEY, 2015

Books for Reference:

1. James Ward Brown, Paul v Churchil, Complex Variables and Applications, 8th Edition, Chapter 1,2,4,5,6 and 7, Mc Graw Hill.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	18	18	18	18	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE XII: SAMPLING TECHNIQUES & DESIGN OF EXPERIMENTS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B12STA	5	4	3

COURSE OUTCOME

Student should be able to

CO 1: design and execute sample survey.
CO 2: estimate population parameter using sampling distribution.
CO 3: to apply ANOVA
CO 4: improve the precision of the design.

Unit 1: Census and Sampling: Principal steps in sample survey, sampling vs census, sampling and non-sampling errors and types of sampling. Simple random sampling: SRSWR and SRSWOR- methods of selecting a SRS, unbiased estimators of population characteristics, their variances and estimators of the variances under both SRSWR and SRSWOR, estimation of sample sizes in SRS

(15 Hrs.)

Unit2: Stratified sampling: Method of selecting a stratified random sample, unbiased estimators of population characteristics and their variances, allocation of sample size in stratified sampling proportional and optimum allocations, estimates of population characteristics and their variances under these allocations, comparison of stratified random sample with SRS. systematic sampling - linear systematic sampling, estimation of population characteristics and the expressions for variance of the estimator under linear systematic sampling, comparison of systematic sampling with SRS and stratified random sampling, circular systematic sampling (definition only).

(30 Hrs.)

Unit 3: Analysis of variance - Definition, assumptions and models used in ANOVA, analysis of one way classified data and two way classified data (with a single observation per cell); use of auxiliary variables and analysis of covariance in one way classified data.

(20 Hrs)

Unit 4: Experimental Design: Comparative and absolute experiments, treatments, experimental units, yield and experimental error, layout of an experiment; Principles of Experimentation-Randomization, replication and local control; Completely Randomized Design-Analysis, advantages and disadvantages; critical differences. Randomized Block Design Analysis, estimation of missing observation, advantages and disadvantages; Latin Square Design - Analysis, advantages and disadvantages. Efficiency of a design. Relative efficiencies of CRD, RBD and LSD.

(25 Hrs)

Books for Study:

1. S.C. Gupta & V.K. Kapoor : Fundamentals of Applied statistics, Sultan Chand & Sons
2. Goon A M Gupta M K Das Gupta (1998): Fundamentals of statistics Volume II Word Press pvt. limited kolkatha

Books for Reference:

1. Cochran.W.G: Sampling Techniques, Wiley Eastern Ltd 3. Desraj: Sampling Theory, Tata Mc Graw Hill.
2. Montogomory D C (2001) Design of Experiments Johnwiley and Sons New Delhi

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	12	20	20	20	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - **Essay** (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

DISCIPLINE SPECIFIC ELECTIVE COURSES

Discipline Specific Elective Course is to be chosen from one of the following courses

6B13A STA: APPLIED STATISTICS

6B13B STA: ACTUARIAL STATISTICS

6B13C STA: STOCHASTIC PROCESSESS

CORE COURSE XIII: APPLIED STATISTICS (*Discipline Specific Elective)*

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B13ASTA	5	4	3

COURSE OUTCOME

Student should be able to

CO1: familiarize with the various statistical organizations.
CO2: compute mortality, fertility and reproduction rates
CO3: understand the application of statistical methods in population projection.
CO4: understand the elementary concept in actuarial statistics

Unit I: Official statistics: Indian Census Operations - Origin and functions of Indian Census Operations. Origin and functions of - National Sample Survey Organization (NSSO), Central Statistical Organization (CSO), Indian Statistical Institute (ISI) and Indian Council for Medical Researches (ICMR)

(14 Hrs)

Unit II :Vital Statistics –Basic concepts, sources of demographic data, rates and ratios, direct and indirect standardization of vital rates, mortality rates - Crude, specific and standardized death rates, infant mortality rates. Fertility and reproduction rates, Crude, general, specific and total fertility rate, gross and net reproduction rates.

(30 Hrs)

Unit III: Life table: Elements of life table, complete life table, their characteristics and construction, abridged life table (concepts and Characteristics only), population projection and logistic law of population growth, graduation of mortality rates-force of mortality and Makehams graduation formula.

(20 Hrs)

Unit IV: Actuarial statistics - Rate of interest: simple and compound, effective rate of interest, nominal rate of interest, relationship between these rate of interest, force of interest, present value, accumulated value, future lifetime random variable, survival

function, force of mortality, probability laws of mortality, curtate future lifetime, Annuities, various types of annuities, numerical problems

(26 Hrs)

Books for Study:

1. Benjamin. B: Elements of vital Statistics, G. Allen & Unwin
2. S C Gupta and V K Kapoor : Fundamentals of Applied statistics, Sultan chand and sons, New Delhi
3. Shylaja R Deshmukh : Actuarial statistics ,Universities Press (India) Pvt. Ltd

Books for Reference:

1. Goon, Gupta and Das Gupta : Fundamentals of Statistics (Vol.II), The world press, Calcutta
2. Parimal Mukhopadhyay : Applied Statistics, Books and Allied(P) Company Ltd, Kolkatta
3. S P Gupta : Statistical Methods, Sultan chand and Sons, New Delhi
4. Newton L Bowers Hans U Grabber James C Hickman and Donald A Jones (1997), Actuarial mathematics , The Society of actuaries
5. M E Atkinson & D C M Dickson : An Introduction to Actuarial studies Second Edition, Edward Elger Publishing limited. UK , USA

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	12	20	18	22	72

About the Pattern of Questions:

Part A -	**Short answer**	(6 questions x Mark 1each = 6)
	• ***Answer* all questions**	(*6 questions x Mark 1each = 6*)
Part B -	**Short Essay**	(9 questions x Marks 2 each =18)
	• ***Answer any 7 questions***	*(7questions x Marks 2 each=14)*
Part C -	Essay	(6 questions x Marks 4 each =24)
	• ***Answer any 4 questions***	*(4 questions x Marks 4 each=16)*
Part D -	**Long Essay**	(4 questions x Marks 6 each =24)
	• ***Answer any 2 questions***	*(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE XIII: ACTUARIAL STATISTICS (*Discipline Specific Elective)*

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B13BSTA	5	4	3

COURSE OUTCOME

Student should be able to

CO1: construct life tables.
CO2: calculate effective and nominal rate of interest, discount.
CO3: understand different types of annuities
CO4: acquire knowledge on insurance and premiums.

Unit 1: Survival function & Life tables

Future life time random variable, Survival function, force of mortality, Probability law of mortality, Curtate future life time, Life tables, assumptions for fractional ages, Uniform distribution of deaths, constant force of mortality assumptions, select and ultimate life tables.

(25 Hrs)

Unit 2: Life insurance

Rate of interest, Simple interest, compound interest, Effective rate of interest, Nominal rate of interest, the force of interest, Relationship between these rate of interest, Present value and accumulated value, Effective and nominal rate of discount, Insurance, Elements present in an insurance contract Insurance payable at the moment of death (whole life insurance, n-year term, n-year pure endowment n-year endowment insurance, Deferred insurance) Benefit payable at the end of year of death

(25 Hrs)

Unit 3: Annuities

Annuity; Types of annuities: Immediate, due certain, life annuity, continuous, discrete, m-th ly annuity, Deferred annuity, level annuity, Present value and accumulated value of (Immediate annuity, Annuity due, deferred immediate and due, continues annuities) Continuous life annuities (Whole life, n-year temporary n-year certain and life annuity). Discrete life annuities (Whole life, n- year temporary, n-year certain and life annuities) **(25 Hrs)**

Unit 4: Premiums:

Loss at issue random variables, Equavalance principle, fully continuous premiums (whole life, term insurance, endowment insurance), fully discrete premiums (whole life, term insurance, endowment insurance)

(15 Hrs)

Books for study:

1. Shylaja R Deshmukh: Actuarial Statistics,Universities Press (India) Pvt. Ltd

Books for reference:

1. M.E.Atkinson and D.C.M. Dickson: An introduction to actuarial studies, second edition, Edward Elgar Publishing limited, UK, USA
2. Newton L. Bowers, Hans U Gerber, James C Hickman & Donald A Jones (1997): Actuarial Mathematics, The society of actuaries.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	20	20	20	12	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - Essay (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE XIII: STOCHASTIC PROCESSESS (*Discipline Specific Elective)*

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B13 C STA	5	4	3

COURSE OUTCOME

Student should be able to

CO1: define stochastic process with examples and obtain parameter space and state space for various classification of stochastic process.
CO2: understand Markov process and Markov chain with examples and to identify the classes of a Markov chain and stationar distribution.
CO3: define Poisson process with examples, its properties and applications.
CO4: acquaint with stationary process and branching process with examples.

UNIT-I : Collection of random variables, joint probability distributions, consistency theorem (statement only), generating function, probability generating function, distribution of sum of independent random variables, conditional distribution, definition of stochastic processes-examples, parameter space, state space, classification of stochastic processes with examples.

(20 Hrs)

UNIT-II: Markov process, Markov chain, transition probability, stationary transition probability, Chapman-Kolmogorov equation (proof not required), stochastic matrix, classification of states recurrent, transient and periodic, properties, closed set of states, stationary distribution and ergodic theorem (statement of theorems and simple problems).

(28 Hrs)

UNIT-III Poisson process-postulates, definition, examples, inter arrival times-its distributions, relation of Poisson process with binomial and uniform distribution, compound Poisson process-definition, examples and applications.

(**20 Hrs)**

UNIT-IV: Stochastic process with stationary and independent increments, stationary process-wide sense and strict sense, Gaussian process. Branching process-definition, discrete time and discrete state branching process-examples, relation between pgfs of number of objects in nth and $(n-1)$ th generations (proof required). Probability of ultimate extinction (concept and problems) **(22 Hrs)**

Books for study:

1. Medhi, J. (1984). Stochastic Processes. Wiley Eastern Ltd, New Delhi
2. S.M Ross Stochastic Processes. Wiley Eastern Ltd, New Delhi

Books for reference:

1. Bailey, N. T. J. (1964). Elements of Stochastic Process with Applications to the Natural Sciences. Wiley, New York.
2. Bartlett, M. S. (1955). An Introduction to Stochastic Processes. Cambridge University Press.
3. Bhat, U.N. and Miller, G.K. (2002). Elements of Applied Stochastic Processes, Third Edition, John Wiley, New York
4. Box, G. E. P and Jenkins, G. M. (1976). Time Series Analysis: Forecasting and Control. Holden- Day, San Francisco.
5. Cinlar, E. (1975). Introduction to Stochastic Processes, Prentice Hall, Inc, New York.
6. Samuel Karlin (1972). A First Course in Stochastic Process. Academic Press, NewYork.
7. Feller, W. (1968). Introduction to Probability Theory and Applications, Vol. I, John Wiley, New York

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	18	20	16	18	72

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1each = 6)

- ***Answer* all questions** (*6 questions x Mark 1each = 6*)

Part B - **Short Essay** (9 questions x Marks 2 each =18)

- ***Answer any 7 questions*** *(7questions x Marks 2 each=14)*

Part C - **Essay** (6 questions x Marks 4 each =24)

- ***Answer any 4 questions*** *(4 questions x Marks 4 each=16)*

Part D - **Long Essay** (4 questions x Marks 6 each =24)

- ***Answer any 2 questions*** *(2 questions x Marks 6 each=12)*

- **Total marks including choice - 72**
- ***Maximum marks of the course- 48***

CORE COURSE XIV: PRACTICALS USING R -II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT
VI	6B14STA	4	4

COURSE OUTCOME

Student should be able to

CO 1: construct confidence intervals mean, variance and proportion

CO 2: conduct tests of hypothesis

CO 3: construct control charts and make inferences

CO 4: plot time series data.

Unit I: Statistical Inference-Estimation - Confidence intervals for mean, difference of means, variance and proportion.

(15 Hrs)

Unit II: Statistical Inference-Testing - computation of p-value – tests for normality, Shapiro – Wilks test, K-S test, test for mean – t test, Wilcoxon test, test for comparing means, t-test, paired t-test, Wilcoxon rank sum test, paired Wilcoxon rank sum test, test for variance, test for comparing variances, Fishers F test, test for proportion, test difference of proportions, test for Goodness of fit,

(25 Hrs)

Unit III: one way ANOVA, Kruskal Wallis Test.

(12 Hrs)

Unit IV: Sampling Techniques- Selection of samples, estimation of population characteristic and standard error; Control Charts. Time series, Fitting and plotting;

(20 Hrs)

Books for Study:

1. Sudha .G. Purohit et al. (2008): Statistics Using R, Narosa Publishing House.

Books for Reference:

1. Maria. L. Rizzo (2007): Statistical Computing with R, Chapman& Hall/CRC.
2. Peter Dalgard : Introducing Statistics with R, Springer.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
No of Questions with 6marks each	2	4	3	3	12
No of Questions To be answered	1	3	2	2	8
Marks	6	18	12	12	48

Guidelines for Practical

- Both internal and external examinations will be conducted.
- Computer lab facilities should be provided by the college.
- Practical exam will be conducted externally at the end of sixth semester by the University with a common time table.
- External Examiners will be appointed by the University from the list of VI semester board of examiners in consultation with the Chairperson of the Board
- There shall be an external and one internal examiner for the practical examination.
- The chairman of the VI semester examinations should form and co-ordinate the evaluation team and their work

INTERNAL EVALUATION

Components	% of Marks
Record	25 %
Test Paper	75 %

CORE COURSE XV: PROJECT

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V & VI	6 B 15 STA	2	0 CREDITS IN SEM. V & 4 IN SEM. VI	3

COURSE OUTCOME

Student should be able to

CO 1: understand research methodology

CO 2: use statistical software packages

CO 3: analyze data in real life

CO 4: acquire good knowledge in inference

Guidelines for Project

- The project will start in Semester V and will end at the end of Semester VI.
- The work may be chosen from any branch of statistics involving data collection (primary/Secondary) and application of statistical theory learned.
- Project may be undertaken by a group of students. However, the project report shall be submitted by each student.
- Report of the project in duplicate shall be submitted to the department by the end of the sixth semester, well before the commencement of the examination.
- There shall be a teacher from the department to supervise the project and the synopsis of the project should be approved by that teacher. The head of the department shall arrange teacher for supervision of the project work.
- A team of two external Examiners will be appointed by the University from the list of VI semester board of examiners in consultation with the Chairperson of the Board
- The chairman of the VI semester examinations should form and co- ordinate the evaluation team and their work
- Submission of the Project Report and presence of the student for viva are compulsory for the internal evaluation. No marks shall be awarded to a candidate if she/he fails to submit the Project Report for external evaluation.
- The student should get a minimum of 40% marks for pass in the project
- There shall be no improvement chance for the Marks obtained in the Project Report.
- In an instance of inability of obtaining a minimum of 40% marks, the project work may be re-done and the report may be re- submitted along with subsequent exams through parent department.

Total Marks for the Project: 35

Internal Components (20% of the total)-7 marks

Components	% of Marks
Punctuality	20%
Use of Data	20%
Scheme/Organization of Report	30%
Viva – Voce	30%

External Components (80% of the total) -28 marks

Components	% of Marks
Relevance of the Topic, Statement of Objectives, Methodology (Reference/ Bibliography)	20%
Presentation, Quality of Analysis/Use of Statistical tools, Findings and recommendations	30%
Viva –Voce	50%

The following books may be used to get an idea about projects and project report writing.

1. C.R. Kothari : Introduction to Research Methodology, New age International Publications
2. P.L.Bhandarkar and T.S.Wilkinson : Methodology and Techniques in Social Research, Himalaya Publishing House

PART B:

STATISTICS COMPLEMENTARY ELECTIVE COURSES

[FOR B.Sc. MATHEMATICS / COMPUTER SCIENCE PROGRAMMES]

WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
						CE	ESE	TOTAL
1C01 STA	BASIC STATISTICS	I	4	3	3	10	40	50
2C02 STA	PROBABILITY THEORY AND RANDOM VARIABLES	II	4	3	3	10	40	50
3C03 STA	PROBABILITY DISTRIBUTIONS	III	5	3	3	10	40	50
4C04 STA	STATISTICAL INFERENCE	IV	5	3	3	10	40	50

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT	WEIGHTAGE	REMARKS
COMPONENT 1 TEST PAPER	**3**	For each theory course there shall be a minimum of 3 written tests and the average mark of the best two tests is to be considered for internal mark. Each test paper may have duration of minimum one hour.
COMPONENT 2 ASSIGNMENT/ SEMINAR/VIVA	**1**	For each theory course each student is required to submit two assignments or to present a seminar or to attend a viva-voce. Assignments /seminar / viva-voce shall be evaluated on the basis of student performance.

COMPLEMENTARY ELECTIVE COURSE I: BASIC STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1C01 STA	4	3	3

COURSE OUTCOME

Student should be able to

CO1: understand the different types of data.

CO2: compute various measures of central tendency, measures of variation.

CO3: analyse the relationship between two variables.

CO4: acquire knowledge in time series data and compute various index numbers.

Unit I : Statistical Methods - Scales of measurement - Nominal, Ordinal, Ratio and Interval, Collection of data, Primary and Secondary data, Census method, Sample survey method, Comparison of census method and sample survey method, Principal steps in a sample survey, Types of sampling - probability, restricted and non-restricted sampling, judgement and mixed sampling, SRSWOR, SRSWR, stratified and systematic random sampling(concepts only).

(12 Hrs.)

Unit II : Measures of Central Tendency Definition and properties of various measures of central tendency - A.M,weighted A.M, Median, Mode, G.M., H.M. and weighted averages, Partition values - Quartiles, Deciles, Percentiles, Dispersion - Definition and properties of various measures of dispersion - Range, Q.D, M.D, S.D, and relative measures of dispersion, Moments - raw moments, central moments and relation between them, Skewness and Kurtosis - Definition and various measures of skewness and kurtosis.

(30 Hrs)

Unit III: Correlation and Regression Analysis - Method of least squares - Fitting of linear, quadratic and exponential curves, Regression analysis - linear regression, fitting of regression lines, regression coefficients and their properties, Correlation analysis - Definition and properties of correlation coefficient, Rank correlation coefficient-formula and problems only, Definitions of partial and multiple correlation coefficients(trivariate case only).

(18 Hrs)

Unit IV: Time Series and Index Numbers- Time series - Meaning, need, components and models of time series, estimation of linear trend by moving average

method and least square method, Index numbers - Meaning and uses of index numbers, weighted index numbers - Laspeyer's, Paasche's and Fisher's index numbers, time reversal and factor reversal tests.

(12 Hrs)

Books for Study:

1. Gupta, S. C. & Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). *Statistical Methods*, Sultan Chand & Sons, New-Delhi.

Books for Reference:

1. Mukhopadhyay, P. (1996). *Mathematical Statistics*, New Central Book Agency (P) Ltd., Kolkata.
2. Agarwal, B. L. (2006). *Basic Statistics*, 4th Edition, New Age International (P) Ltd., New Delhi.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	10	20	15	15	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE II: PROBABILITY THEORY AND RANDOM VARIABLES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2C02STA	4	3	3

COURSE OUTCOME

Student should be able to

CO 1: evaluate the probability of events.

CO 2: understand the concept of random variables with examples in real life

CO3: calculate the probability distribution of discrete and continuous random variables.

CO 4: understand the change of variable technique.

Unit I: Probability Theory-I

Random experiments, sample space, events, classical definition and frequency approach to probability, laws of events, sigma field, axiomatic definition of probability, probability space, addition theorem (2 and 3 events), Boole's inequalities.

(25 Hrs)

Unit II: Probability Theory-II

Conditional probability, multiplication theorem, independence of events, pair wise and mutual independence, Baye's theorem and its applications.

(18 Hrs)

Unit III: Random Variables - Discrete and continuous random variables, probability mass function and probability density function, distribution function - definition and properties, transformation of random variables-discrete and continuous.

(17 Hrs)

Unit IV: Bivariate Random Variables - Definitions, joint probability distributions, marginal and conditional distributions, independence of random variables, transformations of bivariate random variables.

(12 Hrs)

Books for Study:

1. Gupta, S. C. &Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Rao, C. R. (1973). Linear Statistical Inference and its Applications, 2/e, Wiley, New York.

2. Dudewicz, E. J. & Mishra S. N. (1988). Modern Mathematical Statistics, John Wiley & Sons, New York.
3. Pitman, J. (1993). Probability, Narosa Publishing House, New Delhi.
4. Rohatgi, V. K. (1993). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern, New Delhi. Hsu, H. P. (1997).
5. Hsu,H.P.(1997) Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes, The McGraw-Hill Companies, Inc., New York.
6. Lipschutz, S.& Schiller, J. J. (1998). Schaum's Outline of Theory and Problems of Introduction to Probability and Statistics, The McGraw-Hill Companies, Inc., New York.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	20	15	15	10	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE III: PROBABILITY DISTRIBUTIONS

SEMESTER	COURSE CODE	HOURS PER WEEK	SEMESTER	COURSE CODE
III	3C03 STA	5	3	3

COURSE OUTCOME

Student should be able to

CO1: compute mathematical expectation of a random variable.

CO2: familiarize with different discrete probability distribution associated with real life situations.

CO3: understand the characteristics of different continuous distributions.

CO4: identify the appropriate probability model that can be used.

Unit I: Mathematical Expectation: Definition and properties of mathematical expectation, Addition and multiplication theorem on expectation, Expectation of functions of random variables, Moments - Definition of raw and central moments, relation between raw and central moments, Expectation of bivariate random variables, conditional mean and variance, Coefficient of correlation between random variables. Moment generating function - Definition and properties, Characteristic function - Definition and properties.

(22 Hrs)

Unit II: Discrete Distributions - Definition, moments, m.g.f., characteristic function, properties and different characteristics of discrete uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution and Geometric distribution.

(25 Hrs)

Unit III: Continuous Distributions Definition, moments, m.g.f., characteristic function, properties and different characteristics of Uniform distribution, Normal distribution, Standard normal distribution, Exponential distribution, Gamma distribution with one and two parameters, Beta distributions of I and II kind.

(25 Hrs)

Unit IV: Sampling distributions - Definition, standard error, sampling distribution of sample mean and sample variance, Chi-square, Student's t and F distributions, Interrelations between chi-square, t and F distributions.

(18Hrs)

Books for Study:

1. Gupta, S. C. &Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Goon, A. M., Gupta, M. K. & Dasgupta, B. (2003). *An Outline of Statistical Theory,* Volume I, 4thEdn, The World Press Pvt. Ltd., Kolkata.

Books for Reference:

1. John E. Freund (1980). *Mathematical Statistics*, Prentice Hall of India, New Delhi.
2. Rohatgi, V. K. (1993). *An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern, New Delhi.
3. Mood, A. M., Graybill, F. A. &Boes, D. C. (2007). *Introduction to the Theory of Statistics*, 3rdEdn (Reprint). Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	14	17	17	12	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE IV: STATISTICAL INFERENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C04 STA	5	3	3

COURSE OUTCOME

Student should be able to

CO 1: understand the uses of Chebychev's Inequality and Central Limit Theorem.

CO 2: apply various method of estimation

CO 3: understand the concept of testing statistical hypotheses and its importance in real life situation

CO 4: apply ANOVA

Unit I: Chebychev's Inequality and Law of Large Numbers Chebychev's Inequality and its applications, convergence in probability, Weak law of large numbers, Bernoulli's law of large numbers, Convergence in distribution and central limit theorem for IID random variables (Statement only).

(15 Hrs)

Unit II: Theory of Estimation Point estimation, Desirable properties of a good estimator, Cramer-Rao inequality (statement only), Methods of estimation - method of MLE and method of moments. Interval estimation - Confidence interval for mean, proportion, variance, difference of means, difference of proportions.

(25 Hrs)

Unit III : Testing of Hypotheses - Statistical hypotheses, Simple and composite hypotheses, Null and alternative hypotheses, Types of errors, Critical region, Size and power of test – Definition and problems, most powerful test, Neyman - Pearson lemma (without proof).

(20 Hrs)

Unit IV: Large and small sample tests - Test for mean, proportion, equality of means, equality of proportions, paired t-test, test for variance and equality of variance, Chi-square test for goodness of fit, test for independence of attributes, One-way ANOVA (assumptions and problem only).

(30 Hrs)

NOTE: Numerical computations involved in Assignments submitted may preferably be done using any computer packages.

Books for Study:

1. Gupta, S. C. & Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. &Kapoor, V. K. (1994). *Fundamentals of Applied Statistics*, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. John E. Freund (1980). *Mathematical Statistics*, Prentice Hall of India, New Delhi.
2. Rohatgi, V. K. (1993). *An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern, New Delhi.
3. Medhi, J. (2005). *Statistical Methods-An Introductory Text*, New Age International (P) Ltd., New Delhi.
4. Spiegel, M. R., Schiller, J. J. &Srinivasan, R. A. (2013). *Schaum's Outline of Probability and Statistics*, 4thEdn. The McGraw-Hill Companies, Inc., New York.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	10	17	13	20	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

PART B:

STATISTICS COMPLEMENTARY ELECTIVE COURSES

[FOR BSc GEOGRAPHY / PSYCHOLOGY PROGRAMMES]

WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
						CE	ESE	TOTAL
1C01 STA (G&P)	DESCRIPTIVE STATISTICS	I	4	3	3	10	40	50
2C02 STA (G&P)	STATISTICAL METHODS	II	4	3	3	10	40	50
3C03 STA (G&P)	PROBABILITY AND DISTRIBUTION THEORY	III	5	3	3	10	40	50
4C04 STA (G&P)	INFERENTIAL STATISTICS	IV	5	3	3	10	40	50

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT	WEIGHTAGE	REMARKS
COMPONENT 1 TEST PAPER	**3**	For each theory course there shall be a minimum of 3 written tests and the average mark of the best two tests is to be considered for internal mark. Each test paper may have duration of minimum one hour.
COMPONENT 2 ASSIGNMENT/ SEMINAR/VIVA	**1**	For each theory course each student is required to submit two assignments or to present a seminar or to attend a viva-voce. Assignments /seminar / viva-voce shall be evaluated on the basis of student performance.

COMPLEMENTARY ELECTIVE COURSE I -: DESCRIPTIVE STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
1	1C01 STA(G&P)	4	3	3

COURSE OUTCOME
Student should be able to
CO1: understand the elementary concept in statistics.
CO2: compute various measures of central tendency
CO3: compute various measures of dispersion
CO4: acquire knowledge in sampling theory.

Unit I: Data Presentation: Collection of data, primary and secondary data; Numerical presentation – raw data, discrete frequency distribution and continuous frequency distribution; Diagrammatic representation of data- line diagram, bar diagram, sub divided bar diagram, histogram, frequency curve, frequency polygon and Pie diagram

(20 Hrs)

Unit II: Measures of central tendency: Basic concepts, various measures –mean, median, mode, geometric mean, harmonic mean, weighted mean, quartiles and simple numerical problems.

(16 Hrs)

Unit III: Measures of dispersion and moments- Absolute and relative measures of dispersion, range, mean deviation quartile deviation, standard deviation, coefficient of variation, Moments- Raw moments, central moments (Definition only); Skewness and Kurtosis-Definition and various measures with simple numerical problems.

(20 Hrs)

Unit IV: Elementary sampling procedures: Concept of population, sample, census and sample surveys, advantages of sampling and limitations; Sampling methods - sampling unit, sampling frame, sampling and non-sampling errors, probability sampling and judgment sampling, basic concepts of simple random sampling, systematic and stratified sampling, situations where they are used.

(16 Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons
2. S.C Gupta and V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. Rogger Till: Statistical methods for the earth scientists- An Introduction: Mc Millan.
2. John Silk: Statistical concepts in Geography, George Allan and Unwin
3. Prem S Mann : Introductory Statistics 5th Edition, Wiley

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	15	15	15	15	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*
- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE II: STATISTICAL METHODS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2C02STA (G&P)	4	3	3

COURSE OUTCOME

Student should be able to

CO1: analyze the relation between two real life data.
CO2: compute various index numbers and understand their importance in real life.
CO3: acquire knowledge in time series data.
CO4: compute mortality, fertility and infant mortality rate.

Unit I: Correlation analysis - concept of correlation, method of studying correlation, scatter diagram, Karl Pearson correlation coefficient, Spearman rank correlation coefficient (with and without ties)

(22 Hrs)

Unit II: Regression analysis - Fitting of curves of the form linear, linear regression, regression equations (concept only), relation between correlation and regression coefficients.

(20 Hrs)

Unit III: Index numbers and Time Series - Meaning and use of index numbers, simple and weighted index numbers, Laspeyer's, Paache's and Fisher's index numbers, Test for good index number, cost of living index number.

Definition and use of time series, Components of time series, measurement of secular trend semi average, moving average and least square method (linear function only)

(20 Hrs)

Unit IV: Vital Statistics - Sources of vital statistics, rates and ratios, various measures of mortality and fertility-CDR, SDR, infant mortality rate, CBR, SBR, TFR, GRR, NRR age specific birth rate

(10 Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons
2. S.C Gupta and V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. Rogger Till: Statistical methods for the earth scientists- An Introduction: Mc Millan.

2. John Silk: Statistical concepts in Geography, George Allan and Unwin
3. Prem S Mann : Introductory Statistics 5th Edition, Wiley

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	15	15	20	10	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*
- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE III: PROBABILITY AND DISTRIBUTION THEORY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3C 03 STA (G&P)	5	3	3

COURSE OUTCOME

Students should be able to

CO1: evaluate the probability of events

CO2: understand the concept of random variable with examples in real life.

CO3: familiarize with different discrete probability distributions

CO4: understand the characteristics of different continuous distribution.

Unit I : Probability theory - Random experiment, Sample space, events, classical definition, frequency and axiomatic approaches to probability, Addition theorem, conditional probability, multiplication theorem, independence of events, Baye's theorem and its practical applications.

(25 Hrs)

Unit II: Random Variable and Probability distribution: Random variable - discrete and continuous types, probability mass function, probability density function, distribution function, mathematical expectation. Simple problems on discrete case only.

(20 Hrs)

Unit III: Standard discrete and continuous theoretical distributions: Binomial and Poisson distributions – different characteristics and fitting of binomial and Poisson distributions, Features and properties of Normal distribution and Exponential distributions**.**

(25 Hrs)

Unit IV: Sampling distributions: Statistic, standard error, distribution of sample mean, chi square, student's t and F-distributions-definition, mean and variance (Without derivation), interrelation between them. (Statement only)

(20Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons

Books for Reference:

1. John E Freund, Roanld E Walpole: *Mathematical Statistics* 4th Edition, Prentice HallIndia Pvt Ltd.

2. David Ebdon, Basil Blackwell: *Statistics in Geography*-A practical approach, Oxford.
3. Murrau R Spiegel: *Theory and problems of statistics*, Schaums Outline series

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	15	15	20	10	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*
- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

COMPLEMENTARY ELECTIVE COURSE IV: INFERENTIAL STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C04 STA (G&P)	5	3	3

COURSE OUTCOME
Student should be able to
CO1: estimate the parameters
CO2: understand the concept of statistical hypotheses.
CO3: apply parametric and nonparametric tests.
CO4: apply ANOVA

Unit I: Estimation theory: Parameter, statistic, estimator, estimate, point estimation- desirable properties of a good Estimator- unbiasedness, consistency, sufficiency and efficiency (definition only); Interval estimation: Definition, Confidence interval for mean, proportion, difference of means and difference of proportions.

(25 Hrs)

Unit II : Testing of hypotheses: Null and alternative hypotheses, simple and composite hypotheses, two types of errors; size and power of a test, most powerful test.

(20 Hrs)

Unit III: Large and small sample tests: Definition, Test for mean, proportion and variance, difference of means and proportions, chi square test for goodness of fit and independence of attributes, F-test, Non parametric test: Mann - Whiteney U test.

(25 Hrs)

Unit IV: Analysis of variance: One way and two way classification, linear hypothesis, total, between and within sum of squares, ANOVA table, solution of problems using ANOVA tables. Kruskal -Wallis test.

(20 Hrs)

NOTE: Numerical computations involved in Assignments submitted may preferably be done using any computer packages.

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons
2. S.C Gupta and V.K . Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. John Silk: Statistical concepts in Geography, George Allan and Unwin
2. Prem S Mann : Introductory Statistics 5th Edition, Wiley

Marks including choice:

Unit	Unit I	Unit II	Unit III	Unit IV	Total
Marks	18	15	17	10	60

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 = 6)

- **Answer all questions** (*6 questions x Mark 1 = 6*)

Part B - **Short Essay** (8 questions x Marks 2 each =16)

- ***Answer any 6questions*** *(6questions x Marks 2 each=12)*

Part C - Essay (6 questions x Marks 3 each =18)

- ***Answer any 4 questions*** *(4 questions x Marks 3 each=12)*

Part D - **Long Essay** (4 questions x Marks 5 each =20)

- ***Answer any 2 questions*** *(2 questions x Marks 5 each=10)*

- **Total marks including choice -60**
- ***Maximum marks of the course- 40***

PART C

B.Sc. STATISTICS GENERIC ELECTIVE COURSES
WORK AND CREDIT DISTRIBUTION
(2019 ADMISSION ONWARDS)

EACH DEPARTMENT SHALL OFFER A POOL OF FIVE GENERIC ELECTIVE COURSES. STUDENTS OF OTHER DEPARTMENTS CAN CHOOSE **ANY ONE OF THE GENERIC ELECTIVE COURSE FROM THE POOL OF FIVE COURSES.** ALL DEPARTEMENTS WHETHER IT IS A CORE DEPARTMENT OR COMPLEMENTARY DEPARTMENT CAN OFFER THE COURSE IN SEMESTER V

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS		
						CE	ESE	TOTAL
5D01STA	**BASICS OF STATISTICS**	**V**	2	2	2	**5**	**20**	**25**
5D02STA	**SAMPLING TECHNIQUES**	**V**	2	2	2	**5**	**20**	**25**
5D03STA	**VITAL STATISTICS**	**V**	2	2	2	**5**	**20**	**25**
5D04STA	**INDEX NUMBERS AND TIME SERIES**	**V**	2	2	2	**5**	**20**	**25**
5D05STA	**BASIC PROBABILITY THEORY**	**V**	2	2	2	**5**	**20**	**25**

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT	WEIGHTAGE	REMARKS
COMPONENT 1 TEST PAPER	**3**	For each theory course there shall be a minimum of 3 written tests and the average mark of the best two tests is to be considered for internal mark. Each test paper may have duration of minimum one hour.
COMPONENT 2 ASSIGNMENT/ SEMINAR /VIVA	**1**	For each theory course each student is required to submit two assignments or to present a seminar or to attend a viva-voce. Assignments /seminar / viva-voce shall be evaluated on the basis of student performance.

GENERIC ELECTIVE COURSE I: BASICS OF STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5D01STA	2	2	2

COURSE OUTCOME
Student should be able to
CO1: understand the elementary concept of statistics
CO2: classify the collective data
CO3: represent the data in bar chart and pie diagrams
CO4: compute the averages and the measures of dispersion

Unit 1*:*Introduction to Statistics-origin & growth of Statistics-function of Statistics-Scope of Statistics-Statistical Methods, Advantages and disadvantages of census and sampling collection of data, primary and secondary data, Classification and Tabulation of data- Meaning and objective of Classification-Types of classification-Tabulation of data, frequency distribution. Diagrammatic representation of data, bar chart, pie-chart

(16 Hrs)

Unit 2: Descriptive Statistics: -Measures of central tendency, arithmetic mean, median, mode, Measures of dispersion. SD, variance, coefficient of variation

(20 Hrs)

Books for Study:

1. B L Agrawal (2013): Basic Statistics – New Age International Publishers.

Books for Reference:

1. Gupta, S. P. (2004). *Statistical Methods*, Sultan Chand & Sons, New Delhi.
2. J Medhi : Statistical methods: an introductory text, New age International Pvt Ltd

Marks including choice:

Unit	Unit I	Unit II	Total
Marks	15	15	30

About the Pattern of Questions:

Part A -	**Short answer**	(6 questions x Mark 1 each= 6)
	• **Answer all questions**	(*6 questions x Mark 1 each = 6*)
Part B -	**Short Essay**	(6 questions x Marks 2 each =12)
	• ***Answer any 4 questions***	*(4questions x Marks 2 each=8)*
Part C -	**Essay**	(2 questions x Marks 6 each =12)
	• ***Answer any 1 question***	*(1 question x Marks 6 each=6)*

- **Total marks including choice -30**
- ***Maximum marks of the course 20***

GENERIC ELECTIVE COURSE II: SAMPLING TECHNIQUES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS.
V	5D02STA	2	2	2

COURSE OUTCOME
Student should be able to
CO1: understand different types of data.
CO2: understand the concept the census and sampling.
CO3: apply different sampling methods.
CO4: familiarize with the various statistical organizations.

Unit1: Statistical Methods - Data, Different types of data, Primary and Secondary data, Methods of collecting primary data, Sources of collecting secondary data, Census and Sample survey, Errors in sample survey, Different types of sampling-Judgment, probability and mixed sampling.

(14 Hrs)

Unit 2: Sampling methods - Random sampling, Types of random sampling, Simple Random Sampling-SRSWR and SRSWOR, Methods of collecting sample-Lottery method and Random number table method, Stratified random sampling, Systematic sampling-Linear and Circular systematic sampling, Cluster sampling, Multi stage sampling (Elementary concepts only).

(14 Hrs)

Unit3: **Official Statistics** - Directorate of Indian Census Operation, National Sample Survey Organization, Central Statistical Organization, Indian Statistical Institute, Indian Council for Medical Research, Directorate of economics and statistics, Indian Institute of population study etc - their role in planning and development processes of the nation.

(8 Hrs)

Books for Study:

1. S.C.Gupta and V.K. Kapoor : Fundamentals of applied Statistics, Sulthan Chand &Sons

Books for References:

1. D.Singh and F.S.Chaudhary: Theory and Analysis of Sample survey, John Wiley and Sons54

2. Goon, Gupta & Das Gupta : Fundamentals of Statistics, Vol II , Sultan Chand & Sons

Marks including choice:

Unit	Unit I	Unit II	Unit III	Total
Marks	12	10	8	30

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 each= 6)

- **Answer all questions** (*6 questions x Mark 1 each = 6*)

Part B - **Short Essay** (6 questions x Marks 2 each =12)

- ***Answer any 4 questions*** *(4questions x Marks 2 each=8)*

Part C - Essay (2 questions x Marks 6 each =12)

- ***Answer any 1 question*** *(1 question x Marks 6 each=6)*

- **Total marks including choice -30**
- ***Maximum marks of the course 20***

GENERIC ELECTIVE COURSE III: VITAL STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 03 STA	2	2	2

COURSE OUTCOME

Student should be able to
CO 1: compute various mortality and fertility rates.
CO2: interpret the population death and birth rates.
CO3: analyze the population growth.
CO4: study the about vital information.

Unit I: Introduction to Vital Statistics-Introduction, sources of demographic data, uses of vital statistics, method of obtaining vital statistics, measurement of population, rates, ratios, relevant institutions and their role.

(10 Hrs)

Unit 2: **Measures of fertility and mortality** - Definition of Fertility, measurement of fertility-Crude birth rate, specific fertility rate, total fertility rate, definition of mortality, measurement of mortality, crude death rate, specific death rate, infant mortality rate, standardized death rate. Application with numerical examples.

(18 Hrs)

Unit 3: Measurement of population growth: Measurement of population growth, stationary population, stable population, gross reproductive rate, net reproductive growth.

(8 Hrs)

Books for study

1. Benjamin. B: Elements of vital Statistics, G. Allen & Unwin
2. 2. S C Gupta and V K Kapoor : Fundamentals of Applied statistics, Sultan chand and sons New Delhi

Books for Reference

1. Goon, Gupta and Das Gupta : Fundamentals of Statistics (Vol. II), The world press, Calcutta

2. Parimal Mukhopadhyay: Applied Statistics, Books and Allied(P) Company Ltd, Kolkata

Marks including choice:

Unit	Unit I	Unit II	Unit III	Total
Marks	8	15	7	30

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 each= 6)

- **Answer all questions** (*6 questions x Mark 1 each = 6*)

Part B - **Short Essay** (6 questions x Marks 2 each =12)

- ***Answer any 4 questions*** *(4questions x Marks 2 each=8)*

Part C - Essay (2 questions x Marks 6 each =12)

- ***Answer any 1 question*** *(1 question x Marks 6 each=6)*

- **Total marks including choice -30**
- ***Maximum marks of the course 20***

GENERIC ELECTIVE COURSE IV: INDEX NUMBERS AND TIME SERIES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 04 STA	2	2	2

COURSE OUTCOME

Student should be able to

CO1: understand the uses of index numbers in real life

CO2: compute and interpret various index numbers.

CO3: understand different components of time series

CO4: calculate the measurement of trend

Unit 1: INDEX NUMBERS - Meaning and definition, applications and type of index numbers, weighted and unweighted index number, price and quantity indices, Methods for construction of index numbers (Laspeyer's index number, Paasche's index number and Fisher's index number)

(18 Hrs)

Unit 2: TIME SERIES - Definition, uses of time series, components of time series mathematical models of time series (additive and multiplicative models.) measurement of trend, semi average method, moving average method.

(18 Hrs)

Books for study

1. S P Gupta –Statistical Methods, Sultan chand & sons, New Delhi

Books for reference:

1. S.C.Gupta & V.K.Kapoor - Fundamentals of Applied Statistics, Sultan chand & sons, New Delhi

Marks including choice:

Unit	Unit I	Unit II	Total
Marks	15	15	30

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 each= 6)

- **Answer all questions** (*6 questions x Mark 1 each = 6*)

Part B - **Short Essay** (6 questions x Marks 2 each =12)

- ***Answer any 4 questions*** *(4questions x Marks 2 each=8)*

Part C - Essay (2 questions x Marks 6 each =12)

- ***Answer any 1 question*** *(1 question x Marks 6 each=6)*

- **Total marks including choice -30**
- ***Maximum marks of the course 20***

GENERIC ELECTIVE COURSE V: BASIC PROBABILITY THEORY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D05STA	2	2	2

COURSE OUTCOME

Student should be able to

CO1: identify various types of sets and to do various operations on them.

CO2: calculate the number of ways of arrangement and selection using permutation and combination.

CO3: distinguish between random and non-random experiments.

CO4: evaluate the probabilities of various events.

Unit I: Set Theory - Set theory - Concept, Various types of sets- universal set, subset, singleton set, null set, Operations on sets- complement of a set, union of two sets, intersection of two sets, difference of two sets, Venn diagram, Addition theorem.

(10 Hrs)

Unit II: Counting Techniques - Counting techniques - Permutations and Combinations, Numerical examples.

(8 Hrs)

Unit III: Basic Probability - Random Experiment, Sample space, Event, Different types of event - equally likely, mutually exclusive and exhaustive Classical definition of probability, Addition theorem of probability (definition only), Calculation of probability using combination, Numerical examples.

(18 Hrs)

Books for Study:

1. Gupta, S. P. (2004). *Statistical Methods*, Sultan Chand & Sons, New Delhi.
2. Agarwal, B. L. (2006). *Basic Statistics*, 4th Edition, New Age International (P) Ltd., New Delhi.

Books for Reference:

1. Gupta, S. C. & Kapoor, V. K. (1980). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi.
2. Mukhopadhyay, P. (1996). *Mathematical Statistics*, New Central Book Agency (P) Ltd., Kolkata.

Marks including choice:

Unit	Unit I	Unit II	Unit III	Total
Marks	8	7	15	30

About the Pattern of Questions:

Part A - **Short answer** (6 questions x Mark 1 each= 6)

- **Answer all questions** (*6 questions x Mark 1 each = 6*)

Part B - **Short Essay** (6 questions x Marks 2 each =12)

- ***Answer any 4 questions*** *(4questions x Marks 2 each=8)*

Part C - Essay (2 questions x Marks 6 each =12)

- ***Answer any 1 question*** *(1 question x Marks 6 each=6)*

- **Total marks including choice -30**
- ***Maximum marks of the course 20***