SOMAIYA VIDYAVIHAR

K J Somaiya College of Science & Commerce

Somaiya TRUST

Learning Outcomes based Curriculum Framework

(LOCF)

For

B. Sc. Statistics

Undergraduate Programme

From

Academic year

2021-22

Vision & Mission

Mission:

Equip the student with knowledge and skills of their chosen vocation,

Inculcate values.

Provide them opportunities for all, round growth and prepare them for life.

Vision:

- To equip the students with advanced knowledge and skills in their chosen vocation.
- To provide value-based education and opportunities to students.
- To help them to face challenges in life.
- To nurture a scientific attitude, temperament and culture among the students.
- To continually review, develop and renew the approach to build India of the Founder's dream.

Goals and Objectivess:

- To build a strong Academia-Industry bridge.
- To provide flexibility in the courses offered and proactively adapt to the changing needs of students and the society.
- To establish a centre for multidisciplinary activities.
- To mould individuals who would nurture the cultural heritage of our country and contribute to the betterment of the society.

Board of studies in Statistics

Undergraduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Mr. Prashant Shah	Chairman	K. J. Somaiya college of science and commerce
Subject Expert nominated by Vice-Chancellor			
1	Dr. Santosh Gite	Head, Department of Statistics	University of Mumbai
Subject experts			
1	Mr. Subhash S Shende	Head and Associate Professor	Fergusson College, Pune
2	Mr. Prasad Patki	Head and Associate Professor	Bhavans College, Mumbai
Representative from Industry/corporate sector/allied area			
1	Ms. Pooja Jadhav	Deputy Manager	Axis Bank
Meritorious Alumnus			
1	Mr. Lalit Kothawale:	Specialist in Analytics and model development	Wills Towers Watson
Faculty of the specialisation			
1	Ms. Madhavi Jardosh	Associate Professor	K.J. Somaiya College of Science and Commerce
2	Ms. Arati Kore	Assistant Professor	K.J. Somaiya College of Science and Commerce
3	Ms. Namrata Nagwekar	Assistant Professor	K.J. Somaiya College of Science and Commerce

Foreword

Autonomy reflects efforts for excellence in academic performances, capability of self-governance and enhancement in the quality of education. In the year 2012, the UGC and University of Mumbai conferred the Autonomous Status to K. J. Somaiya College of Science and Commerce. Post this recognition and having several accolades to our credit, we made significant changes to our existing syllabi to reflect the changing business, industrial and social needs. A holistic education that provides opportunities to gain and shareknowledge, experiment and develop beyond curriculum, is offered at our College.

Autonomous colleges carry a prestigious image for the students and the teachers and we have made a collaborative attempt to maintain a high level of quality in the standard of education that we impart.

Structured feedback obtained from the students, alumni and the experts from the industry and the changes suggested by them were duly incorporated in the syllabi. The Board of Studies constituted for each department meets to carry out in depth discussions about different aspects of the curriculum taking into cognizance the recent trends in the discipline.

The IQAC team has facilitated the conduct of a number of workshops and seminars to equip the faculty with the necessary skill set to frame the syllabi and competencies to deliver the same. Training was also provided to employ innovative evaluation methods pertaining to higher cognitive levels of revised Bloom's taxonomy.

This ensured the attainment of the learning Outcomes enlisted in the syllabus. Audits are conducted to critically review the practices undertaken in teaching, learning and evaluation. Innovative learning methodologies such as project-based learning, experiential learning and flip- class learning practiced by a committed fleet of faculty, supported by several hands have been our unique outstanding propositions.All efforts have been made to nurture the academic ambitions as well as the skills in co-curricular activities of the most important stakeholder i.e. student.

With sincere gratitude, I acknowledge the constant support and guidance extended by Shri Samir Somaiya, President- Somaiya Vidyavihar, and all the esteemed members of

the Governing board and Academic council of the College. I also would like to acknowledge the Heads of the Departments and all the faculty members for their meticulous approach, commitment and significant contribution towards this endeavour for academic excellence.

Dr.Pradnya Prabhu
Principal

Acknowledgement

At the outset, I would like to thank our, Principal Dr.Pradnya Prabhu for her guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies, for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Statistics for the long and arduous work they have put in during the compiling of the restructured syllabus.

Mr. Prashant Shah
Chairperson
Board of Studies in Statistics

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Preamble

The underlying philosophy of the B.Sc. Statistics programme is to develop theoretical and analytical skills of the students so that they may be absorbed in the corporate world or be able to pursue higher studies at the Master's level in Statistics. In the rapidly changing globalised market scenario, the need was felt to equip students with the capability to understand and handle the dynamic of Statistics and the business world.

In order to achieve the above-mentioned Objectives, a comprehensive revised syllabus comprising of topics relating to Statistics, quantitative techniques and business have been included in the three-year, six-semester module, giving wider coverage to the course contents, better organisation to enable easier assimilation of the same by the students, and a more professional touch to the course.

This Learning Outcomes-based Curriculum Framework (LOCF) supports the fundamental principle of providing quality education in India. Our focus is to involve young minds to participate, contribute and add value at each stage in the field of their study. The introduction of Choice Based Credit System (CBCS) has maximized the benefits of the newly designed curriculum in multiple folds. Keeping all this in mind, the curriculum under Learning Outcomes-based Curriculum Framework (LOCF) is designed.

The LOCF will certainly help teachers to envisage the Outcomes expected from the learners at the end of the programme. For students, it will be a guide which shows how this curriculum will help them acquire all the skills and knowledge which are essential in their personal and academic growth. Higher education qualifications such as Bachelor's Degree Programme are awarded on the basis of demonstrated achievement of Outcomes and academic standards; and this is the very essence of this curriculum.

1. Introduction

The B.Sc. Statistics programme is developed by keeping in mind the interest of learners to explore the field of Statistics. The framework helps to maintain the standard of Statistics degrees/programmes through periodic programme review within a broad framework of agreed/expected graduate attributes, qualification descriptors, programme learning Outcomes and course-level learning Outcomes. The BSc programme is planned in such a way that it allows flexibility and innovation in programme design, syllabi development, teaching-learning process and quality assessment of students' learning levels.

B.Sc.(Statistics) programme consists of 132 credits spread over three academic years, each academic year consists of two semesters. Along with Statistics, students have to take Physics and Mathematics in Sem-1 and 2; Mathematics in Sem-3 and 4. This programme emphasizes both theory and practical and is structured to provide knowledge and skills in depth necessary for the employability of students in industry, other organizations, as well as in academics. Besides this, students will attain various 21st century skills like critical thinking, problem solving, analytic reasoning, cognitive skills, self-directed learning etc.

The syllabus assumes the knowledge of XI and XII standard Mathematics syllabus. It provides a firm foundation for the learner who intends to study Statistics and/or related subjects up to and beyond graduate level and for the statistical requirements of a wide range of professions.

The courses of Semester I and II have been designed to introduce the basic concepts of Statistics such as different types of data, measurement scales, calculating and interpreting the measures of central tendencies and dispersion, univariate correlation and regression analysis, theory of attributes, concept of probability, discrete and continuous random variables with the properties of expectation and variance, discrete and continuous probability distribution functions, introduction to point and interval estimation, large sample test etc.

The courses of Semester III and IV have been designed to introduce topics such as sampling techniques, designs of experiment, optimisation techniques such as LPP, transportation problem, sequencing problem, PERT-CPM technique, SQC. Also for course-III, elective courses such as Time Series Analysis and Forecasting for Sem-III and Research Methodology for Sem-IV are introduced.

The courses of Semester V and VI have been designed to include more recent changes and developments in the concerned subjects. There has been a substantial increase in the quantitative techniques component of the course to equip students with the essential tools for business and statistical analysis. Thus a fine balance has been maintained between the statistical theory and practical. Core courses include courses such as probability theory and distribution, theory of estimation, demography and vital statistics, survival analysis, stochastic process, elements of actuarial science.

Introduction of discipline specific electives such as regression analysis, econometrics, data mining, biostatistics etc. and skill enhancement courses such as statistical computing using C and R, help students choose the areas that are best suited to their interest and skill. At the end of the B.Sc. (Statistics) degree programme a student is expected to apply the statistical tools to real life data and analyse it.

2. Learning Outcomes based Curriculum Framework

LOCF focuses on learning targets and Objectives. The curriculum framework also provides examples of effective learning, teaching and assessment practices. As the curriculum development is a collaborative and an on-going enhancement process, the LOCF instructs periodic reviews and revisions of the curriculum in accordance with the ever changing needs of students, teachers and industry.

2.1 Nature and extent of B.Sc. Statistics

The B.Sc. (Statistics) Programme has some unique features such as well-structured practical in the all six semesters, project work in semesters 4 and 6. Statistical software namely R, SPSS, Python etc. are used in all practical courses and project work. Elective

courses such as Regression analysis, Econometrics, Operation research, Design of experiments, Data mining, Biostatistics, Time series and forecasting, Linear model, Research Methodology are introduced in sem-4, 5 and 6.

2.2 Programme Education Objectives (PEOs)

The overall aim of bachelor's degree programme in Statistics is to

1. Instil the fundamentals of statistical theories which will develop the overall approach in dealing with the problems of the real world.
2. Develop theoretical and analytical skills of the students so that they may be absorbed in the corporate world or be able to pursue higher studies at the Master's level in Statistics.

3 Graduate Attributes in Statistics

Attributes expected from the graduates of B.Sc. Statistics Programme are:

GA 1: To equip students with theoretical and analytical skills with the capability to understand and handle the dynamic of Statistics in the business world.

GA 2: Students will have ability to express thoughts and ideas effectively in statistical language; present complex information in a clear and concise manner to different groups in graphical, tabular and PPT format.

GA 3: Enrich the students to think about social, economic and global issues using statistical techniques in a more logical and methodical manner.

GA 4: The students could develop statistical reasoning to analyse and interpret socio-economic data from a variety of sources; draw valid unbiased and consistent conclusions and support them with significant results.

GA 5: The students would be able to forecast, estimate parameters, formulate and test the hypothesis.

GA6: The students will be able to equip themselves with in depth 'C' and 'R' programming and simultaneously use appropriate Statistical software for Statistical computing.

GA 7: The students will be familiar with preparing questionnaire, data collection, compilation, analysis and interpretation and writing of project reports independently.

4 Qualification descriptors

Upon successful completion of the programme, students receive B.Sc. degree in Statistics. B.Sc. Statistics graduates of this department will be able to demonstrate the extensive knowledge of various concepts of Statistics and its application thus contributing in research, development, teaching, government and public sectors. This programme will establish a foundation for students to further pursue higher studies in Statistics. The list below provides a synoptic overview of possible employment areas provided by an undergraduate training in Statistics.

The list below provides a synoptic overview of possible career paths provided by an undergraduate training in Statistics:

1. Pharmaceuticals
2. Data analytics
3. Government organizations such as NSSO, NSO
4. Actuaries
5. Academics
6. Banking
7. Market research
8. Machine learning/Artificial intelligence/Data Mining
9. Indian Statistical Services

Job Roles for B.Sc. Statistics graduate:

After graduation one can seek a professional career as:

1. Statistic consultant
2. Software developer
3. Data Analyst
4. Statistical quality controller

5. SAS/SPSS/R-programmer
6. Biostatistician

Higher Education options for B.Sc. Statistics graduate:

1. M.Sc. Statistics from any university
2. M.Sc. Actuarial science
3. MS in data analytics
4. MCA
5. MBA

The learners who complete three years of full-time of an undergraduate programme of study will be awarded a Bachelor's degree in Statistics.

5 Programme Learning Outcomes (PLOs)

After the successful completion of modules in different courses of B.Sc. Statistics, the learner will be able to:

PLO I: Demonstrate a strong theoretical groundwork in Statistics related subjects up to and beyond graduate level.

PLO II: Develop analytical skills so that they may be absorbed in the corporate world or be able to pursue higher studies.

PLO III: Present information in written, graphical, diagrammatic and tabular terms.

PLO IV: Apply the knowledge and skill of using scientific tools and statistical software to solve real life problems.

5.1 Course Mapping

Semester	PLO	I	II	III	IV
	Course				
I	CC I	√	√	√	
	CC II	√	√	√	√
	AECC I FC*				
	SEC I STP1				
	SEC II BCE**				
II	CC I	√	√	√	
	CC II	√	√	√	√
	AECC I FC*				
	SEC I STP2				
	SEC II ICH1***				
III	CC I				
	CC II				
	CC III				
	AECC I FC*				
	SEC I STP3				

	SEC II ICH2***				
IV	CC I				
	CC II				
	CC III				
	AECC I FC*				
	SEC I STP4				
	SEC II ICH3***				
V	CC I				
	CC II				
	CC III				
	CC IV				
	DSE I				
	DSE II				
	DSE III				
	DSE IV				
	AECC I EVS				
	SEC I				
	SEC II				
VI	CC I				
	CC II				
	CC III				
	CC IV				
	DSE I				
	DSE II				
	DSE III				
	DSE IV				
	AECC I				

	EVS				
	SEC I				
	SEC II				

*FC= Foundation Course

** CE= Basic communication in English

***ICH= Indian Cultural Heritage (Value Education)

6 Structure of B.Sc. Statistics programme

The curriculum framework is designed around the choice-based credit system (CBCS).The programme consists of three years and six semesters (two semesters per year). To acquire a degree in B.Sc. Statistics a learner must study

1. Core Courses (CC):

a) A course which is required to be opted by a candidate as a core course.

b) There are eighteen Core courses (CC), two each, in semesters I and II; three each in semesters III and IV and four each in semesters V and VI (for 6 units).

c) Each Core Course is compulsory except in semesters III and IV where option is provided for Core course III (CC III).

d) Each CC consists of 2 credits for theory i.e. 30 hour; 3 lectures of each 50 min per week and 1 credit for practical of two hour per week in every semester.

e) The purpose of fixing core papers is to ensure that the institution follows a minimum common curriculum so as to adhere to common minimum standards with other universities/institutions.

f) The course designed under this category aims to cover the basics that a student is expected to imbibe in that particular discipline.

2. Ability Enhancement Compulsory Courses (AECC)

a) There are six AECC courses. Students must take two Ability Enhancement Compulsory Courses (AECC) in semester I and one AECC each in semesters II-VI.

b) The AECC courses offered are:

AECC 1- Foundation Course (2 credits) (Semester I-IV),

AECC 2- Basic communication in English (1 credit) (Semester I)

AECC 3-Environmental Science (2 credits) (Semester V and VI).

3. **Skill Enhancement Course (SEC):**

a) They are designed to provide skill-based knowledge and contain both lab/hands on training/field work.

b) The main purpose of these courses is to provide life skills in hands-on mode to increase employability.

c) There are Twelve skill enhancement courses offered. Each student is supposed to take two in each semester I-IV (Sports training program, Basic communication in English and Indian Cultural Heritage) of 1 credit each. There are four discipline-related skill enhancement courses (SEC), two offered in each semester V and semester VI each of 2 credit. The student is supposed to choose one SEC in Semester V and VI.

4. **Discipline Specific Elective Courses (DSE):**

a) Elective courses offered under the main discipline subject of study.

b) There are eight discipline specific elective courses (DSE), four in each semester V and VI. The student is supposed to choose two out of four in each semester V and VI.

c) Each DSE theory course is of 2 credits i.e.30 hour; 3 lectures of each 50 min per week and 1 credit for practical of two hour per week in every semester.

d) Research Project is offered as an option for the student to choose in lieu of a regular DSE course

5. **Generic Elective Course (GE)**

a) Students can opt for one interdisciplinary Generic Elective Course (GE) in each of the semester V and VI.

b) Generic elective courses are offered in cognate disciplines by different departments in the college.

c) Credits for these courses are granted as additional credits.

6.1 Content

Sr. No	Semester	Course number	Course Code	Course title
Core Course (CC)				
1	I	CC I	21USISTCCIDST1	Descriptive Statistics-I
2		CC II	21USISTCC2STM1	Statistical Methods-I
3		CC P	21USISTCCP	Practical
4	II	CC I	21US2STCCIDST2	Descriptive Statistics-II
5		CC II	21US2STCC2STM2	Statistical Methods-II
6		CC P	21US2STCCP	Practical
7	III	CC I	22US3STCCIPRD1	Probability Distribution–I
8		CC II	22US3STCC2SAT	Sampling Techniques
9		CC III	22US3STCC3OPR1 OR	Operations Research-I
			22US3STCC3SQC	Statistical Quality Control
10		CC P	22US3STCCP	Practical
11	IV	CC I	22US4STCCIPSD	Probability and Sampling Distributions
12		CC II	22US4STCC2DOE1	Design of Experiments-I
13		CC III	22US4STCC3OPR2 OR	Operations Research-II
			22US4STCC3REM	Research Methodology
15		CC P	22US4STCCP	Practical
16	V	CC I	23US5STCCIPRT	Probability Theory
17		CC II	23US5STCC2PRD2	Probability Distribution-II
18		CCP I	23US5STCCP1	Practical

19		CC III	23US5STCC3TOE	Theory of Estimation
20		CC IV	23US5STCC4DVS	Demography and Vital Statistics
21		CC P II	23US5STCCP2	Practical
22	VI	CC I	23US6STCC1SUA	Survival Analysis
23		CC II	23US6STCC2TOH	Testing of Hypothesis
24		CC P I	23US6STCCPI	Practical
25		CC III	23US6STCC3STP	Stochastic Process
26		CC IV	23US6STCC4ACT	Elements of Actuarial Science
27		CC P II	23US6STCCP2	Practical
Discipline Specific Electives (DSE)				
1	V	DSE I	23US5STDS1REA	Regression Analysis
2		DSE II	23US5STDS2ECO	Econometrics
3		DSE III	23US5STDS3OPR3	Operations Research-III
4		DSE IV	23US5STDS4DOE2	Design of Experiments-II
5		DSE P	23US5STDSP	Practical
6	VI	DSE I	23US6STDS1DAM	Data Mining
7		DSE II	23US6STDS2BIO	Biostatistics
8		DSE III	23US6STDS3TSA	Time Series Analysis
9		DSE IV	23US6STDS4LIM	Linear Model
10		DSE P	23US6STDSP	Practical
	Skill Enhancement Courses (SEC)			
1	I	SEC I	21US1SE1STP1	Sports Training Programme Level I
2		SEC II	21US1SE2BCE	Basic Communication In English
3	II	SEC I	21US2SE1STP2	Sports Training Programme Level II
4		SEC II	21US2SE2ICH1	Indian Cultural Heritage Level I (value education)
5	III	SEC I	22US3SE1STP3	Sports Training Programme Level III
6		SEC II	22US3SE2ICH2	Indian Cultural Heritage Level II

				(value education)
7	IV	SEC I	22US4SE1STP4	Sports Training Programme Level IV
8		SEC II	22US4SE2ICH3	Indian cultural Heritage Level III (value education)
9	V	SEC I	23US5STSE1SCC	Statistical Computing using C-Programming
10		SEC II	23US5STSE2SQL	*SQL
11	VI	SEC I	23US6STSE1SCR	Statistical Computing using R
12		SEC II	23US6STSE2SCP	*Statistical Computing using Python
Ability Enhancement Compulsory Course (AECC)				
1	I	AECC I	21US1AE1FOC	Foundation Course
2	II	AECC I	21US2AE1FOC	Foundation Course
3	III	AECC I	22US3AE1FOC	Foundation Course
4	IV	AECC I	22US4AE1FOC	Foundation Course
5	V	AECC I	23US5AE1EVS	Environmental Science
6	VI	AECC I	23US6AE1EVS	Environmental Science

6.2 Credit distribution for B.Sc. Statistics

Semester	Course number	Course title	Credits		
			Theory	Practical	Total
I	CC I	Descriptive Statistics-I	2	1	3
	CC II	Statistical Methods-I	2	1	3
	AECC I	Foundation Course	2		2
	AECC II		1		1
	SEC I	Sports Training Programme Level I	1		1
	SEC II	Basic Communication in English	1		1
II	CC I	Descriptive Statistics-II	2	1	3
	CC II	Statistical Methods-II	2	1	3

	AECC I	Foundation Course	2		2
	SEC I	Sports Training Programme Level II	1		1
	SEC II	Basic Communication in English	1		1
III	CC I	Probability Distribution–I	2	1	3
	CC II	Sampling Techniques	2	1	3
	CC III	Operations Research-I/Statistical Quality Control	2	1	3
	AECC I	Foundation Course	2		2
	SEC I	Sports Training Programme Level III	1		1
	SEC II	Indian Cultural Heritage Level II (value education)	1		1
IV	CC I	Probability and Sampling Distributions	2	1	3
	CC II	Design of experiments-I	2	1	3
	CC III	Operations Research-II/Research Methodology	2	1	3
	AECC I	Foundation Course	2		2
	SEC I	Sports Training Programme Level IV	1		1
	SEC II	Indian Cultural Heritage Level III (value education)	1		1
V	CC I	Probability theory	2	1	3
	CC II	Probability Distribution-II	2	1	3
	CC III	Theory of Estimation	2	1	3
	CC IV	Demography and Vital Statistics	2	1	3
	DSE I/II	Regression Analysis/Econometrics	2	1	3
	DSE III/IV	Operations Research-III/Design of Experiments-II	2	1	3

	AECC I	Environmental science	1		1
	SEC I/II	Statistical Computing using C-Programming/SQL*	2		2
VI	CC I	Survival Analysis	2	1	3
	CC II	Testing of Hypothesis	2	1	3
	CC III	Stochastic Process	2	1	3
	CC IV	Elements of Actuarial Science	2	1	3
	DSE I/II	Data Mining/Biostatistics	2	1	3
	DSE III/IV	Time Series Analysis/Linear Model	2	1	3
	AECC I	Environmental Science	1		1
	SEC I/II	Statistical Computing using R/ Statistical Computing using Python*	2		2

6.3 Semester Schedule

Semester	Core Course number	Core Course (CC) title	Discipline Specific Electives (DSE)	Generic Elective Course (GE)	Skill Enhancement Course (SEC)	Ability Enhancement Compulsory Course (AECC)
I	CC I	Descriptive Statistics-I	-	-	1] Sports Training Programme Level I 2] Basic Communication in English	Foundation Course
	CC II	Statistical Methods-I	-	-		
II	CC I	Descriptive	-	-	1] Sports	Foundation

		Statistics-II			Training Programme Level II 2] Indian cultural Heritage Level I (Value Education)	Course
	CC II	Statistical Methods-II	-	-		
III	CC I	Probability Distribution–I	-	-	I] Sports Training Programme Level III 2] Indian cultural Heritage Level II(Value Education)	Foundation Course
	CC II	Sampling Techniques	-	-		
	CC III	Operations Research-I/Statistical Quality Control	-	-		
IV	CC I	Probability and Sampling Distributions	-	-	I] Sports Training Programme Level IV 2] Indian cultural Heritage Level III(Value Education)	Foundation Course
	CC II	Design of Experiments-I	-	-		
	CC III	Operations Research-II/Research Methodology	-	-		
V	CC I	Probability Theory	DSE I/II: Regression Analysis/E	GE	SEC I/II: Statistical Computing	Environmental Science
	CC II	Probability				

		Distribution-II	conometrics and DSE III/IV: Operations Research-III/Design of Experiments-II		using c-Programming/SQL*	
	CC III	Theory of Estimation				
	CC IV	Demography and Vital Statistics				
VI	CC I	Survival Analysis	DSE I/II: Data Mining/Biostatistics and DSE III/IV: Time Series Analysis/Linear Model	GE	SEC I/ II: Statistical Computing using R/ Statistical Computing using Python	Environmental Science
	CC II	Testing of Hypothesis				
	CC III	Stochastic Process				
	CC IV	Elements of Actuarial Science				

6.4 Course Learning Objectives

The three-year undergraduate Statistics programme is designed to familiarize students with significant developments in Statistics. The Objectives of structured syllabus in Statistics is to make the concepts and basics of Statistics clear and interesting to students and also to ensure the development of vertical growth in the subject. The idea behind this is to enable students to develop analytical skills and critical thinking.

It is our attempt that students achieve this Objectives through systematic reading and class lectures and through feedback on their written work-assignments, project/research papers, presentations, discussions, debates, etc. our intention is to enable students to formulate cogent arguments, presenting the necessary evidence to establish these, based on a training in Statistics.

7. Detailed B.Sc. Statistics Syllabus

F. Y. B.Sc. Syllabus with effect from theAcademic year 2021–2022

Syllabus -F. Y. B.Sc. Statistics

Course No.	Course Title	Course Code	Credits	Hr.	Periods (50 min)	Module	Lectures per module (50 minutes)	Examination		
								Internal Marks	External Marks	Total Marks
SEMESTER I										
Core courses THEORY										
I	Descriptive Statistics-I	21USISTCCI DSTI	2	30	36	3	14+11+11	40	60	100
II	Statistical Methods-I	21USISTCC2 STMI	2	30	36	3	12	40	60	100
Core courses PRACTICAL										
		21USISTCCP	2	75	90			40	60	100
SEMESTER II										
Core courses THEORY										
I	Descriptive	21US2STCCI	2	30	36	3	14+11+11	40	60	100

	Statistics-II	DST2								
II	Statistical Methods-II	2IUS2STCC2 STM2	2	30	36	3	12	40	60	100
Core courses PRACTICAL										
		2IUS2STCCP	2	75	90			40	60	100

F.Y. B. Sc. (STATISTICS) SEMESTER I

Core Course- I

COURSE TITLE: Descriptive Statistics-I

COURSE CODE: 2IUSISTCCIDSTI [CREDITS - 02]

Course Learning Outcomes		
After the successful completion of the Course, the learner will be able to: 1. Identify the nature of the variable for further course of statistical analysis. 2. Present the data in tabular and graphical form. 3. Calculate various measures of central tendency. 4. Calculate various measures of variation, coefficient of skewness and kurtosis.		
Module I	**Data: Types, Collection and Management**	**[14L]**
Learning Objectivess: The module is intended 1. To make students realise about understanding and importance of the data along with summarising and presenting the data in tabular / diagrammatic manner. 2. To be able to decide what graphs are appropriate for displaying quantitative and categorical variables 3. Given a variable of interest, identify whether the variable is categorical or quantitative (discrete, continuous) 4. Analyse the categorical data		

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Identify the type of the variable along with the scale of measurement.
2. Classify and tabulate the data.
3. Analyse the categorical data.
4. Represent the data graphically.

1.1	**Types of data**	[2L]
1.1.a	Qualitative and Quantitative data	
1.1.b.	Time series data and Cross Sectional data	
1.1.c.	Data Source: Primary Data, Secondary Data	
1.2	**Measurement of Scale and Tabulation**	[4L]
1.2.a.	Nominal scale, Ordinal scale, Interval scale, Ratio scale	
1.2.b.	Tabulation: One way, Two way, Three way table	
1.3	**Analysis of Categorical Data**	[4L]
1.3.a.	Introduction to classes, Notations used, dichotomous classification, contingency tables for two and three attributes, order of the frequency, and proof of total number of frequencies in case of 'k' attributes is 3k.	
1.3.b.	Consistency: Derivations of conditions of consistency of the data in case of two and three attributes	
1.3.c.	Independence of the attributes: Derivations of the conditions of the independence of the two attributes. Conditions for positive and negative association	
1.3.d.	Association of the two attributes: Coefficient of association, Yule's coefficient of colligation. Derivation of relationship between the two coefficients. Concept of partial coefficient of association	
1.4	**Frequency Distribution and Graphical Presentation**	[4L]
1.4.a.	Univariate: Frequency distribution for continuous and discrete variable, Relative frequency, cumulative frequencies, ogives	
1.4.b.	Bivariate: Frequency distribution, marginal and conditional frequency distribution	
1.4.c.	Graphical representation: Histogram, Frequency polygon,	

	Frequency curve and Ogives. Diagrammatic representation: Rectangle, Square, Pyramid, Stem and Leaf diagram.	
Module 2	**Measures of Central Tendency or Location**	**[IIL]**
Learning Objective: This module is intended to: Introduce to various measures of central tendencies.		
Learning Outcomes: After the successful completion of the module, the learner will be able to: 1. Calculate various measures of central tendencies. 2. Understand the merits and demerits of each of the measure of central tendency. 3. Locate the positional averages and mode of the distribution graphically. 4. Identify the proper measure of central tendency to be used depending on the data which is to be analysed.		
2.1	What is meant by Measure of Central Tendency, Requisites of good measure of central tendency	[1L]
2.2	Arithmetic mean (A.M) and its properties, simple A.M, weighted A.M., Combined mean, merits and demerits	[3L]
2.3	Geometric Mean (G.M.), Harmonic Mean (H.M.), merits and demerits of G.M. and H.M.	[2L]
2.4	Relationship between A.M., G.M. and H.M.	[1L]
2.5	Positional Averages: Quantiles (Median, Quartiles, Deciles, Percentiles), Mode	[3L]
2.6	Empirical relationship between mean, median and mode, proper selection of an average	[1L]
Module 3	**Absolute and Relative Measures of Dispersion**	**[IIL]**
Learning Objectives: The module is intended to 1. Introduce various measures of variation present in the data. 2. Introduce the concept of skewness and kurtosis of the given data. 3. Compare the different sets of the data based on these measures.		
Learning Outcomes: After the successful completion of the module, the learner will be able to:		

1. Calculate various measures of variation. 2. Select the proper measure of variation depending on the data given. 3. Calculate the coefficient of skewness and kurtosis. 4. Compare the multiple data sets based on the various statistical measures studied.		
3.1	Range, Interquartile Range, Quartile Deviation, Box-Whisker Plot ,Mean Absolute Deviation, Standard Deviation (Variance) and their relative measures, Combined variance	[4L]
3.2	Raw and Central moments up to fourth order and the relationship between them (with proof)	[4L]
3.3	Measures of Skewness and Kurtosis	[3L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata.
- Miller and Fruend: Modern Elementary Statistics.
- Spiegel M.R.: Theory and Problems of Statistics, Schaum's Publications series Tata, McGraw-Hill.
- Neil Weiss: Introductory Statistics : Pearson Publishers
- R. J. Shah: Descriptive Statistics, Sheth Publication, Ist Edition 2010
- B. L. Agarwal: Programmed Statistics, New Age International Publishers, New Delhi
- 7. K. V. S. Sarma: Statistics Made Simple: Do it yourself on PC. Prentice Hall of India Pvt.Ltd., New Delhi.

Question paper Template

F.Y. B. Sc. (STATISTICS) SEMESTER I

Core Course- I

COURSE TITLE: Descriptive Statistics-I

COURSE CODE: 21USISTCCIDST1 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
1	12	6	5	5	5	3	36

II	12	7	2	3	3	-	27
III	14	3	3	3	4	-	27
Total marks per Objectives	38	16	10	11	12	3	90
% Weightage	42	18	12	12	13	3	100

F.Y. B. Sc. (STATISTICS) SEMESTER I

Core Course- II

COURSE TITLE: Statistical Methods-I

COURSE CODE: 21USISTCC2STM1 [CREDITS - 02]

Course Learning Outcomes		
After the successful completion of the Course, the learner will be able to: 1. Explain different hierarchical approaches to be used to calculate probability in a given scenario. 2. Evaluate probability using addition and multiplication rules. 3. Differentiate between discrete and continuous random variables. 4. Evaluate probabilities using various discrete probability distributions.		
Module 1	**Elementary probability theory**	**[12L]**
Learning Objectives: The module is intended to 1. Classify different types of events. 2. Calculate probability using different approaches of probability. 3. Evaluate probability using an appropriate probability rule.		
Learning Outcomes:		

After the successful completion of the module, the learner will be able to:

1. Differentiate between different types of events.
2. Differentiate between different definitions of probabilities such as Classical, Empirical and Axiomatic.
3. Apply correctly probability rules such as addition, multiplication and Baye's rule.

1.1	Random Experiment, Sample Point & Sample Space, Definition of Event, Elementary Event, Algebra of Events (occurrence of at least one, none, all, exactly one event), mutually exclusive events, exhaustive events	[2L]
1.2	Classical, Empirical and Axiomatic definitions of probability.	[2L]
1.3	Conditional Probability, Independence of n Events (n = 2, 3), examples of pair-wise and complete independence. Addition theorem with proof.	[4L]
1.4	Multiplication Theorem and Bayes' rule (All theorems with proofs).	[4L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt.Ltd.,Kolkata.
- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000
- R. J. Shah: Statistical Methods, Sheth Publication, 1st Edition 2010

Module 2	Discrete Random variable	[12L]

Learning Objectives:

This module is intended to:

1. Define different types of random variables.
2. Interpret probability mass function (pmf) and cumulative distribution function (cdf).
3. Describe properties of expectations of univariate and bivariate discrete random variables.

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Understand the difference between discrete and continuous random variables.
2. Explain properties of probability mass function and cumulative distribution function of discrete random variables.
3. Explain various properties of expectations of univariate and bivariate discrete random variables.

2.1	Definition: Univariate discrete random variable, probability mass function, cumulative distribution function.	[3L]
2.2	Theorems on Expectation and variance of a univariate discrete random variable, Raw & Central Moments and their relationship (with proof).	[4L]
2.3	Bivariate discrete random variable, Joint probability mass function of two random variables, Marginal and Conditional probability distributions, Independence of two random variables.	[3L]
2.4	Theorems on expectation, variance and covariance of bivariate discrete random variables, correlation coefficient between two random variables.	[2L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata.
- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000
- R. J. Shah: Statistical Methods, Sheth Publication, 1st Edition 2010

Module 3	Standard Discrete Probability Distributions	[12L]

Learning Objectives:

The module is intended to

1. Identify discrete probability distributions
2. Design relationship amongst various discrete probability distributions.
3. Prepare the expected frequency table by estimating appropriate parameters of the given distribution.

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Construct various discrete probability distributions.
2. Examine properties, applications and relationships amongst various discrete probability distributions.
3. Build or fit discrete probability distribution by estimating appropriate parameters.

3.1	Bernoulli distribution, binomial distribution, hypergeometric distribution, derivation of its expectation and variance. Relation between binomial and hypergeometric distribution (With proof). Derivation of its recurrence relation to calculate binomial probabilities.	[5L]
3.2	Poisson distribution, derivation of its expectation and variance, Relation between binomial and poisson distribution (With proof), Derivation of its recurrence relation to calculate binomial probabilities.	[3L]
3.3	Uniform distribution, derivation of its expectation and variance.	[2L]
3.4	Fitting of discrete probability distribution.	[2L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata.
- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000
- R. J. Shah: Statistical Methods, Sheth Publication, 1st Edition 2010

Question Paper Template

F.Y. B. Sc. (STATISTICS) SEMESTER I

Core Course- II

COURSE TITLE: Statistical Methods-I

COURSE CODE: 21USISTCC2STM1 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	6	5	4	3	30
II	6	6	6	5	4	3	30
III	6	6	6	5	4	3	30
Total marks per Objectives	18	18	18	15	12	9	90
% Weightage	20	20	20	17	13	10	100

F. Y. B. Sc. (STATISTICS)

SEMESTER I - Practical

COURSE CODE: 21USISTCCP Credit- 02

Learning Objectivess:

The Practical is intended to

1. Make learners able to summarise and present the data in tabular / diagrammatic manner.
2. Analyse Categorical/Qualitative and Quantitative data.
3. Calculate the probabilities of events using different approaches of probability and appropriate probability rule
4. Calculate joint and marginal pmfs, raw and central moments for given Bivariate data and various properties of expectations of univariate and bivariate discrete random variables.
5. Understand properties of discrete probability distributions.

Learning Outcomes:

After the successful completion of the practical, the learner will be able to:

1. Present the data in tabular and graphical form.
2. Calculate various measures of central tendency and variation.
3. Interpret association between attributes.
4. Evaluate probability using addition and multiplication rules.
5. Obtain joint and marginal pmfs of bivariate discrete random variables.
6. Evaluate probabilities, raw and central moments of different discrete probability

distribution.	
Core Course I	**Descriptive Statistics I**
1. Classification and Tabulation 2. Theory of attributes 3. Diagrammatic representation of data 4. Measures of central tendency 5. Quartiles 6. Measures of dispersion 7. Skewness and Kurtosis	
Core Course II	**Statistical Methods I**
1. Probability Practical I 2. Probability Practical II 3. Probability Practical III 4. Probability Practical IV 5. Discrete random variable I 6. Discrete random variable II 7. Standard discrete distribution I 8. Standard discrete distribution II	
References: • Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata. • M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014. • Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000 • R. J. Shah: Statistical Methods, Sheth Publication, Ist Edition 2010	

F.Y. B. Sc. (STATISTICS) SEMESTER II

Core Course- I

COURSE TITLE: Descriptive Statistics-II

COURSE CODE: 21US2STCCIDST2 [CREDITS - 02]

Course Learning Outcomes
After the successful completion of the Course, the learner will be able to: 1. Interpret the relationship between the two variables which are logically connected. 2. Study the different methods to predict behaviour of a variable which is dependent on time. 3. Calculate various indices to measure price and quantity changes over period of

time.

Module 1	Correlation and Regression analysis for bivariate data	[14L]

Learning Objectives:

The module is intended to

1. Identify the direction and guess the strength of the linear relationship between two logically related variables from the scatter plot.
2. Compute and interpret the Pearson correlation coefficient.
3. Compute and interpret the coefficient of determination.
4. Fit various curves using method of least squares.

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Interpret the relationship between the 2 logically related variables from the scatter plot.
2. Understand that the correlation always does not imply causality.
3. Calculate the Rank correlation for the ordinal data.
4. Able to fit the best line to the data.
5. Use the line of best fit to predict make prediction.

1.1	Scatter diagram.	[2L]
1.2	Covariance between two variables, Relationship between variance and covariance	[2L]
1.3	Product Moment correlation coefficient and its properties, graphical interpretation	[2L]
1.4	Rank correlation Spearman's measure.	[2L]
1.5	Principle of least square fitting of a straight line, fitting of curves reducible to linear form by transformation and fitting of quadratic curve using method of least squares	[3L]
1.6	Concept of linear regression, fitting of a linear regression line by method of least square. Relation between regression coefficients and correlation coefficient, Coefficient of determination	[3L]

Module 2	Time Series	[11L]

Learning Objectives:

This module is intended to:

1. Understand different components of time series.
2. Study different models used in time series analysis.
3. Studyvarious methods of estimating trend component with their merits and demerits.
4. Study various methods of estimating seasonal component with their merits and demerits.

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Identify various components present the given time series data.
2. Use the proper model while doing time series analysis.
3. Segregate the Trend components of the time series data using various methods.
4. Segregate the Seasonal components of the time series data using various methods.

2.1	Definition of time series .Components of time series. Analysis of time series including different models of time series.	[3L]
2.2	Methods of estimating trend with their merits and demerits	
2.2.1	Freehand curve method	[1L]
2.2.2	Semi average method	[1L]
2.2.3	Moving Average method	[1L]
2.2.4	Method of least squares(linear and parabolic trend)	[1L]
2.3	Methods of estimating seasonal component with their merits and demerits	
2.3.1	Method of simple average	[1L]
2.3.2	Ratio to moving average	[1L]
2.3.3	Ratio to trend method	[2L]
Module 3	**Index Numbers**	**[11L]**

Learning Objectives:

The module is intended to

1. Understand the meaning of the term index number
2. Understand the concept of Price index number, quantity index number and value index number

3. Get accustomed to use of some widely used index numbers
4. Learn time reversal test, factor reversal test and circular test

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Calculate simple and composite index numbers for various situations.
2. Check whether a specific index number satisfies Time reversal test, Factor reversal test and circular test.
3. Apply a suitable index number to the given dat.
4. Calculate CPI, Real Income and interpret it.

3.1	Index number as a comparative tool, Stages in the construction of Index Numbers	[2L]
3.2	Simple and Composite Index Numbers.Fixed base Index Numbers. Chain Base Index Numbers, Base shifting, Splicing and Deflating.	[2L]
3.3	Composite index numbers, methods of computing composite index numbers, Some standard index numbers - Laspeyres', Paasche's , Marshal-Edgeworth's, Dorbisch-Bowley's and Fisher's Index Numbers.	[2L]
3.4	Price and Quantity Index Numbers, Value Index Number	[1L]
3.5	Time reversal test.Factor reversal test, Circular test	[1L]
3.6	Cost of Living Index Number, Concept of Real Income based on the Consumer Price Index Number. Problems in the construction of Consumer Price Index Number	[2L]
3.7	Applications of Index numbers	[1L]

References:

- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Spiegel M.R.: Theory and Problems of Statistics, Schaum's Publications series Tata, McGraw-Hill.
- R. J. Shah: Descriptive Statistics, Sheth Publication, Ist Edition 2010
- B. L. Agarwal: Programmed Statistics, New Age International Publishers, New Delhi
- K. V. S. Sarma: Statistics Made Simple: Do it yourself on PC. Prentice Hall of India Pvt.Ltd., New Delhi.

Question Paper Template

F.Y. B. Sc. (STATISTICS) SEMESTER II

Core Course- I

COURSE TITLE: Descriptive Statistics-II

COURSE CODE: 21US2STCC1DST2 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	12	12	2	3	2	36
II	14	4	3	3	3		27
III	9	10	3	3	2		27
Total marks per Objectives	28	26	18	8	8	2	90
% Weightage	31	29	20	9	9	2	100

F.Y. B. Sc. (STATISTICS) SEMESTER II

Core Course- II

COURSE TITLE: Statistical Methods-II

COURSE CODE: 21US2STCC2STM2 [CREDITS - 02]

Course Learning Outcomes		
After the successful completion of the Course, the learner will be able to: 1. To define various properties of PDF and CDF of a continuous r.v. 2. To establish PDF of Rectangular, Exponential, Normal and chi-square distribution 3. To estimate parameters using, point and interval estimation for large samples 4. To setup suitable null and alternative hypothesis 5. To determine z-value and p-value for large samples.		
Module 1	**Continuous Random Variable (Univariate and Bivariate) and Standard Univariate Continuous Probability Distributions**	**[12L]**
Learning Objectives: The module is intended to 1. Evaluate probabilities for continuous random variables using given probability density function. 2. Evaluate probabilities for continuous random variables using given cumulative distribution function. 3. Measure the properties of rectangular and exponential probability distribution. 4. Compute probabilities using rectangular and exponential probability distribution.		
Learning Outcomes: After the successful completion of the module, the learner will be able to: 1. Explain properties of probability density function and cumulative distribution function of continuous random variables. 2. Outline properties of expectations of univariate and bivariate continuous random variables. 3. Construct continuous probability distributions. 4. Examine properties, applications and relationships amongst various continuous probability distributions.		
1.1	Definition: Univariate continuous random variable, probability density function, cumulative distribution function, Theorems on Expectation and variance of a random variable, Raw & Central Moments, Median, Mode and measures of location.	[4L]
1.2	Bivariate continuous random variable, Joint probability mass	[4L]

	function of two random variables, Marginal and Conditional probability distributions, Independence of two random variables, Theorems on expectation and variance.	
1.3	Rectangular distribution, exponential distribution: Derivation of cumulative distribution function, mean, variance for rectangular, exponential distribution.	[4L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata.
- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000
- R. J. Shah: Statistical Methods, Sheth Publication, Ist Edition 2010

Module 2	Normal Distribution, Sampling distribution & Estimation	[12L]

Learning Objectives:

This module is intended to:

1. Explain the properties of Normal and standard normal distributions.
2. Compute probabilities using standard normal probability tables.
3. Construct estimates for unknown population parameters using point and interval estimation.
4. Examine the properties of the estimator.

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Explain normal probability distribution, properties of normal probability curve.
2. Calculate normal probabilities using standard normal probability table.
3. Explain additive property of independent normal variates and Central limit theorem.
4. Study normal approximation to binomial and Poisson distribution.
5. Recognize the difference between a population and a sample, parameter and a statistic.
6. Estimate parameters using point and interval estimation for large samples.

7. Identify good estimators.		
2.1	Properties of normal distribution, normal curve (without proof), Normal Approximation to binomial and Poisson distributions (without proof).	[4L]
2.2	Concept of Parameter, Statistic, Estimator and bias, Sampling distribution of estimator, Standard error, Central Limit Theorem (Statement only), Sampling distribution of sample mean and sample proportion for large samples.	[4L]
2.3	Point estimation and interval estimation of single and double population mean and proportion for large samples.	[2L]
2.4	Properties of a good estimator: Unbiasedness, Efficiency.	[2L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata.
- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000
- R. J. Shah: Statistical Methods, Sheth Publication, Ist Edition 2010

Module 3	Testing of hypothesis, Large sample test and Chi-square distribution	[12L]

Learning Objectives:

The module is intended to

1. Build null and alternative hypothesis, critical and acceptance region, size of the test.
2. Construct critical region for large samples.
3. Calculate p-value for large sample test.
4. Define chi-square distribution and study its applications.

Learning Outcomes:

After the successful completion of the module, the learner will be able to:

1. Classify statistical hypothesis as Simple and Composite, Null and alternative hypothesis, types of errors.

2. Construct critical and acceptance region, size of the test. 3. Determine p-value. 4. Test for single/double population means and proportions for large samples. 5. Show the relation between normal distribution and chi-square distribution. 6. Explain applications of chi-square distribution.		
3.1	Statistical tests - Concept of Hypotheses. (Null and alternative hypotheses, Simple and composite hypothesis), Types of Errors, Critical Region, Level of Significance, size of the test, p-value, power of the test, power function, power curve.	[3L]
3.2	Large Sample Tests (using Central Limit Theorem, if necessary): For testing specified value of population mean, difference of two populations means, population proportion, difference of two population proportions.	[3L]
3.3	Introduction to chi-square distribution and its applications.	[6L]

References:

- Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata.
- M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014.
- Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000
- R. J. Shah: Statistical Methods, Sheth Publication, 1st Edition 2010

Question Paper Template

F.Y. B. Sc. (STATISTICS) SEMESTER II

Core Course- II

COURSE TITLE: Statistical Methods-II

COURSE CODE: 21US2STCC2STM2[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	6	5	4	3	30

II	6	6	6	5	4	3	30
III	6	6	6	5	4	3	30
Total marks per Objectives	18	18	18	15	12	9	90
% Weightage	20	20	20	17	13	10	100

F. Y. B. Sc. (STATISTICS)

SEMESTER II - Practical

COURSE CODE: 21US2CHCCPCredit- 02

Learning Objectives:

The practical is intended to

1. Compute correlation between two random variables and obtain regression coefficients.
2. Fit a straight line and quadratic curves using the method of least squares.
3. Compute trend values and seasonal variations using different methods.
4. Compute Index numbers using different methods.
5. Evaluate probabilities for continuous random variables using given pdf and cdfs.
6. Evaluate probabilities and properties of Uniform, Exponential and Normal distribution.
7. Construct Estimates for unknown population parameters using point and interval Estimation.
8. Define null, alternative hypothesis and critical, acceptance region. Also compute probabilities of types of errors and power of the test.
9. Study applications of Chi-Square distributions.

Learning Outcomes:

After the successful completion of the practical, the learner will be able to:

1. Understand the relation between two variables and predict the value of dependent variable based on independent variable.

2. Fit straight lines and different curves to the given data. 3. Predict the behaviour of phenomenon under consideration in the context of time. 4. Obtain Index number using different methods and calculate Cost of Living Index. 5. Evaluate PDF and CDF of the Continuous Probability Distribution. 6. Compute probabilities using rectangular and exponential distribution and Standard Normal Probability tables. 7. Estimate parameters using point and interval estimation for large samples. 8. Compute probabilities of Type I and Type II errors. 9. Understand applications of the Chi-Square test.	
Core Course I	**Descriptive Statistics II**
1. Correlation Coefficient 2. Rank Correlation Coefficient 3. Regression Analysis 4. Curve Fitting 5. Time Series Analysis I 6. Time Series Analysis II 7. Index Number	
Core Course II	**Statistical Methods II**
1. Continuous Random Variable 2. Uniform Distribution and Exponential Distribution 3. Normal Distribution 4. Sampling Distribution and Estimation 5. Testing of Hypothesis 6. Significance of Testing Based on Large Samples 7. Applications of Chi-Square Test	
References: • Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. I, The World Press Pvt.Ltd.,Kolkata. • M. N. Welling, P. P. Khandeparkar, R. J. Pawar and S. S. Naralkar: Descriptive Statistics, Manan Prakashan, 2nd Revised Edition 2014. • Gupta Sc and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publications, 10th Revised Edition 2000 • R. J. Shah: Statistical Methods, Sheth Publication, Ist Edition 2010	

8. Teaching learning process

The pedagogic methods adopted, involve direct lectures, tutorial discussions, as well as technology- supported presentations. We believe that education is interactive and all sessions between students and teachers are based upon reciprocity and respect.

I) The lectures (of fifty minutes duration) delivered to one whole class at a time systematically deal with the themes of the syllabus. This constitutes the core of the teaching- learning process. The students are provided with bibliographic references and encouraged to go through at least some readings so that they could be more interactive and ask more relevant questions in the class. This also helps obtain knowledge beyond the boundaries of the syllabi.

2) Wherever needed, teachers use audio-video based technology devices (e. g. power point, YouTube videos) to make their presentations more effective. Some courses require that students see a documentary or feature film and course themes are structured so that discussions of these will further nuance the critical engagement of students with ideas introduced in their textual materials.

3) Remedial coaching, bridge courses are adopted to enhance the scope of learning for the learners. Remedial sessions are conducted to offer assistance on certain advanced topics. Bridge courses facilitate to develop a concrete basis for the topics to be learnt in the coming academic year.

9. Assessment Methods

Evaluation Pattern: Theory

- Assessments are divided into two parts: Continuous Internal Assessment (CIA) & Semester End Examination.
- The Semester End Examination shall be conducted by the College at the end of each semester.
- Semester End Examination (external) (60 M)- Duration:
  2 hours Paper Pattern

Question No	Module	Marks with Option	Marks without Option
1	I	5 M x 6 Q = 30 M	5 M x 4 Q = 20 M
2	II	5 M x 6 Q = 30 M	5 M x 4 Q = 20 M
3	III	5 M x 6 Q = 30 M	5 M x 4 Q = 20 M

Each question will have six sub questions a, b, c, d, e, f and out of which any four should be answered.

- For Internal Evaluation (40 M)

i. Mid Sem Examination 25 M

ii. Workshop/Project/Industrial Visit/ Excursion/ Seminar/ Assignment/ Research paper review 15 M

Or

i. Project (40 M)

Evaluation pattern: Practical

- Semester-end evaluation: 30 Marks practical examination for each Course at the end of semester.
- Continuous internal evaluation 20 marks as per the following rubrics

Experimental Work	Experimental Report	Quiz	Total
10 M	5M	5M	20M

10. Programme and Course Code Format

The course is coded according to following criteria:

1. First two numbers in each course code indicates year of implementation of syllabus (21- year of implementation is 2021-22)
2. Third letter 'U' designates undergraduate
3. Fourth letter 'S' designate Science discipline and the digit followed is for semester number (S1 – 1st Semester)
4. Letter 'ST' is for Statistics discipline (ST- Statistics)

This forms the programme code 2IUSST. For the further course codes programme code is amended as follows

5. To designate the semester, add the digit (1-6) after S in the programme code. (Eg: 2IUSIST- for semester I)

   For the further course codes, addition to the programme code should be done as per the following instructions.

6. To represent core courses (CC) followed by course number digit (1/2/3/4) and three lettered code representing the title of the course.
7. For Ability enhancement course code, (AE) alphabets followed by a digit (1/2) followed by 'FOC'- Foundation course, 'EVS'-Environmental science are used.
8. For Skill enhancement courses code (SE) followed by digits (1/2/3) followed by letters 'STP'-Sports training programme, 'BCE'-Basic communication in English,'ICH'-Indian cultural heritage, followed by digits (1/2/3) representing the levels used. In case of subject related SEC, (SE) followed by digits (1/2/3) followed by a three lettered code representing the title of the course are used.
9. For Discipline specific elective course (DS) of Semester V and VI, (DS) followed by digits (1/2/3/4) followed by three lettered code representing the title of the course are used.
10. 'P' followed by digit indicates practical course number. (practical course number will be added for semesters only where there are more than one course.